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October 9, 2008

Michael Lesar
Chief, Rulemaking, Directives and Editing Branch
Office of Administration
Mail Stop T-6D59
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Comments on the Security and Continued Use of Cesium-137 Chloride Sources (Docket No. NRC-2008-0419) [*See* 73 FR 44780 (July 31, 2008)]

Dear Mr. Lesar:

The American Society for Therapeutic Radiology and Oncology (ASTRO) appreciates the opportunity to participate in this process by offering the following comments to the U.S. Nuclear Regulatory Commission (NRC) regarding the Security and Continued Use of Cesium-137 Chloride Sources. ASTRO urges the NRC to proceed with caution in its consideration of these issues to ensure that patient care and advances in biomedical research impacting patient care not be compromised by any limitations or regulatory constraints imposed on the medical use and research applications of cesium chloride.

ASTRO is the largest radiation oncology society in the world, with more than 9,000 members who specialize in treating patients with radiation therapies. As a leading organization in radiation oncology, biology, and physics, the Society is dedicated to the advancement of the practice of radiation oncology by promoting excellence in patient care, providing opportunities for educational and professional development, promoting research and disseminating research results and representing radiation oncology in a rapidly evolving healthcare environment.

Areas of Research Affected

Cesium-137 irradiators play an important role in medical research related to understanding and treating cancer and other serious illnesses as well as for developing countermeasures for radiologic terrorism. Throughout this comment letter, ASTRO focuses its remarks on the use of cesium research irradiators, not blood irradiators.

Researchers use irradiators to expose living cells and animals to doses of radiation in order to evaluate the biological effect. Radiation exposure may also be used to effect immunosuppression for transplantation. New techniques have yielded valuable information about how molecules, cells, tissues, animals and humans respond to doses of radiation, enabled establishment of meaningful radiation protection standards, and led to major breakthroughs in stem cell research.

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Radiological countermeasure researchers are investigating the molecular mechanisms of injury caused by gamma radiation to develop effective treatments that prevent or ameliorate the effects of ionizing radiation, to safeguard military personnel, and first responders. Other research continues to improve radiation therapies and the quality of life after treatment.

These preclinical studies that will advance patient care in the future are heavily dependent on the use of cesium irradiators. Whole-body exposures of laboratory animals which are necessary to study the effects of nuclear terrorism are more readily performed with cesium because of its energy spectrum and dose distribution, and much of the low dose DOE and NASA work looking at the role of stem cells in carcinogenesis and central nervous system effects would lose practical relevance using non-gamma sources.

Improving radiation therapy. The American Cancer Society anticipates 1.5 million Americans will be diagnosed with cancer each year, and approximately 500,000 Americans per year will die from this disease. A majority of all cancer patients in the United States are treated with radiation therapy in their cancer care, and the use of radiation therapy is increasing. Research in radiation therapy, radiation biology and radiological physics and related fields of tumor biology have advanced understanding of how cancer cells and healthy cells respond to radiation, and have resulted in tailored cancer therapies including improvements in dosimetry, tumor imaging, treatment planning, and highly focused radiation delivery.

A broad spectrum of research, which uses cesium irradiators, is investigating DNA repair pathways to better understand how cancer cells are killed by radiation, genetic variants that predispose individuals to cancer and influence therapeutic outcomes, approaches to correct mutations at the DNA level, and methods of identifying subsets of cancer patients who would gain a survival advantage from particular radiation therapies—all with the goal of developing new therapeutic strategies against cancer. Research in which stem cells are irradiated has also shown that hematopoietic stem cells and progenitor cells from cord blood restore blood, bone marrow, and immune function after radiation or chemotherapy, and stem cells themselves may fight against certain cancers. Continued progress in these areas is essential to winning the war on cancer. Removal of cesium irradiators would create an unparalleled hardship for many of those engaged in research.

Further, cesium is an important radioisotope in brachytherapies, which are saving lives and preserving quality of life by delivering radiation doses more precisely to certain tumor sites, while minimizing dose to healthy tissue. Cesium-137 in either ceramic or chloride form is used for treating gynecological cancers with brachytherapy during which sources are temporarily placed adjacent to or within the tumor. Cesium-131 seeds are being used in permanent implant brachytherapies for prostate cancer.

