

Building a simulated environment for the study of multilateral approaches to nuclear materials verification

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Symposium on International Safeguards, Vienna

22 October 2014

The IAEA medium term 2012-2017 strategy states that:

“Agency must remain ready to assist, in accordance with its Statute, with verification tasks under nuclear disarmament or arms control agreements that it may be requested to carry out by the States parties to such agreements.”

Future tasks may present the Agency and the states involved with novel and unexpected verification challenges, including greater issues related to:

- Incomplete or non-existent accounting procedures;
- Sensitive, proprietary, or proliferative information;

Exploring verification challenges:

Why simulate?

- While we can conduct a desk review of the various technologies, procedures and methodologies applicable to future verification challenges, there is presently little ability to thoroughly explore the variety of tasks that may be expected of the Agency.
- Trialling verification solutions on real facilities or real material is expensive, legally complicated, and politically sensitive.

Exploring verification challenges: Real-world v. virtual simulations

Real-world simulation: UK-Norway Initiative:

- Only explores the verification of warhead dismantlement;
- The total costs have never been estimated, but are likely to be substantial;

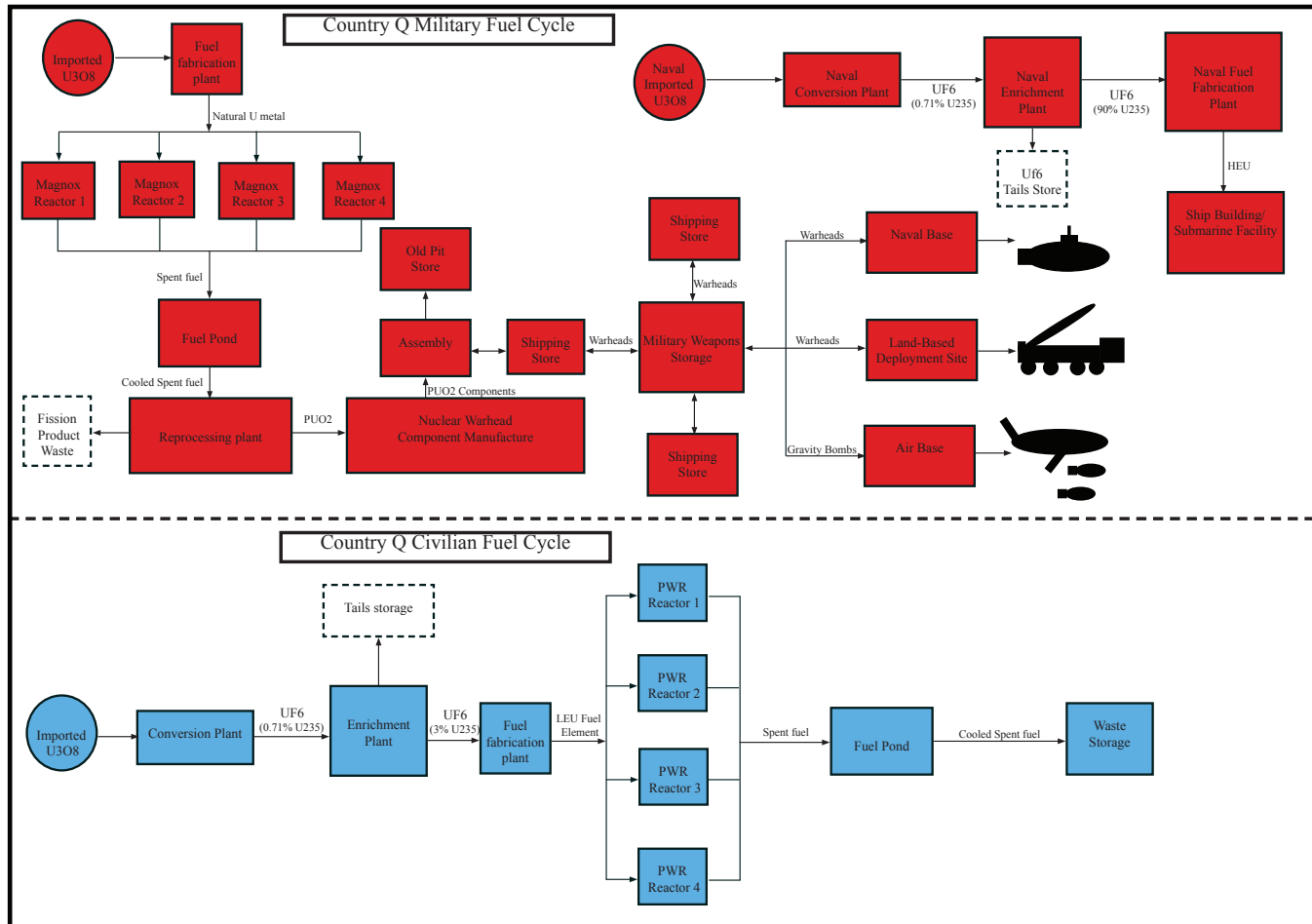
Virtual simulation: Multilateral Verification Project

