

November, 2014

Dear Valued Nuclear Medicine Customer,

I am writing to you today to provide visibility into some of the significant cost drivers that the Nuclear Medicine industry and Mallinckrodt are experiencing. In addition, I will provide our outlook on Molybdenum-99 (Mo-99) availability during the coming years when some of the reactors we use for the irradiation of this vital isotope will be closing down.

Since 2009, our industry has faced many difficult challenges impacting patients, technologists, physicians, pharmacists, healthcare facilities and manufacturers. This began with the unexpected shutdown and necessary repairs to some of the global research reactors used in irradiating uranium targets to produce Mo-99 and other isotopes. The resulting supply disruptions created the first worldwide Technetium-99m (Tc-99m) shortage, which lasted nearly 18 months. The impact of this can still be felt today, despite the significant value our modality has in the diagnosis and treatment of patients.

During and after that difficult time, Mallinckrodt made it a priority to communicate with and listen to you, our customer. The message we heard: use your expertise, size and your vertical integration (supplying both Mo-99 and Tc-99m generators) to help prevent future such shortages.

Mallinckrodt has repeatedly risen to that challenge, starting by including the Maria reactor in Poland in the global Mo-99 supply chain to further diversify and strengthen the nuclear medicine community's ability to meet patient needs around the world. We have also successfully increased our Mo-99 production capacity through contracting for extra target irradiation positions with our reactor partners, known as Outage Reserve Capacity (ORC), allowing irradiation of extra targets for unexpected Mo-99 demand. Yet while ORC helps to increase reliable access to Tc-99m for patients, these irradiation positions must be paid for whether or not they are used, increasing overall Mo-99 production costs. Mallinckrodt has also helped overcome intermittent supply disruptions by negotiating access to every Mo-99 supplier available to the global market and skillfully utilizing this access when required. This resulted in an almost uninterrupted supply even during the outages we experienced earlier this year.

And while Mallinckrodt has been investing in supply improvements requested by Nuclear Medicine regulators, other forces have been acting upon our industry. For example, for decades our profession has relied on the supply of highly enriched uranium (HEU) to produce Mo-99 and other isotopes. To support global non-proliferation efforts, the U.S. government has mandated conversion from HEU to low-enriched uranium (LEU) production methods for medical isotopes.

As a major Mo-99 producer, Mallinckrodt supports this conversion, which requires significant time and investment throughout the industry to complete the scientific and technical modifications

necessary to operate without HEU. Beyond the conversion outlay, Mo-99 production using LEU will be inherently more costly than using HEU, partially driven by the need for additional regulatory approvals.

In addition to these factors, Tc-99m supply is impacted by the cost to produce and distribute Mo-99. These costs have continued to rise, driven by increased irradiation charges and Full Cost Recovery (FCR) models currently being implemented by reactor operators. The impact of FCR will continue to be felt as it is fully implemented around the world. The ability for manufacturers to pass these costs on to customers is challenged by the current reimbursement for Tc-99m-based procedures. It is therefore important that health insurance and governments are made aware of the need for adequate reimbursement.

Although nuclear medicine is a very cost-effective and useful tool for clinicians, the reimbursement for these procedures does not adequately reflect the true costs throughout the chain, which include:

- Irradiating and processing uranium targets
- Disposing of radioactive waste produced in the purification processes
- Manufacturing under cGMP and GDP standards
- Shipping rapidly decaying products (considered dangerous goods) in a timely manner
- Delivery of the final product to healthcare facilities globally

Mallinckrodt has been, and continues to be, committed to the stability of nuclear medicine, but these many cost-impacting factors – ORC, FCR, transportation, LEU conversion – simply cannot continue to be absorbed. Consequently, the continued availability of Mo-99 and Tc-99m generators will necessitate a series of price increases over the next few years that will be easier for customers to manage than a one time, larger increase. In so doing we will ensure our ability to sustain production and support the future for Nuclear Medicine and the industry.

In preparation for expected changes in the supply chain in the coming years, with certain older reactors going offline, we have successfully strengthened our global Mo-99 supply stability through various measures. We are confident that, if current capacity projections from all sources prove accurate, patient needs can continue to be met as they are today, barring unplanned outages at other reactors or processors.

I hope you continue to share our passion for and dedication to nuclear medicine, knowing the utility for Tc-99m-based procedures and other radiopharmaceuticals remains strong due to their unique characteristics. With appropriate planning and collaboration across the industry, we can all help to ensure nuclear medicines' vital role in healthcare is maintained.

Yours sincerely,

Mark M. Heselton
Vice President - Europe