The American Cancer Society estimates that in 2008 approximately 11,000 cases of invasive cervical cancer will be diagnosed in the United States and that approximately 3,900 women will die from cervical cancer. The incidence of cervical cancer is highest among poor women, affecting Hispanic, Native American and African-American women at higher rates than Caucasian women. These groups of women are much less likely to receive regular Pap tests, and accordingly, their cervical cancers are often diagnosed at a later stage.

One study[1] estimated that 16,375 patients were treated in the United States from 1996-1999 and that a majority of the women who were treated with brachytherapy (77.8%), received low-dose-rate (LDR), cesium-137-based therapy. In 2008, cesium-137 LDR remains an important treatment for many medically underserved patients diagnosed with cervical cancer, and sustained access to this therapeutic agent is critical for this vulnerable population.

ASTRO acknowledges that the focus of the NRC's Roundtable on the continued use of cesium chloride has been on sources within the International Atomic Energy Agency (IAEA) Categories 1 and 2. It is important to note that a facility at which cesium brachytherapy procedures are performed is likely to have less than one half of a curie of cesium-137 for these procedures—a quantity that is substantially lower than that found in a research or blood irradiator. Although we assume that any regulatory action stemming from this inquiry would not include cesium-137 brachytherapy sources, ASTRO requests that any rulemaking explicitly note this treatment modality and specifically exclude cesium-137 brachytherapy sources from any regulatory constraints imposed.

Responding to nuclear terrorism. Countermeasure research focuses on discovering and developing new drugs and strategies that could prevent the life-threatening effects of ionizing radiation in the event of radiation accidents or radiological terrorism. Countermeasure research, which is heavily dependent on cesium chloride irradiators, would suffer significant adverse impact if research use of cesium-137 were eliminated. This research is focused on developing methods of rapidly assessing radiation exposure to improve medical treatment, and investigating the effects of radiation injury combined with trauma, disease, or chemical exposures. Stem cell research is also being conducted with cesium irradiators to develop therapies for lethal radiation injuries that adversely impact hematopoiesis.

ASTRO is concerned that limitations on the use of cesium irradiators could adversely impact the valuable, cutting edge research that is underway and inhibit further research that could be instrumental in improving therapies for cancer patients and treatments for victims of radiologic terrorism.

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[1] Erickson B, Eifel P, Moughan J, Rownd J, Iarocci T, Owen J. Patterns of Brachytherapy Practice for Patients with Carcinoma of the Cervix (1996-1999): a Patterns of Care Study. Int J Radiat Oncol Biol Phys 2005; 63(4): 1083-92.

FEASIBILITY OF USING ALTERNATIVES

As stated by a number of experts attending the NRC's Cesium Chloride Roundtable, there is no currently available technology for producing irradiators with cesium-137 in any form other than cesium chloride. Experts believe that the technology is possible, but estimate that production of a commercially viable irradiator using a glass or ceramic form of cesium-137 is several years away. We encourage the NRC and other government agencies to support this research needed to develop such a form of cesium-137 that would produce the same energy levels as the cesium chloride that is currently used.

ASTRO acknowledges that while it may be theoretically feasible to transition some radiation research from cesium irradiators to x-ray irradiators, the transition process remains problematic. In instances where x-ray irradiators could be used for research purposes, it would take considerable time and skilled physics support to develop an x-ray protocol that could replace existing cesium-137 protocols. Such a change in radiation quality would require duplication of years of research to determine new baselines and responses, and even then, some of the research being done would lose all practical relevance using non-gamma sources.

We believe it would be necessary for all investigators to conduct side-by-side studies so that the differences between x-rays and cesium-137 gamma rays could be studied, evaluated, and appropriate controls established. This arduous process would require both a cesium irradiator and an x-ray irradiator to be operational simultaneously within the same facility over a long period for appropriate comparison and calibration. Most research lab facilities, however, do not have the space for housing two sizable machines in their facility at the same time, nor can they afford the expense of the additional technical skilled medical physics support. Calibrating the x-ray equipment to match prior studies with Cs-137 irradiators is difficult, requires skilled physics support and sufficient lead time. If repeating base line studies produces subtle differences, the data from the studies cannot be combined, and the research would be lost or continuation with cesium irradiators would be necessary.

Furthermore, trained medical physicists are in short supply and high demand. ASTRO voices concern that there are not enough trained medical physicists to meet current demand for radiotherapies, and that it would take some time and investment for the physics workforce to be able to accommodate increased demand resulting from a shift toward x-ray irradiator technologies in the research arena.

