THE SUPPLY OF MEDICAL ISOTOPES

AN ASSESSMENT OF THE MARKET ECONOMICS, ALTERNATIVE TECHNOLOGIES AND PROPOSED POLICY APPROACH TO ACHIEVING SUSTAINABILITY

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Nuclear Development Division
OECD Nuclear Energy Agency
Established by NEA in April 2009

• 22 experts: 13 countries, EC, IAEA
• 2 year mandate: June 2009-2011
• Oversees and assists international efforts – not duplicative

• Significant progress achieved already: communication; coordination of reactor schedules; better understanding within supply chain

• Three reports published under The Supply of Medical Radioisotopes series:
  • An Economic Study of the Molybdenum-99 Supply Chain
  • Interim Report of the OECD/NEA High-level Group on Security of Supply of Medical Radioisotopes
  • Review of Potential Molybdenum-99/Technetium-99m Production Technologies
Historical Market Development

- Historically - developed unsustainable economic model
  - Started with low prices; structure perpetuated low prices

- Resulted in supply reliability concerns:
  - Not enough financial incentives for new (LEU) infrastructure
  - New reactors struggling to cover $^{99}$Mo production investments
  - Supply from ageing reactors not reliable
  - Reserve capacity required but not supported

- Industry survived through government financial support
  - Also supported foreign health care systems/foreign companies

- Social contracts moving towards more commercial funding

- Actions are needed to correct market, policy and technology failures

- Step one: Ensuring full-cost recovery in prices
• Illustrative approximate prices

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<th>Levelised Unit Cost of $^{99}$Mo (LUCM) in €/6-day curie EOP</th>
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• Understand value of supply chain stages in end-user prices

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- ...remains small portion of patient price
Short-term shortage solved; Long-term concerns remain

- NRU and HFR back on line
- Shortages were symptom of longer-term problems, including insufficient capital investment and processing constraints
- Current reactors scheduled to go offline over next decade

Conservative Potential Supply vs. Demand

- New projects being discussed and some being developed
- Need to keep working to ensure will happen
- Cannot be lulled into complacency
• Global processing capacity seems sufficient
• However regional capacity limitations affect ability to supply global market, especially if reactor shutdowns
• Processors need to be reasonably close to reactors
• Some regions where processing capacity not sufficient for:
  • Supporting increased production
  • Meeting increased demand
  • Dealing with possible reactor outages globally, or
  • Adapting to changing supply structure as older reactor retired
• Possible barrier to new irradiation capacity
• Transportation regulatory processes and denials of shipment are impediments to reliable supply
  • Streamline and consistency in approvals, and education necessary
  • IAEA working on this matter
• Short term is defined as potentially available in the time frame 2010-2017
  • 7 years - order of magnitude for a time needed to build a new research reactor
  • Physical details and the economic data are available from industry

• Mid-term technologies are expected to be available in 2017-2025
  • Preliminary feasibility tests have been performed
  • Construction of experimental facilities is planned

• Long-term technologies are expected to be available after 2025
  • No economic assessment is currently possible
Conclusions for Short-term Technologies

• The use of LEU targets has advantages over HEU
  • Proliferation resistance
  • Easier availability of the target material
  • Easier compliance for target transportation and processing

• However, LEU currently has lower production yield than HEU
  • May require more targets to be irradiated, increased volumes of waste
  • Need to increase the uranium content to counteract
  • No technological or economic reasons not to deploy LEU target based production

• Neutron activation in a research reactor
  • Advantages in terms of safety, waste management and proliferation resistance
  • But low specific activity
  • Current technologies require recycling of the highly enriched molybdenum to be cost-effective; currently not done
  • More development and experience needed in (gel) generator technology for larger deployment

• Direct technetium-99m production using cyclotrons
  • Potential advantages in terms of cost, waste management, proliferation resistance and ease of approval
  • But can only provide local needs; large number of cyclotrons needed to meet world demand
  • Requires significant amounts of highly enriched molybdenum ($^{100}$Mo)
Policy Approach: Central Pillars

- HLG-MR is developing a cohesive policy approach to:
  - address issues being faced by supply chain
  - move to a long-term secure supply of $^{99}$Mo and $^{99m}$Tc

Central Pillars of Reform: Issues to be addressed

- Market economics need to be improved
- Structural changes are necessary
  - Multisourcing
  - Contracts need to be adapted
- Government role has to be clearly defined
- An effective co-ordinated international approach is necessary
HLG-MR agreed on the approach most likely to achieve necessary reforms in a coherent and comprehensive manner

- Markets should do what they can, but may be limits
- Governments have essential role
  - Supporting market operations by:
    - Ensuring proper environment for investment
    - Addressing market failures
    - While recognising commercial nature of supply chain
- International collaboration is necessary
  - Particularly to avoid policy approaches at the domestic and regional levels that could negatively affect global $^{99}\text{Mo}/^{99m}\text{Tc}$ supply security
- Transparency is important
  - Ensure market continues evolution to economic sustainability
Policy Approach: Principles

• To ensure consistent fulfilment of responsibilities, HLG-MR formulating detailed policy approach:
  • Principles and supporting recommendations

• Once finalised, will suggest addressing main issues by:
  • Implementing full-cost recovery
  • Sourcing, valuing and paying for reserve capacity
  • Fulfilling essential government role
    • Setting the proper environment for safe and efficient market operations
  • Encouraging conversion to using LEU targets
  • Collaborating internationally to ensure globally consistency
  • Periodical reviews of progress to implementing an economically sustainable supply chain
Conclusions

• HLG-MR and stakeholders have identified issues affecting security of supply
• Significant actions already undertaken
• However, underlying problem – unsustainable economic structure – has not yet been adequately addressed
• Supply shortage could become commonplace over next decade unless longer-terms actions are taken
• Without government financial support, commercial pricing required
• Policy approach to provide consistent and comprehensive steps forward to ensuring long-term security of supply
  • Finalise by June 2011
• More detail available on: www.oecd-nea.org/med-radio