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## INTRODUCTION

Dear Nuclear Medicine professional,

As part of our ongoing support in the supply of Tc generators, we are pleased to send you the fifth edition of the Molybdenum Supply Review. The review consolidates the last news published about the Mo/Tc Supply and its perspectives.

This edition, which follows the restart of two major reactors (NRU, Canada and HFR, NL) contributing to the worldwide supply of Mo, provides a rather positive short-term outlook on the supply of Tc generators. According to the information available at time of publication, it appears that the supply of generators for the next 2-3 months should be secured.

Beyond this short term outlook, significant uncertainty remains on the supply of Mo and on the sustainability of the generators distribution.

Two major reasons prevail:

First because the obsolescence of the current network of reactors still remain unsolved. Although all technical incidents experienced in the last years have been fixed, the risk of a breakdown at one of the 5 reactors is still serious, due to the extreme aging of the infrastructure. Fully secure supply of Mo will occur only when new capacities will become operational at CEA's Jules Horowitz Reactor, planned for 2015. In September, IBA has entered into an agreement with both CEA and IRE in order to process these new Molybdenum quantities and ensure that they safely and reliably reach the nuclear medicine community by 2015. Once it is operational, this collaboration should put an end to the high uncertainty which prevails on generator distribution in the current environment.

Second reason, of higher magnitude, is the imbalanced economic condition of Tc Supply; which goes beyond pure Molybdenum supply issues. A recent report from the Organisation for Economic Co-operation and Development (OECD) is providing relevant insights on this economic imbalance. The report shows that Tc supply faces a typical market failure where the price of Mo/Tc has been set too low to allow re-investment in the maintenance and development of the sector. The report highlights that the net revenues generated for all actors of the Tc chain does not allow its sustainability. It also evidences that, among all actors, the manufacturers of generators are by far capturing the smallest share of net revenues. An executive summary and a link to download the full report are available on page 3 of this Review.

For these reasons, our company remains committed to bring necessary changes in the industry to overcome these challenges and ensure long-term sustainable development of our community.

Our teams remain at your disposal to provide further information and perspectives on this critical topic.

**INDUSTRIALS****EUROPE****New Industry Partnership will Secure Manufacturing of Radioisotopes for Medical Use in Europe****September 02, 2010, IBA Website**

Radiopharmaceutical firm Ion Beam Applications (IBA), the French Atomic Energy and Alternative Energies Commission (CEA), and the National Institute for Radioelements (IRE) have signed an agreement to secure the supply of technetium-99m (Tc-99m) beginning in 2015.

**Dutch reactor back online, isotope shipments begin next week****September 10, 2010, Health Imaging**

The High Flux Reactor in Petten, the Netherlands, has resumed operations after being shut down for repairs on Feb. 19. Reactor operator Nuclear Research and Consultancy Group said shipments of medical isotopes will begin next week.

**TU Delft to produce medical isotopes****September 28, 2010, SNM SmartBrief**

The Technical University in Delft, the Netherlands, has received the green light from the Ministry of Health to start producing medical isotopes for Dutch hospitals. The university will serve as a backup for the isotope-producing reactor in Petten.

**CANADA****MDS Nordion Signs Framework Agreement for Collaborative Alliance with JSC "Isotope"****September 24, 2010, Competitor's Web Site**

MDS Nordion of Ottawa has entered into an agreement with a Russian company to develop, market, and sell molybdenum-99 (Mo-99) radioisotopes produced in Russia.

Called Isotope, the company is the authorized subsidiary of Rosatom State Corporation of Moscow, the regulatory body of the Russian nuclear complex. The 10-year collaboration between MDS Nordion and Isotope may result in the creation of joint ventures or supply agreements to efficiently sell isotopes outside of Russia, according to MDS.

**AECL's NRU resumes operation****September 03, 2010, AuntMinnie**

The National Research Universal reactor in Ontario has restarted operations after it was shut down this week for unscheduled repair work. Atomic Energy of Canada Limited said the production of the molybdenum-99 isotope was not interrupted during the temporary shutdown.

**AUSTRALIA****MiPod inks Australian Mo-99 licensing agreement****October 22, 2010, AuntMinnie**

MiPod Nuclear will give Vector Trading of Victoria, Australia, exclusive rights to manufacture and distribute in Australia and New Zealand molybdenum-99 (Mo-99) produced with MiPod's medical isotope production-on-demand technology.

**SOUTH AFRICA****South African radioisotope production on target****September 22, 2010, SNM SmartBrief**

NTP Radioisotopes of South Africa, a unit of the South African Nuclear Energy Corporation, said it is preparing to produce molybdenum-99 radioisotopes from the Safari 1 reactor using only low-enriched uranium. NTP will be the only supplier in the world to produce Mo-99 from LEU, Necsa CEO Rob Adam said.