Moreover, ASTRO cautions that a large spectrum of research using cesium irradiators cannot be done using an alternate technology. Research irradiation facilities designed to study effects from continuous low-dose-rate exposure over periods of hours, days, or longer periods of time cannot use available x-ray technology because the x-ray sources cannot operate continuously and reliably for such periods. X-ray machines cannot be left on for any period of time, whereas irradiators using radionuclide sources can be. Studies involving continuous low-dose-rate exposures are critical for our understanding of environmental radiation exposure following accidents or terrorist action, as well as certain medical treatments. There is a very wide range of different radiobiological research studies that use cesium chloride sources, and within this breadth and range of applications, there are many studies that simply could not be transferred to another source.

ASTRO members involved in research caution that a move away from cesium irradiators would have a huge impact in hematology, bone marrow transplant, investigations requiring whole-body irradiation of mice, and would hamper development of new research facilities in the stem cell area.

In fact, the Radiation Research Society recently conducted an informal survey of researchers to gauge the potential impact of banning cesium-137 and other sources. Of the 114 researchers responding to the poll, 78% indicated that the loss of isotopic sources would have a major or catastrophic impact on their research. Many of those researchers said that although they had access to x-ray sources, the x-ray sources would not be suitable for their studies. It is important to note that some institutions have installed orthovoltage (x-ray) units, which provide better imaging to simulate therapy in small animals, but these machines are not replacing cesium irradiators. Rather, this technology is being used for different kinds of research.

ASTRO believes that limitations on the use of cesium-137 in research applications would impede the investigators who are developing and improving technologies that benefit so many patients and would further burden the research infrastructure already constricted by lean budgets. Research institutions with a limited number of radiation investigators could conclude that the additional investment in support staff and equipment would be too much trouble and opt to terminate their programs instead. This would have the effect of reducing the number of radiation research programs at a time when there is a national priority to increase programs and investigators focused on confronting the consequences of radiologic terrorism.

ASTRO doubts that cobalt-60 irradiators present a viable alternative to cesium-137. Considerable additional shielding is required for cobalt units, which often necessitates ground-floor installation, and the heavily-shielded rooms required for the cobalt irradiators are costly to construct. It is important to note that irradiators using cesium-137 chloride are self-shielded units; they are self-contained, with considerable built-in shielding, designed to protect the integrity of the source and limit access to the source. Additionally, cobalt-60 irradiators require reloading every 5 years, exposing the decommissioned and new sources to transportation and other security vulnerabilities. Cesium irradiators, however, can function for 30 years before it is necessary to reload the source or replace the entire irradiator.

ASTRO's analysis, as well as that of many of the experts at the Roundtable, reflects that there are many different uses for cesium-137 chloride within the research and medical communities with very different need situations, and no one-size-fits-all solution. ASTRO urges that any rulemaking take into consideration the complexity of this issue avoiding a broad-brush approach to regulation.

COSTS/ECONOMIC ISSUES

ASTRO recommends restraint in further burdening our country's research infrastructure with extraordinary replacement costs. While the capital outlay to purchase a cesium irradiator is substantial, the irradiator can be used for 30 years with limited maintenance. Replacing a cesium irradiator with an x-ray irradiator, however, is an expensive proposition. The additional cost includes not only the purchase of a new machine, but also the decommissioning of the cesium irradiator, and large annual operational costs.

The life span of an x-ray machine is roughly one-third that of a cesium unit. While the cesium irradiators used by researchers are self-shielded, some x-ray irradiators require heavily shielded rooms for operation which can cost more than a hundred thousand dollars to construct. There are commercial self-shielded x-ray units that do not require shielded rooms, however, that are being purchased by institutions. The real cost of these self-shielded x-ray irradiators comes from the maintenance agreements and the costs of the dosimetry. The complexity of dosimetry presents a significant challenge for orthovoltage units because the energy distribution is complex and the energy range ensures that one gets preferential deposition of dose to bone. A great deal of sophistication is required to understand how energy is being deposited because it can vary substantially depending on what hardening filters are used. Another difference is that x-ray units require frequent dosimetry/quality control, and maintaining an x-ray unit requires employing a physics support staff, that is both expensive and in short supply.

