

ALTERNATIVE TECHNOLOGIES TO HIGH ACTIVITY RADIOACTIVE SOURCES

6TH REGIONAL REVIEW MEETING (RRM)

COLOMBO, SRI LANKA. 6 - 9 MARCH 2018

WINS SESSION ON 7 MARCH 2018 – REPORT

OVERVIEW

Although adequate security measures will significantly reduce the risks posed by high activity radioactive sources, replacing them altogether with a different, but equivalent, technology (X-rays, electron beams, etc.) would permanently reduce the risk. Ongoing research, advancements in new technologies, and improvements in existing technologies have made many alternatives to radioactive sources attractive and cost effective. However, more work is needed before certain applications can be replaced successfully with an alternative.

The movement to adopt alternative technologies is growing in some countries, as well as for some practices. This has been encouraged, at least in part, by the potential risks and liabilities posed by radioactive material. In other cases, complacency and the lack of incentives and viable alternatives have limited the movement to non-isotopic replacements.

When it comes to developing and promoting alternative technologies, many different stakeholders play an important role. Coordinated efforts at the international level and the engagement of all stakeholders is a prerequisite to an effective and sustainable movement towards alternative technologies. End-users of radioactive sources are the key decision makers in this effort because they are generally the best qualified to assess the viability of replacing their current radioactive sources with an alternative.

Regulators also play a major role because they can provide end-users with information on such technologies and explain how others have benefitted from adopting them. In addition, they can implement policies to facilitate the adoption of alternative technologies; for example, they could create disincentives for the continued use of sealed sources.

Device manufacturers play a central role in the development of radionuclide-based devices and alternative technologies because they are continuously upgrading existing products and developing new ones. Government agencies and professional associations also have important roles to play in this process.

Objectives of the Session

At the request of the DOE/NNSA's Office of Radiological Security (ORS), WINS organised a one-day event on Alternative Technologies to High Activity Radioactive Sources during the 6th Regional Review Meeting (RRM) conducted in Colombo, Sri Lanka, from 6 to 9 March 2018. Over 70 participants from 20 countries attended the meeting; they included people from regulatory agencies and governmental bodies, end users, industry and international organisations.

The WINS session, which was held on 7 March, gave participants the opportunity to better understand alternative technologies and how they contribute to radiological security. It focused on four major issues: 1) the availability of non-isotopic alternative technologies to radioactive sources, 2) lessons learned from implementing alternative technologies, 3) key elements of an effective transition process towards alternative technologies and the potential impacts from such a process, and 4) how to effectively manage disused sources.

One key objective for the event was to help participants better understand the availability of alternative technologies for applications using high activity sealed radioactive sources, as well as their advantages, limitations and some challenges they could face when replacing radioactive sources or purchasing new equipment that does not use sources. Due to time constraints, the session focused mostly on medical practices (i.e. blood irradiation and radiation therapy). Some discussions related to industrial irradiation were also conducted during the session.

A second objective was to encourage and facilitate dialogue between those who have experience using alternative technologies and those who are considering converting to them. Discussions focused on identifying barriers to conversion and understanding the dynamics of successful transition. Participants had the opportunity to listen to and talk with alternative technology vendors, as well as with end-users and regulators who shared their experiences using, or regulating the use of, these technologies.

The session finally provided an opportunity to review good practices for managing the disused radioactive sources that result from the adoption of alternative technologies.

Logistics

A professional facilitator, Mr Carl Reynolds, guided the discussions using plenary sessions and table and breakout discussions. An instant electronic voting system (e-voting) was used to obtain participants' opinions and concerns throughout the session. A variety of experts made presentations during the session, setting the scene for the discussions that followed.

Session discussions were designed around the structure of the WINS Special Report titled *Considerations for the Adoption of Alternative Technologies to Replace Radioactive Sources*, which will be revised by June 2018 based on the key findings of the session.

Some Conclusions

During the discussions, many participants indicated a lack of knowledge on the topic. In fact, 40% said they had limited or no knowledge of alternative technologies prior to their participation in the session. Consequently, they emphasized the need for access to reliable and comprehensive information so they can better understand the benefits and challenges involved in adopting alternative technologies.

