NTP Radioisotopes SOC Ltd

Status Update on the ^{99}Mo HEU/LEU Conversion Project in South Africa

G Ball

Mo-99 2013 Topical Meeting on Molybdenum-99 Technological Development
1-4 April 2013, Chicago

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Outline

- Background
- Conversion Project
- Current Status
- The Way Forward
- Concerns

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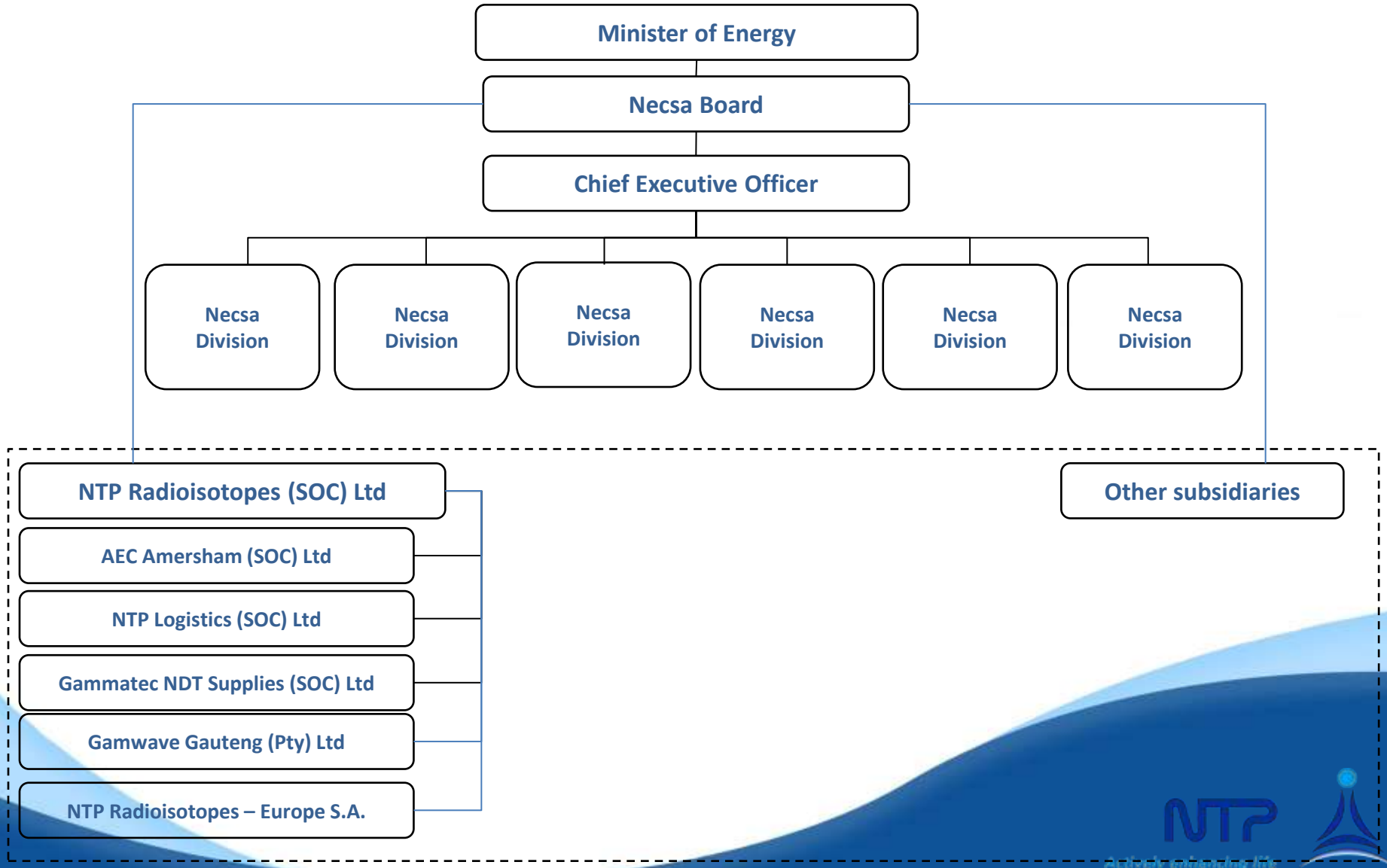
Background * NTP in Context



Background * Product Portfolio

Radiochemicals

Mo-99, I-131, Lu-177

Radioactive Sources

Ir-192, Cs-137, Co-60

Irradiation Services

Neutron Transmutation doping of Silicon, Neutron Irradiation Services

Radiopharmaceuticals

NovaTec-P Tc-99 Generator, FDG, MIBG, Cold kits, I-131 Capsules and Solution

Radiation Technology Products

Transport containers

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Background * Markets Served

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Background * Mo-99 History

- Development work on HEU process commenced in late 1980's
- First export Mo99 sales in Q4 1994
- Pilot plant commissioned in 1992 but underwent various changes up to 1994
- New production line comes online in 1995
- Second production line comes online in 2000
- First production line upgraded in 2005
- Third production line constructed and being commissioned (Required due to conversion)

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Conversion Project

Mo-99 Target Conversion Strategic Considerations

- Minimum changes to target, irradiation, handling & chemical processes
- Retention of production capacity
- No interruption in current production

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Conversion Project

Conversion to LEU to take place in 2 phases:

Phase 1: Known target technology; minimum changes at reactor facilities; minimum process changes.