ASTRO is concerned that the cost of acquiring an orthovoltage x-ray unit, installing it and providing physics support might limit development of new research facilities or cause existing facilities to question the value of maintaining research programs. Another concern is that researchers facing these economic issues might be forced to omit critical controls or experiments, possibly producing inaccurate research data that will not lead to medical advances.

SECURITY ISSUES

ASTRO supports the voluntary "hardening program" sponsored by the Department of Homeland Security and the Department of Energy that enhances the security of cesium-137 chloride irradiators by making design modifications that would further hinder an unauthorized individual from gaining access to the sealed sources.

ASTRO, however, questions whether imposition of additional security requirements would significantly lower the risk of cesium-137 chloride from irradiators being used by those with malevolent intent. Even without "hardening," it is not a trivial matter to get cesium-137 chloride out of the irradiators. ASTRO members question whether cesium-137 chloride sources could be removed from the irradiator by those with malevolent intent without causing grave injury or rapid death to the perpetrator. Self-shielded irradiators incorporate many engineering features to protect operators and the general public from radiation exposure and ensure that source integrity is not compromised. An individual intent on getting the source out of the unit must have specialized equipment and technical expertise, and theft of a self-shielded irradiator is unlikely because of the typical unit's size and weight.

Moreover, with the NRC's recent security-related orders in place, there is already a high level of security around these irradiators. Currently, cesium irradiators need to be located in what are essentially armored cells that would require heavy equipment to break down the walls. Users are required to be fingerprinted and background checks are conducted by the FBI. There are biometric entry security systems and 24/7 security video surveillance. If the video monitoring is impaired, guards respond immediately to the area.

REGULATORY CONCERNS

ASTRO asserts that there is a regulatory basis—including the already implemented increased controls/enhanced security measures as well as the ongoing irradiator hardening project--that supports the NRC not moving forward with rulemaking limiting the use of cesium-137 chloride. ASTRO requests that any risk analysis conducted prior to rulemaking include consideration of the health care community and the various medical uses of cesium-137. As stated repeatedly through this comment letter, ASTRO has concerns that disallowing future licensing of cesium irradiators may have a significantly harmful impact on future biomedical research and advances.

ASTRO is also concerned that regulatory action may impact cesium irradiators that are already licensed. ASTRO strongly urges that if the NRC moves forth with rulemaking, the agency should grandfather these irradiators which are already licensed and follow an approach allowing the licensee to amend its license upon moving an existing irradiator within its existing facilities or to a new building/facility. Occasionally, an institution will move an existing, licensed cesium irradiator to another floor within its existing facility or to a newly constructed research lab as part of the institution's ongoing development. We believe facilities should continue to have the ability to develop their campuses as long as they continue to meet the NRC's security requirements.

TRANSPORTATION/STORAGE

ASTRO believes that currently cesium chloride irradiators present few transportation concerns. Cesium-137's long 30-year half life ensures that the cesium sources are not transported with any frequency. When a unit requires maintenance, the entire unit is returned to the manufacturer. The 2-4 ton unit is packed in a crash-resistant over-pack designed to withstand impact injuries such as an accidental collision. However, any policy that requires removal of cesium-137 sources would necessitate an increase in the movement of these sources and may increase the likelihood of a security breach or an accident.

ASTRO is concerned that at present there is no disposal pathway available to licensees for retiring cesium irradiator sources and that stockpiling of sources in one location poses other security threats. Moreover, while some vendors and government programs provide for long-term storage of these sources, there is no permanent storage option.

ASTRO believes that it is important that sources that are stored but no longer used (orphan sources) be retired through legitimate disposition pathways and that government programs such as Source Collection and Threat Reduction (SCATR) and the Off-Site Source Recovery Project (OSRP) be expanded and fully funded to meet the need for safe disposition with little or no cost to the licensee.

CONCLUSION

ASTRO advocates a pragmatic, measured approach to this issue that acknowledges the importance of research in advancing patient care and the treatment of cancer and other diseases and avoids impairment or dismantling research capabilities. Thank you for affording ASTRO this opportunity to provide comments on the Security and Continued Use of Cesium-137 Chloride Sources. Please contact Richard Martin at 703-839-7366 or richardm@astro.org if you have any questions.

Sincerely,

Laura Thevenot

Laura I. Thevenot
Chief Executive Officer