The consensus was that alternative technologies are currently available and successfully meeting the required needs for teletherapy and blood irradiation. (Brachytherapy, however, remains an issue.) Participants expressed the wish to have more access to the lessons learned by facilities that have successfully converted to alternatives. Some participants indicated that increased performance, especially for Linacs, was the main driver for shifting towards alternative technologies. They also said that selecting the most appropriate maintenance and servicing contract was essential to the sustainable use of the new devices.

Some of the biggest challenges to effective adoption of alternative technologies include infrastructure, cost, and the availability of appropriate training for staff. Possible mitigation factors include raising awareness among decision makers of the benefits of alternative technologies and ensuring initial and continuous training of staff. Participants agreed that due to technological changes in the new devices, some barriers related to infrastructure (e.g. bunker modification and power supply requirements) are less of a concern now.

To support an effective transition, participants recommended establishing a mechanism as early as possible that involves all relevant stakeholders and clarifies their roles and responsibilities. They also recommended a transparent procurement process to support a clear expression of the needs and selection of the most suitable technology.

Discussions highlighted the essential role played by the regulator, who has multiple tools to support the shift, including banning certain equipment. Participants recognized the important role of regulatory agencies, but they also said it could be challenging to involve the regulator in the process while maintaining their independence. Finally, the discussions stressed the need for an effective plan for managing disused sources generated by the adoption of alternative technologies, especially when there is no opportunity to include the repatriation of the sources in the procurement process.

Looking at the way forward, participants highlighted the essential role that the international community plays at all levels of the conversion process. This ranges from making information available and sharing success stories to providing education and training opportunities. It also includes helping end-users evaluate their needs and select the most appropriate technologies through guidance documents or direct incentives for replacing radioactive sources. Participants stressed the importance of coordinating international programmes and developing regional approaches. They suggested that certain organisations could be identified as references for others and become ambassadors in supporting the change. Finally, they suggested working closely with industry and organisations involved in the supply chain to facilitate the procurement process.

STRUCTURE OF THE DAY

SESSION I – DEVELOPING A COMMON UNDERSTANDING

Pierre Legoux, WINS Head of Programmes. Mr Legoux welcomed all participants, provided a preliminary overview of the importance of alternative technologies for radiological security, and introduced participants to the WINS programme of work and its relevance to the topic. He also introduced the session agenda, the results of the pre-event questionnaire, and success criteria for the day.

Mr Reynolds then asked attendees to introduce themselves at their tables and share what they would like to achieve by the end of the day. Responses included to:

- ✦ Gain more information¹ on available technologies, international trends, new developments, etc.;
- ✦ Better understand the benefits and challenges when shifting towards alternative technologies;
- ✦ Assess cost, performance, relevance to the need and various local constraints and specificities;
- ✦ Listen to the experiences and lessons learned by those who are using alternative technologies;
- ✦ Learn how the approaches that other countries take toward this topic compare with the practices in their own country;
- ✦ Explore incentives for facilitating the adoption of alternative technologies²;
- ✦ Better understand roles and responsibilities of each stakeholders; and
- ✦ Network during and after the session.

SESSION II – AVAILABLE NON-ISOTOPIC ALTERNATIVE TECHNOLOGIES AND LESSONS LEARNED FROM USING THESE TECHNOLOGIES

This session was designed to review alternative technologies that are currently available and some locations for unbiased, relevant and reliable information on the topic. It also provided an opportunity to identify and discuss some potential impediments to the adoption of alternative technologies, as well as possible incentives for facilitating their adoption.

Plenary discussion

As an overall introduction to the day, participants were asked to discuss if alternative technologies can effectively replace sources and if the need for security is a sufficient reason to replace radioactive sources with a non-isotopic alternative.

Participants agreed that viable alternatives now exist for many practices (e.g. Linear accelerators for radiotherapy) and are being widely adopted. They also said, however, that effective alternatives for some uses (e.g. brachytherapy and certain well-logging applications) are not yet viable and need additional research before they can become so.