U-Al Dispersion target

Phase 2: New target; changes at reactor facilities and process; significant benefits

Probably higher density target; retrievable from clad

Conversion Project

Parameter	LEU	HEU
Meat	Dispersion	Alloy
Enrichment	19.75%	45.0%
Uranium density ($g.cm^{-3}$)	2.75	1.42
Dimensions (mm)	200/50/1.66	200/50/1.66
Cladding	Alloy	Pure aluminium
U-235 Loading	Maintain (or minimise decrease)	

Conversion Project

Year	Event
2007	Theoretical feasibility studies
2008	Cold and depleted uranium experiments
Oct 2009	NNR approval received for test stage and first hot runs commence
Mar/Apr 2010	Process validation runs performed
Jun 2010	Submission to NNR for routine LEU ^{99}Mo production Submission of DMF to Medical Regulators commenced
Jul 2010	Customer tests and validation runs commenced
Sep 2010	NNR approval received for routine operation with LEU
Sep 2010	US FDA approves LEU ^{99}Mo for a customer in the US
Dec 2010	First large scale commercial FDA approved batch of LEU ^{99}Mo produced and shipped to US for patient use
Jun 2011	Commercial supply of LEU ^{99}Mo commenced
Mar 2012	Commenced with project to regain lost production capacity

Conversion Project

Technical issues:

- **Target Specifications**
- **Changes to process due to change in target**
- **Simultaneously performing development work and routine production**
- **Routine HEU & LEU production**
- **Increased waste volumes**

Conversion Project

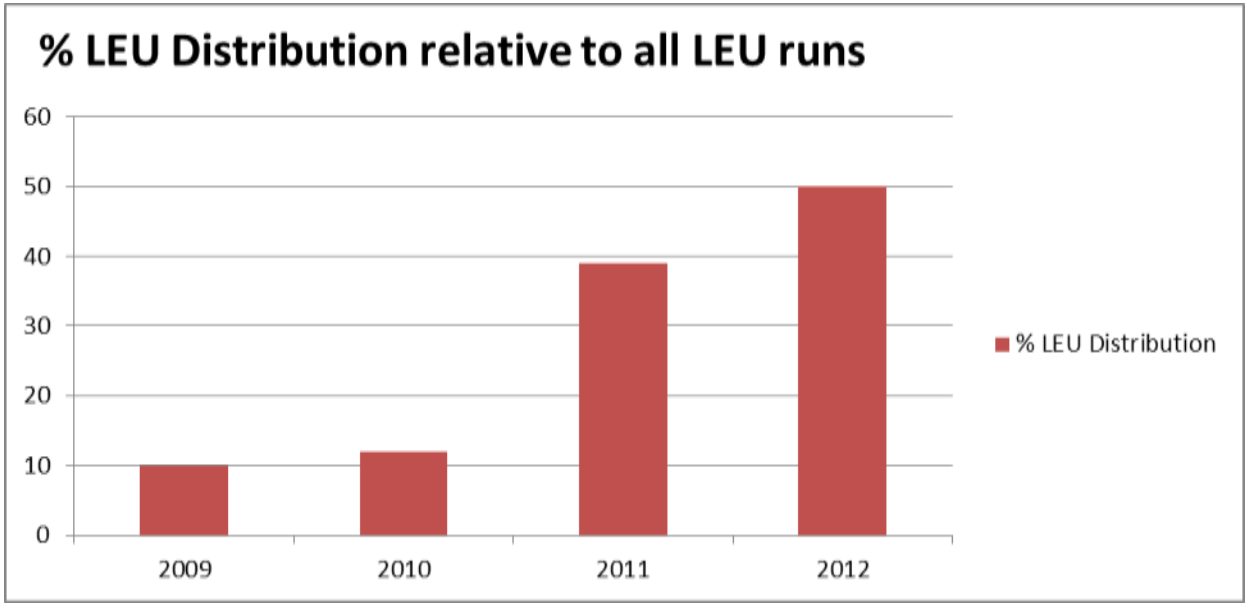
Non-Technical issues:

- **Customer appetite**
- **Regulatory complexities**
- **Inconsistency regarding ‘full cost recovery’**