**RESEARCH – INVESTMENTS****DoE funds Wisconsin institute for medical isotope production****October 06, 2010, Health Imaging**

Two groups from Wisconsin have received \$500,000 each from the U.S. Department of Energy to develop technologies to manufacture molybdenum-99 (Mo-99). According to a report in the Milwaukee Journal Sentinel, the National Nuclear Security Administration awarded funding to the Morgridge Institute for Research in Madison, Phoenix Nuclear Labs of Middletown, and NorthStar Medical Radioisotopes of Madison and its partners.

In January, Babcock & Wilcox Technical Services Group of Lynchburg, VA, received \$9 million and GE Hitachi Nuclear Energy of Wilmington, NC, received \$2.25 million. Both awards were made in January.

**EU reactor operators sign nuclear research policy****September 21, 2010, Health Imaging**

The French Alternative Energies and Atomic Energy Commission, Belgian Nuclear Research Centre SCK-CEN and Nuclear Research & Consultancy Group have signed the European Research Area of Experimental Reactors policy, which promotes the implementation of guidelines concerning the activities of European research reactors. The policies will cover the Jules Horowitz reactor in France, the MYRRHA reactor in Belgium and the Pallas reactor in the Netherlands. Production of radioisotopes is a major focus.

**Government of Canada Funds Projects to Diversify Sources of Supply of Key Medical Isotope****September 18, 2010, Google alert**

The Canadian government has allotted \$35 million for an initiative that will explore the use of cyclotrons and linear accelerators in the production of the medical isotope technetium-99m. As part of the Non-reactor-based Isotope Supply Contribution Program, the Canadian Institutes of Health Research will conduct studies to help advance the translation of isotope research into practice. Health Canada also aims to promote steps to improve the use of the isotopes in the country's health system.

**EXPERTS****The High-level Group on the Security of Supply of Medical Radioisotopes****September 23, 2010, Google alert**

The principle objective of the HLG-MR is to oversee and assist, where necessary, efforts of the international community to address the challenges of medical isotope supply reliability.

**OECD Nuclear Energy Agency Releases Report: The Supply of Medical Radioisotopes: Interim Report of the OECD/NEA High-level Group on Security of Supply of Medical Radioisotopes****September 29, 2010, SNM SmartBrief****Executive summary**

Key OECD members have ask OECD-NEA to assess the origin of the Mo/Tc shortage

The conclusion of the report is that:

1. Mo/Tc has experienced a typical market failure
  - Insufficient capital investment in reactors and Enriched Uranium (EU) processors
  - Oligopoly situation for HEU or LEU processors (IRE and Covidien) maintaining low prices
  - Low value of Tc generator pricing compensated with cold kits profit drives to undervalue the Tc in reimbursement procedure. In particular:
    - Today OECD estimates that, from reactors to end-users, Mo/Tc generates a net revenue of appx 1750 EUR per Ci for the entire industry, which does not allow the sustainability of the Mo Chain. The report also evidences that generators manufacturers receive by far the smallest part of the net revenues created (ie appx. 60 EUR per Ci) among all actors, which prevents them even more strictly to re-invest in the Mo chain
    - Mo/Tc prices—and particularly generator prices- account for a very small fraction of the amount reimbursed for the examination
  - Mo/Tc considered as a simple by-product of reactors
  - Governments not charging for all costs as waste
2. This economic situation is unsustainable in the long term
 

The economical structure of Mo/Tc supply depends historically on a Social contract between governments and actors including Social Security organizations. This Social contract has to be redefined
3. Governments have a central role to play in correcting this situation
 

A key requirement is for governments to define and to clearly communicate their role in financially supporting the industry. Once this is defined, the full cost of Mo-99 production must be identified and funded. Actors in the supply chain must also recognize the value of having reserve capacity and be willing to pay for this capacity to ensure reliable supply. To overcome the long-standing, longer-term problem of insufficient capital investment, changes must occur. The electricity market could be a source for a new Mo/Tc economical model.
4. OECD formulates some preliminary comments
  - Downstream steps of 99Mo supply needs to be studied further by OECD (99Mo processing and generator manufacturing)
  - Data sources for prices and cost considerations may be relevant to build a decision tree, but remain country specific.

**With reactors back online, Mo-99 supply concerns remain****September 20, 2010 AuntMinnie**

The supply of the medical isotope molybdenum-99 is starting to stabilize in North America with the restoration of two nuclear reactors, but there is a need to put more focus on the long-term supply of isotopes, according to SNM. Michael Graham, the organization's past president, emphasized the need to have the capacity for domestic isotope production and to lessen dependence on foreign reactors. Graham expects that the earliest that the Congress could act on the American Medical Isotopes Production Act, which would promote local isotope production, would be next year.

**Bond digs in heels against ban of uranium exports****September 15, 2010, SNM SmartBrief**

Nuclear medicine experts are frustrated at the continued holdup of the American Medical Isotopes Production Act in the Senate. The delay is being caused by Sen. Kit Bond, R-Mo., who said the bill, which would support the domestic production of medical isotopes and cut off U.S. exports of highly enriched uranium, could endanger isotope supply in the country. "We don't think this is a bill that would cripple us," countered Dr. Michael Graham, past president of SNM. "It's a fairly unique opportunity for us to build a domestic isotope supply."