Participants also said that the primary rationale for conversion was how well an alternative technology performs and how capable it is of meeting practitioner needs and constraints. Security is an important factor, especially for Cs-137 sources used in blood irradiation and for locations with a high level of threat, but it is not usually the main driver.

¹ 40% of the participants in the pre-session questionnaire indicated they had limited or no knowledge at all of Alternative Technologies prior to their participation

² 70% of the participants in the pre-session questionnaire believed that end users should be further incentivized to adopt alternative technologies

ALTERNATIVE TECHNOLOGIES FOR BLOOD IRRADIATION

Presentations

Dan Aitkenhead, Best Theratronics, Canada. Mr Aitkenhead opened the session with a manufacturer perspective. He provided an overview of Best Theratronics, explained the purpose of blood irradiation, and listed available options for irradiating blood. Mr Aitkenhead then described the difference between Gamma (Cs-137) and X-ray irradiators and presented the key features and technical specificities of the X-Ray blood irradiators currently supplied by his business. He also gave his perspective on how the market and blood irradiation practices will evolve in the next three to five years.

Kristin Ramberg, Hospital Construction Agency, Norway. Ms Ramberg summarised the main lessons learned by St Olavs Hospital in Trondheim, Norway, during the process of converting from a Cs-137 blood irradiator to an X-ray unit and said that users are very satisfied with the change. She began by describing the structure of the health organisation in Norway and providing some background information on blood irradiation capabilities in the country. She then detailed the process, initiated in 2009, that finally led to the adoption of an alternative technology in 2015. Ms Ramberg also provided additional information on the procurement and change processes, the associated economics, the disposal of the Cs-137 source, and some unforeseen issues the hospital faced during the conversion process. Finally, she highlighted the need to involve key personnel at the hospital and the importance of establishing and implementing a thorough conversion plan.

Follow-up discussions

The follow-up discussions highlighted participants' appetite for obtaining more information on the topic. They expressed the wish to have better access to reliable and comprehensive information and said they lacked confidence in currently available information. Participants were encouraged to engage directly with vendors and to seek information and advice from peers who have already been through a conversion process. Professional conferences were also mentioned as a good opportunity for meeting key stakeholders—both vendors and practitioners—at the same time. The role of the IAEA was also emphasised as a source of relevant information.

On a more technical side, participants agreed that X-ray devices were generally an effective replacement for Cs-137 based units; however, participants also stressed the essential role of device servicing and maintenance for the efficient use of such devices. They noted that the process of procuring an X-ray device was more complicated than simply purchasing and installing a device. Long-term operation issues, in particular costs, should be considered up-front, and maintenance matters should be addressed properly in the contract signed with relevant vendors.

ALTERNATIVE TECHNOLOGIES FOR RADIATION THERAPY

Presentations

Michael Sandhu, Varian, Switzerland. Mr Sandhu offered a presentation on *Alternative Technologies to High Activity Radioactive Sources for Radiation Therapy*. He began by clarifying that he did not intend to make a one-to-one comparison between linear accelerators (Linacs) and cobalt units since both have very different specificities and roles and will probably co-exist for many years. Instead, he focused on the development of alternative technologies and how manufacturers are making them easier to implement. Mr Sandhu also provided some background information on the

need for radiation therapy and current practices in radiation treatment for cancer. He then focused specifically on linear accelerators and detailed how manufacturers have upgraded these devices to improve their performance and facilitate their operation. Mr Sandhu concluded his presentation by highlighting the need for competency building among staff involved in radiation therapy and emphasizing the essential role of vendors in the process.

Athula Kumara, National Cancer Institute, Sri Lanka. Mr Kumara then provided a licensee perspective by describing his organisation's experience in replacing Co-60 units with linear accelerators. He described the current radiation therapy capabilities in Sri Lanka and the process for exchanging disused sources with new ones. He then introduced the national project initiated in 2014 to replace all Co-60 units by Linacs and provided an update on the current status of the project, including the challenges faced in the last few years. Mr Kumara finally presented the experience gained by the National Cancer Institute in Maharagama, which was the first facility in the country to commission and operate a Linac.

