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REVISS Services Inc.

Formal Feedback to US NRC regarding
Continued Use of Cs-137 Sources in the Form of CsCl

This feedback is provided by REVISS Services – currently the sole supplier of Cs-137 sources in the form of CsCl into the US market (and also overseas markets).
The feedback is based on discussions held by REVISS with its manufacturing partner, Mayak Production Association and also on discussions held with key users of the products.

General Feedback

1. It seems clear, as evidenced at the meeting organised in Washington DC on September 29th/30th 2008 that there remains a very significant and justified demand for these products in support of medical treatment, research activities and safety-related calibration services. It appears that the great majority of users from these areas regard the continued availability of suitable Cs-137 sources as being essential.

   Currently the only legitimate alternative to Cs-137 irradiation for blood processing and for research is X-ray. While some facilities are beginning to use the x-ray machines there are serious shortcomings with this technology at present. These shortcomings can be broken into three areas: capacity/economics, efficacy and reliability.

   Capacity/Economics:
   a. The capital cost of new X-ray and Cs blood irradiators are comparable, however, the usable lifetime of an X-ray machine is 10 years, a Cs irradiator 20+ years. The capital cost of an X-ray device is twice that of Cs.
   b. Current X-ray blood machines process 2 blood bags per processing cycle which takes more than 5 minutes per process. Compare this with a Cs-137 irradiator that processes 3-4 bags per cycle which takes 3 minutes per process (x-ray is less than ½ as effective).
   c. The current x-ray machines require large quantities of electricity to fire the x-ray tubes as opposed to a normal house current to run the control panel of a Cs-137 irradiator. This is significant in areas where electric power is not reliable or plentiful.
   d. The current x-ray machines require a cooling water source to cool the x-ray tubes. This also requires either a chiller system for a closed loop cooling system or a large reliable water source to support an open loop cooling system. The current Cs-137 irradiators require no support systems other than the modest power supply described above.

   Efficacy:
   a. X-ray machines produce a spectrum of x-ray energies. As a result it is extremely difficult to measure the dose imparted on the target. Whereas Cesium sources impart a single energy gamma to the target so that dosimetry can be calibrated to that specific energy. This often requires additional costs for health physics staff to support use of the x-ray device.
   b. The spectrum of x-ray energies result is secondary reactions in the target, which create uncontrolled variations in experiments.
   c. Research irradiators require a threshold dose rate of 1 gray per minute. This dose rate is required to expose the sample target without creating secondary effects in the sample. This is quite easy to achieve using a cesium irradiator but is nearly impossible using a current x-ray machine for two reasons. One is achieving the dose rate and second is that the varying energies cause secondary effects.

   Reliability:
   a. A typical Cesium irradiator operates for 20 plus years and requires very little maintenance, most of which is associated with updating the electronic control system. The sources remain sealed in the unit, safe and secure.
   b. A typical x-ray machine operates for approximately 10 years. The maintenance requirements are similar to the requirements for a Cesium irradiator for the control systems but also require regular x-ray tube replacement. There is also considerable high level of sophisticated maintenance required for the support systems associated with the x-ray machine which are not required for a Cesium irradiator.

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2. Arguments have been presented by politicians and the security community in favour of taking steps to reduce the potential for Cs-137 to be used as part of a terrorist offensive on society. In view of the perceived concerns about CsCl being security-related, it seems obvious that any resolution must encompass both:-
   - A strategy to address the risks from existing CsCl sources within the United States. This could include both hardening of the security associated with equipment and facilities that use these sources and also improved accessibility to national facilities for disposal or long-term storage of sources that are no longer required.
   - A strategy that addresses risks outside the United States – in order both to protect citizens (US and foreign) when overseas and also to reduce the risk of CsCl sources being imported into the United States illicitly for terrorist purposes.