Current Status

- Increasing commercial supply to customers authorized to use LEU ^{99}Mo
- Supply of LEU ^{99}Mo to customers for testing & validation
- Significant investment in infrastructure

Current Status



The Way Forward

Target & Process Optimisation

- Investigate feasibility of regaining lost production capacity (with existing target)
  - Increasing uranium density (target manufacturer)
  - Changing target geometry
  - Changes to reactor irradiation positions

- Status: Commenced in 2012

The Way Forward

New High Density Target & Process Development

- Work with existing international initiatives
  - Manufacturing qualification
  - Irradiation qualification
  - Waste handling
- Status: Ongoing

The Way Forward

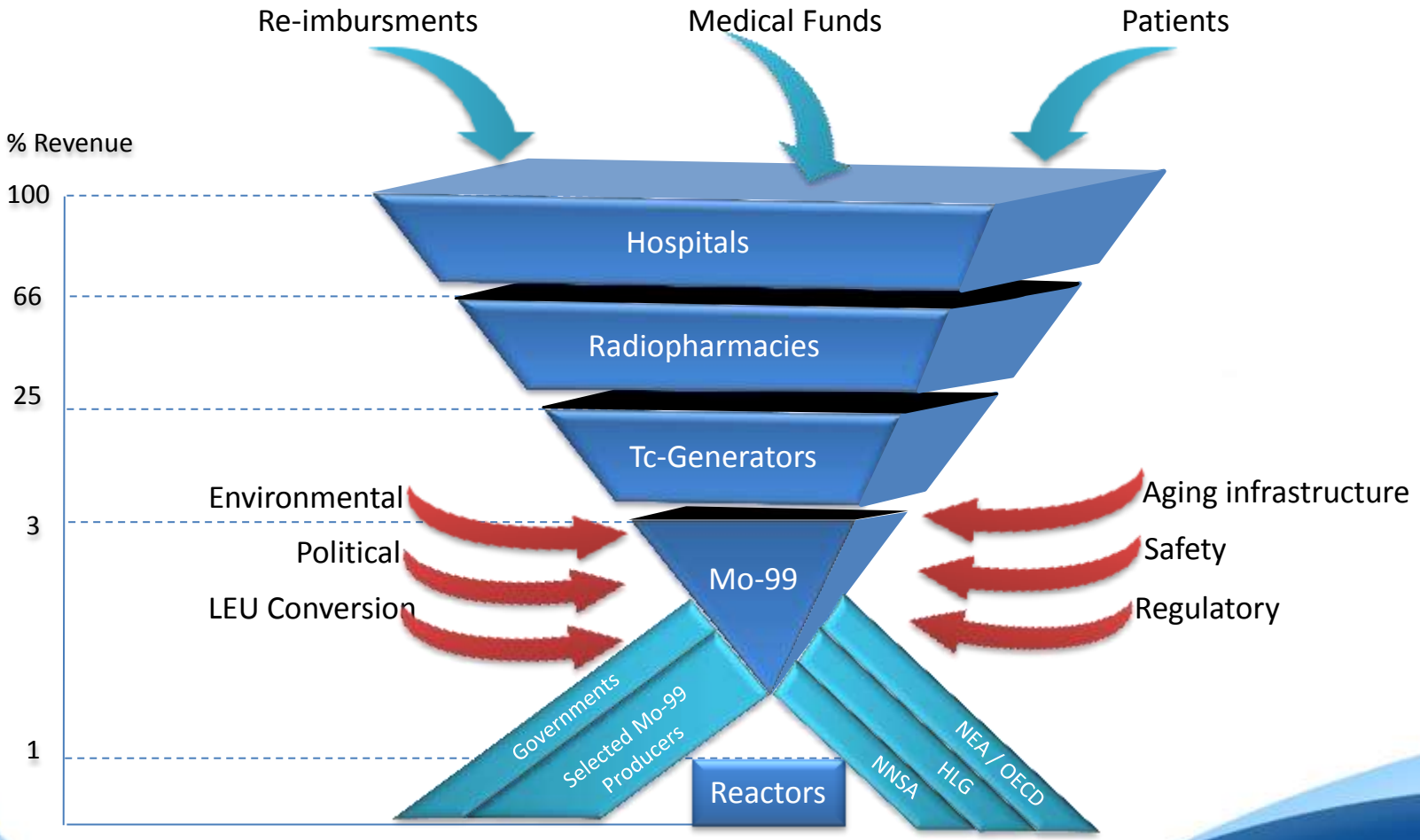
Finalise Construction and Commissioning of Infrastructure

(Required due to Conversion)

- **3rd Dissolution line**
- **Uranium residue storage facilities**

- **Status: Commenced and to be completed progressively by June 2014**

Concerns - ^{99}Mo Value Chain



Sustainability ?

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Thank you for your attention

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