Follow-up discussion

During the follow-up discussion, it was agreed that Linacs were an effective replacement for Co-60 units and that in many cases the medical staff were the driver for the change. When properly operated, participants said, Linacs offer better treatment services.

The discussions highlighted the existence of multiple success stories around the world, and participants urged that such experiences be shared more broadly. They also agreed that many misconceptions, mostly around the infrastructure needed for Linacs, still exist and that proper communication and sharing of experience would eliminate them.

As mentioned in Mr Sandhu's presentation, the availability of competent staff remains a significant barrier to an effective transition and to enjoying the full benefits of Linacs' capabilities. Participants highlighted the challenge of educating and/or retraining staff—both in the organisation and in the country itself. In addition, the choice of the most appropriate service contract for blood irradiators (in particular) was seen as essential to the sustainable use of such devices.

Overall, participants felt that the main obstacle to change is often a lack of understanding by decision makers. Consequently they emphasised the importance of preparing business case studies to raise awareness of the benefits of alternative technologies amongst senior managers—both in medical organisations and at the political level.

INDUSTRIAL IRRADIATION

Presentation

Viraj Sampath, Sri Lanka Gamma Center. Mr Sampath discussed the use of industrial irradiation in Sri Lanka. He began by describing the different applications of industrial irradiation and the technologies that are currently available. He then detailed the specific role and capabilities of the Sri Lanka Gamma Center (SLGC). In particular, he described the business evolution of the organisation in the last few years and highlighted the importance of adopting quality standards. Mr Sampath concluded his presentation by providing some information on the upcoming business priorities for the company and targets for the next few years.

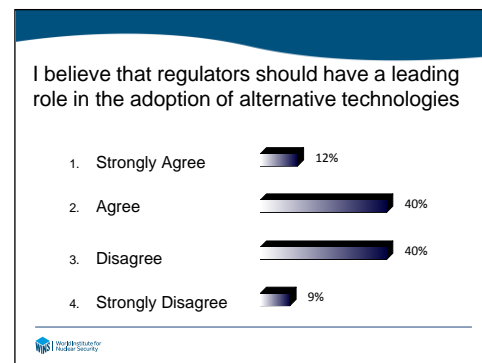
SESSION III – SUPPORTING THE TRANSITION TO ALTERNATIVE TECHNOLOGIES AND MANAGING THEIR IMPACT ON RADIOACTIVE SOURCE END-OF-LIFE MANAGEMENT

The purpose of Session III was to review the key elements of an effective transition process towards alternative technologies and to assess how replacing sources with alternative technologies can impact the traditional supply chain of radioactive sources and the backend of the lifecycle. It also gave participants an opportunity to learn more about the on-going regional and international efforts to support the development and dissemination of alternative technologies.

ROLES AND RESPONSIBILITIES FOR AN EFFECTIVE TRANSITION PROCESS TOWARDS ALTERNATIVE TECHNOLOGIES

The roles of end-users and regulators

The session began with an e-vote that asked participants whether the regulator should have a leading role in the adoption of alternative technologies. As shown in the slide, participants expressed very different views on the topic. Discussions highlighted the essential role that the regulator plays and the multiple tools at their disposal to support the shift, including banning certain equipment. Although participants recognized this important role, they also said it could be challenging to involve the regulator in this process while maintaining their independence.



Break-out groups

Participants were then asked to break into groups to discuss the roles and responsibilities of various stakeholders in supporting an effective transition towards alternative technologies. They were also asked to identify some actions that would help to support an effective transition process.

The discussion highlighted the need for strengthening communication amongst stakeholders and participants. Participants recommended establishing a mechanism as early as possible that involves all relevant stakeholders and clarifies their roles and responsibilities. End-users should clearly be in charge of identifying the needs, setting up the specifications to be met by the equipment, budgeting and planning for the procurement process, and ensuring the smooth operation of the new technology.