3. There has been extensive discussion regarding the potential for development of an alternative form of Cs-137 that might offer improved characteristics in terms of lower solubility, leach resistance, reduced dispersibility and reduced chemical reactivity with building materials. REVISS/Mayak, as the sole current manufacturer, wishes to state that:-
   - Research into options for alternative forms of Cs-137 has been under way for some time with the same objectives as above
   - Whilst the science for non-dispersible forms of Cs-137 is understood, the challenge is to develop a technology and production process that can be incorporated into existing or planned facilities.
   - REVISS and Mayak expect to be in a position to share more information on progress and technology options by the middle of 2009.
   - As part of the development of options, a better understanding of the issues surrounding dispersibility needs to be reached between the manufacturers and the security experts and we hereby petition the US government to facilitate this process and work with industry to develop criteria for this parameter.
   - Assuming that a technology option can be identified that meets both user and regulatory needs and also manufacturability considerations, then a commercial solution will be needed to provide the incentive for the manufacturer to invest in delivering a production capability which delivers a viable business model in the medium term.
   - It seems clear to us that a key element of this will need US government investment in the development project. In our opinion, this means that the US government, either directly or indirectly, will need to fund some or all of the development of that production capability. Costs are unknown at this point but likely to be in the range $500k-$2000k. It is expected that a more definitive cost proposal should be possible by early/mid 2009 but it would be helpful if some preliminary thought could be given to possible funding mechanisms by US Government. Delivery of such a capability could be expected to take several years (3 – 5) from the point at which a viable business model can be demonstrated.
   - All parties must recognise the risk that an economically viable new technological processes for a less dispersible form of Cs may not be achievable, (there is currently thought to be 60% to 80% likelihood of success). Such a process is unlikely to be developed without support from government and the user community. Under these circumstances, a ban by the United States on the use of Cs-137 in the form of CsCl may result in continued supply of CsCl sources to users outside the United States, thus depriving the US medical and research communities of the use of this valuable technology whilst, at the same time, not reducing the threat of misuse of the sources by terrorist groups who would simply obtain them overseas and import them illicitly.
   - REVISS/Mayak recognise the benefit of potential recovery and recycling of CsCl sources as part of this process, and call for intergovernmental agreements to be developed to facilitate such capability.

4. Conclusion:
   REVISS/Mayak are willing to participate in a program to develop replacement technological processes to make available a less dispersible Cesium. We would welcome further discussion to agree specifications for such products and financial input to the development of the new processes.

Feedback to Specific Issues and Questions Raised in the US Federal Register and the Meeting of 29/30 September 2008 (Note: comments provided only for those questions that REVISS considers itself to have a relevant opinion on).

Q1.1–1. Are manufacturers currently considering the use of other forms of cesium (other than CsCl)? If yes, what are such considerations?
Yes, MAYAK/REVISS are considering other forms of cesium in the form of glass or sintered ceramic.

Q1.1–2. Is the use of other forms of cesium feasible? If so, please describe desired methods and discuss any benefits or obstacles (e.g., intended function of source, costs, timeframe).
Yes, in principle but more detailed proposals will not be available until mid 2009.

Q1.1–3. (a) Would the effect of density loading with different forms of cesium preclude their use in existing devices? (b) Would it require modification of existing devices?
We believe that much of the equipment currently in use could be modified to use re-formulated cesium although it is anticipated that the reduction in radiation output from the new sources is likely to be in the range 20% - 40% by comparison with a CsCl source of the same dimensions.

Q1.1–4. Is it feasible that high-activity (e.g., IAEA Category 1 and 2) cesium sources will be available in alternative material forms? If so, what is the estimated timeframe for manufacturing?
We believe that it will be feasible technically although we need until mid 2009 to confirm options. If a technical solution can be identified along with a viable business model to make investment in the new product a commercial reality then it is likely to take a further 3 – 5 years to establish a capability to deliver to the market.

Q1.1–5. Since all the CsCl is manufactured in Mayak, Russia, is it known if the cesium source producer can modify its production process?
Yes, in principle, but a definitive response awaits completion of the current technology review. We expect to be able to respond more fully by mid 2009

Q1.1–6. Would other entities (in the U.S. or worldwide) engage in manufacturing sources with alternative forms of Cs-137?
No specific comment – this is a question for such other entities.

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