**SNM past president calls for domestic production of isotopes****August 23, 2010, Health Imaging****Summary**

Robert Atcher, SNM's immediate past president, at a recent conference of the American Chemical Society discussed how the U.S. is dependent on foreign providers of medical isotopes and that there is a need to address the shortage in the isotopes used for both medicine and research. "The challenge we have is to produce enough materials to meet commercial needs as well as needs of the research community -- from nuclear physics, to environmental research, to medical research -- amid increasing demands and fewer isotope sources," Atcher said.

**European Commission proposes resolutions to isotope shortage****August 10, 2010, Health Imaging**

The European Commission is calling on European Union states and the European Parliament to seriously consider and promote new methods for the production of the medical isotope Technetium-99m. The commission said the seven reactors producing the vast majority of the isotope "are approaching the end of their lifespan."

**99Mo/99mTc generator shortage: free, Web-based software.****Cecchin D, Zucchetto P, Faggin P, Bolla E, Bui F.****J Nucl Med. 2010 Aug;51(8):14N-15N.**

Calculating the theoretical and estimated yield of the 99Mo/99mTc generator enables a rational use of available activity, also enabling a selection of the type and number of procedures to perform. The authors are sharing the program free of charge in the hope that it will be clinically useful to optimize multiple generator elutions, to monitor 99Mo contamination levels, and also for educational purposes.

**Effects of technetium-99m/molybdenum-99 shortage on Wisconsin nuclear medicine departments****Stacy Sengpiel, Amanda Keller and Ann Voslar****J Nucl Med. 2010; 51 (Supplement 2):2110**

In order for nuclear medicine to continue to be a valued and utilized department in the healthcare field it is necessary to discover a solution to the Tc-99m/Mo-99m shortage. While Tl-201 is a suitable replacement for nuclear cardiology studies, it increases patient radiation exposure and imaging time. It is more cost effective for large nuclear medicine departments to use Molybdenum-99 generators and that product also allows the department to have more flexibility on their patient schedule. Rescheduling procedures, even by as little as one day, can be detrimental to patient health and certainly delays care and drives up health care costs. Approximately 21% of hospitals reported having diverted at least one patient to a different modality. This may be the most concerning statistic for the future of nuclear medicine. It is important that a new source of Tc-99m be found before physicians begin relying on other modalities more heavily for services previously performed in nuclear medicine

**Direct production of 99mTc with a medical cyclotron?****Brigitte Guerin, Alexander Zyuzin, Sébastien Tremblay, Erik van Lier, Serge Rodrigue, Jacques Rousseau, Veronique Dumulon-Perreault, Roger Lecomte and Johannes van Lier****J Nucl Med. 2010; 51 (Supplement 2):589**

A medical cyclotron can produce USP-compliant 99mTc-radiopharmaceuticals that can be used as substitute of generator derived 99mTc radiopharmaceuticals for nuclear imaging procedures. Perspective: Direct production of 99mTc using cyclotrons is a potential cost-effective means to alleviate the isotope crisis. Implementing networks of medium-energy medical cyclotrons would reduce reliance on nuclear reactors and attenuate the negative consequences associated with the use of fission technology

**The technetium shortage.****Thomas GS, Maddahi J.****J Nucl Cardiol. 2010 Aug 18. [Epub ahead of print]**

This is a review concerning the problem of technetium shortage

## TECHNETIUM SUPPLY FORECAST

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**TECHNETIUM SUPPLY FORECAST****Key**

**Secure** supply, all generators should be delivered according to order requirements.



**Light** disturbance of supply, generators could be delivered with up to one day less of calibration.



**Strong** disturbance of supply, generators could be delivered with 2 or 3 days less of calibration.



**Critical** disturbance of supply, generators could be delivered with 4 days less of calibration or delivery could be postponed.



Delivery potentially delayed to a later day in the week

Disclaimer: The forecast provided here is only tentative and reflects the information available at time of the publication. Actual supply could be higher or lower than documented due to unforeseeable changes in the supply conditions.

**IBA Molecular.**

**Society of Nuclear Medicine.**

**European Association Of Nuclear Medicine.**

**Sociedad Espanola de Medicina Nuclear.**

**Société Française de Médecine Nucléaire.**

**Société Belge de Médecine Nucléaire.**

**Nederlandse Vereniging voor Nucleaire geneeskunde.**

**Associa Italiana di Medicina Nucleare ed Imaging Molecolare.**

**British Nuclear Medicine Society.**

**Deutsche Gesellschaft für Nuklearmedizin e.V.**



**IMAGEM**

Educational and bibliographic platform on Molecular Imaging.



**Molecular Life**

Informational portal on Molecular Imaging (Italy)

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