On their side, regulators should implement national policies through regulations, including establishing justification principles for the use of sources, or banning selected sources in certain instances, and for assessing compliance through inspection and enforcement mechanisms. As independent bodies, they have a limited role in promoting alternative technologies, but they can facilitate and encourage access to relevant information. Overall, it was felt that a further forum of exchanges should be established that is led by regulatory organisations, industry or end-users (whichever is most appropriate for a given country).

Taking the end-users' perspective, participants recommended that a transparent procurement process be established to support a clear expression of the needs and to select the most suitable technology. They also mentioned that establishing a funding plan, addressing both the upfront costs of purchasing the equipment and the medium- and long-term costs for operating it, was a prerequisite. They further mentioned that adopting a new technology was more complex than simply procuring a new device and that a transition plan is necessary to detail the infrastructure change required and the impact on human resources. Participants also recommended that attention be paid to the transition phase. Full operation and availability of the new equipment may take time and require the overlapping use of both technologies for a certain period.

The role of the international community

Presentation

Malika Taalbi, US DOE. In her presentation titled *Permanently Reducing the Risk of an RDD through Alternative Technology*, Ms Taalbi provided a broad overview of international efforts to support the development and dissemination of alternative technologies. She highlighted the importance of implementing a holistic approach toward source security and described the strategic approach that the DOE Office for Radiological Security follows in adopting and developing non-isotopic alternative technology. Ms Taalbi emphasised the need for partnerships and coordination and described in detail the roles and contributions that various international stakeholders make at implementation, outreach, research and policy levels. In the second part of her presentation, she focused on two ongoing initiatives to support the adoption of alternative technologies: the *Cesium Irradiator Replacement Project (CIRP)* and the *Ad Hoc Working Group on Alternative Technologies to High Activity Radioactive Sources*. She concluded her presentation by providing her perspective on global trends and areas where international stakeholders could best focus their efforts.

End of life management

Presentation

Kate Roughan, Waste Technology Section, IAEA. In the final presentation of the day, Ms Roughan provided a broad overview of the *End of Life Management of Radioactive Sources*. She described the source lifecycle, possible options for managing their end-of-life, potential barriers to the effective management of disused sources, and the role of the IAEA in helping Member States establish adequate end-of-life management programmes. Ms Roughan then introduced an upcoming document the IAEA is creating to help decision makers make informed decisions about the end-of-life management of radioactive sources. Finally, she provided some thoughts on the way forward and key issues to strengthen the international framework.

During the discussions that followed, participants stressed the importance of anticipating future needs and establishing a proper plan for managing disused sources generated by the adoption of alternative technologies, especially when there is no opportunity to include the repatriation of the sources in the procurement process.

SESSION IV – THE WAY FORWARD

Session IV was designed to summarise the key findings of the day, identify the opportunities for improvement, highlight some remaining challenges, and suggest actions that can be taken at individual and organisational levels to support the adoption of alternative technologies.

Looking at the way forward, participants highlighted the essential role that the international community plays at all levels of the conversion process. This ranges from making information available and sharing success stories to providing education and training opportunities. It also includes helping end-users evaluate their needs and select the most appropriate technologies through guidance documents or even direct incentives for replacing radioactive sources.

Participants also stressed the importance of coordinating international programmes and developing regional approaches. They suggested that certain organisations could be identified as references for others and become ambassadors in supporting the change. Finally, they suggested working closely with industry and organisations involved in the supply chain to facilitate the procurement process.

Concluding remarks

In his concluding remarks, Mr Legoux emphasised that the success of the session was largely due to the active contributions of all participants, and he praised the willingness of the group to share their experiences, raise questions and learn from each other. Mr Legoux reminded participants of WINS' commitment to build on this success and to continue offering fora in which stakeholders can exchange their knowledge and experience in reducing the radiological security risk.

Evaluation

Participants indicated that they were very satisfied with the session, thought it had been an excellent and useful learning experience, and would recommend it to others. In particular, participants stated they valued the interactions among participants, how well-organised the session was, and the effective facilitation process and facilitator. They also appreciated the expert presentations and the large amount of information that was shared during the day.