- Accurately generate a broad range of verification challenges for an equally broad range of hypothetical notional nuclear programmes;
- Enables researchers to devise verification solutions for managing and overcoming these challenges;
- Is far less resource intensive by comparison.

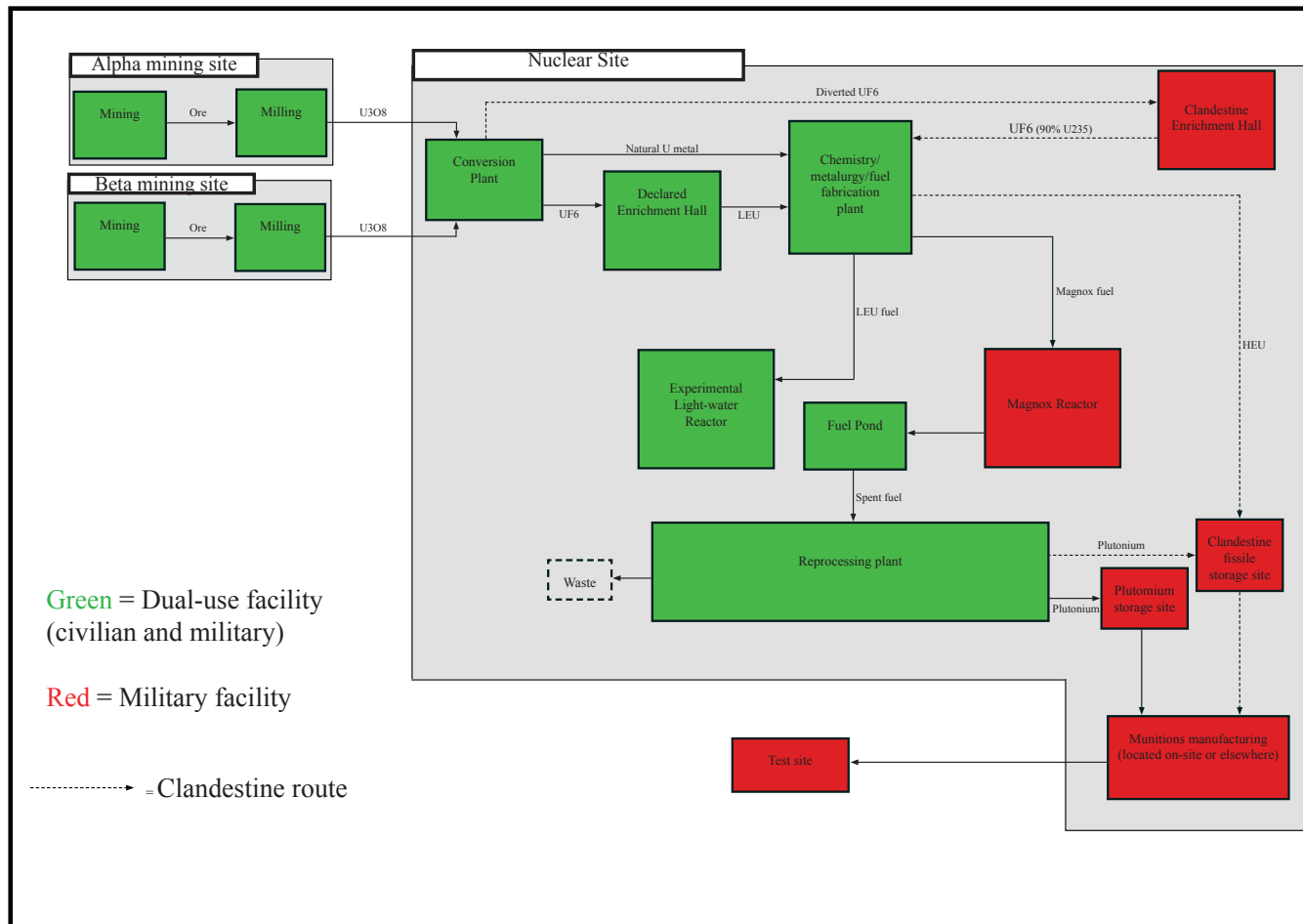
VERTIC is now developing virtual simulations based on:

1. One or several nuclear fuel cycle ‘models’ of a notional state, capable of supplying quantitative data on nuclear material production, use and storage for any given period of time (usually year-on-year). The nuclear fuel cycle models are detailed representations of military and/or civilian nuclear fuel cycles that describe in as much detail as possible the fictitious state’s nuclear history.
2. One or several disarmament ‘scenarios’ which specify the verifiable commitments undertaken by a hypothetical state, in addition to providing the legal and political context for the simulation.

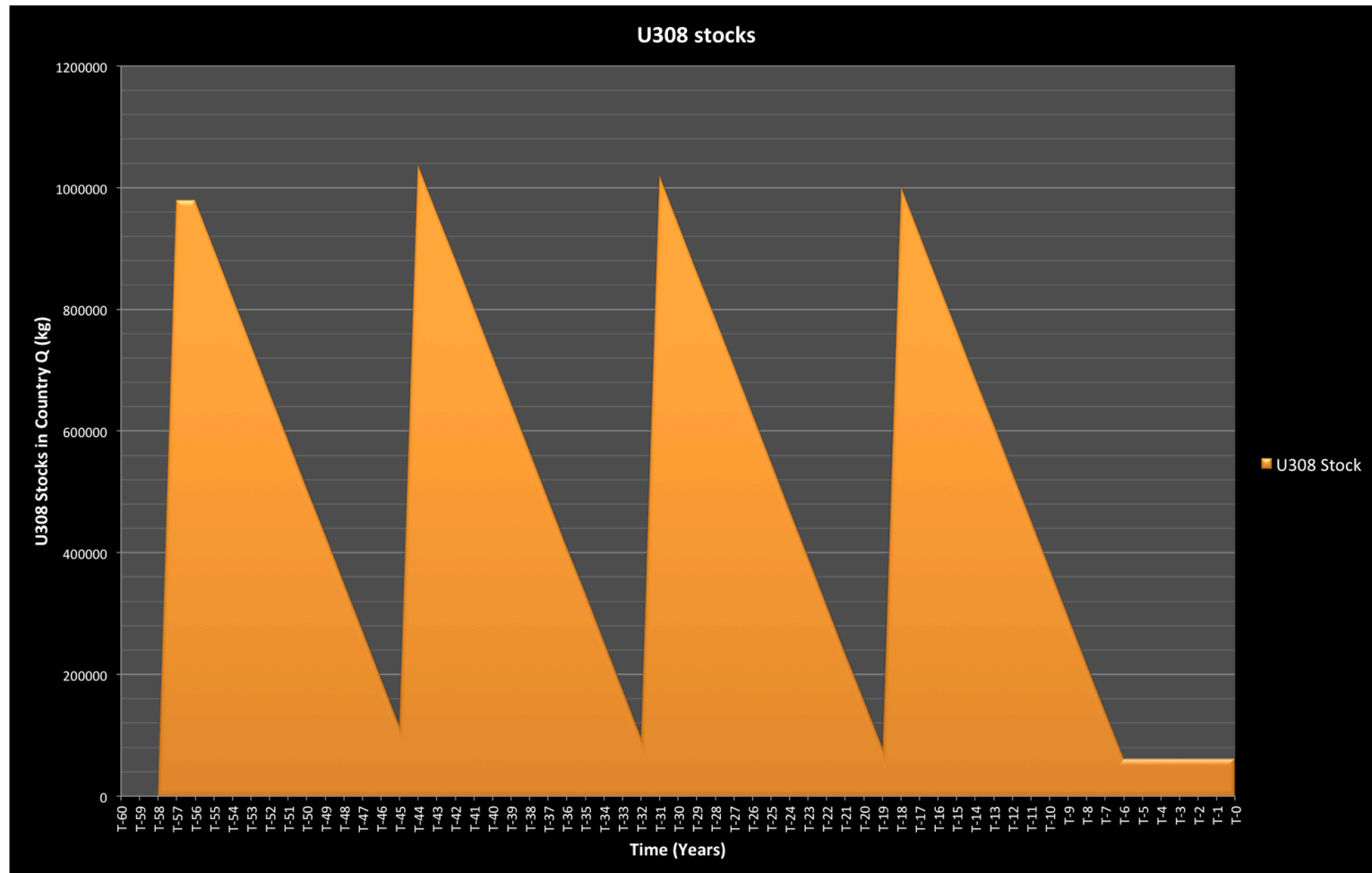
Medium sized state: Country Q:



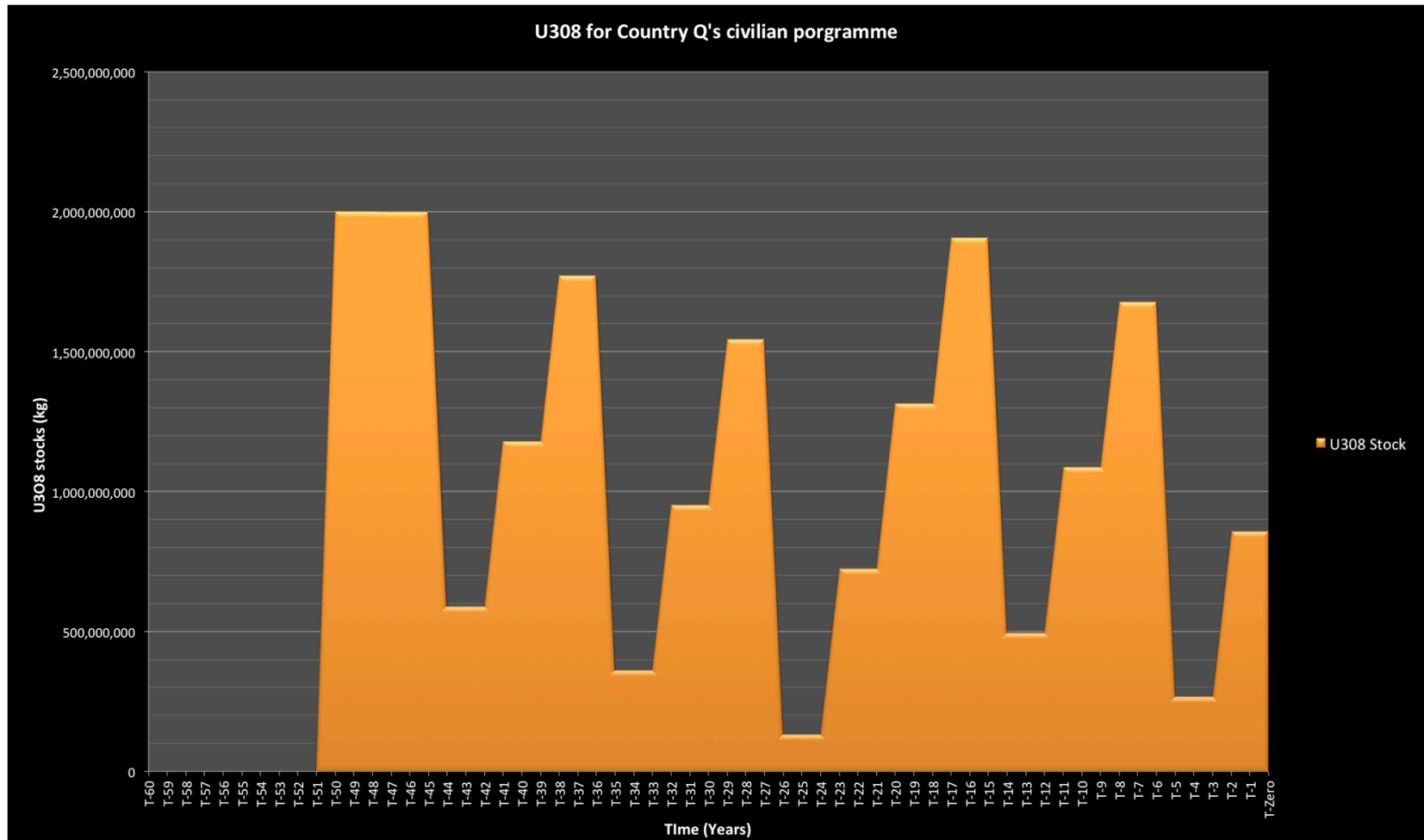
Nascent state: Country K:



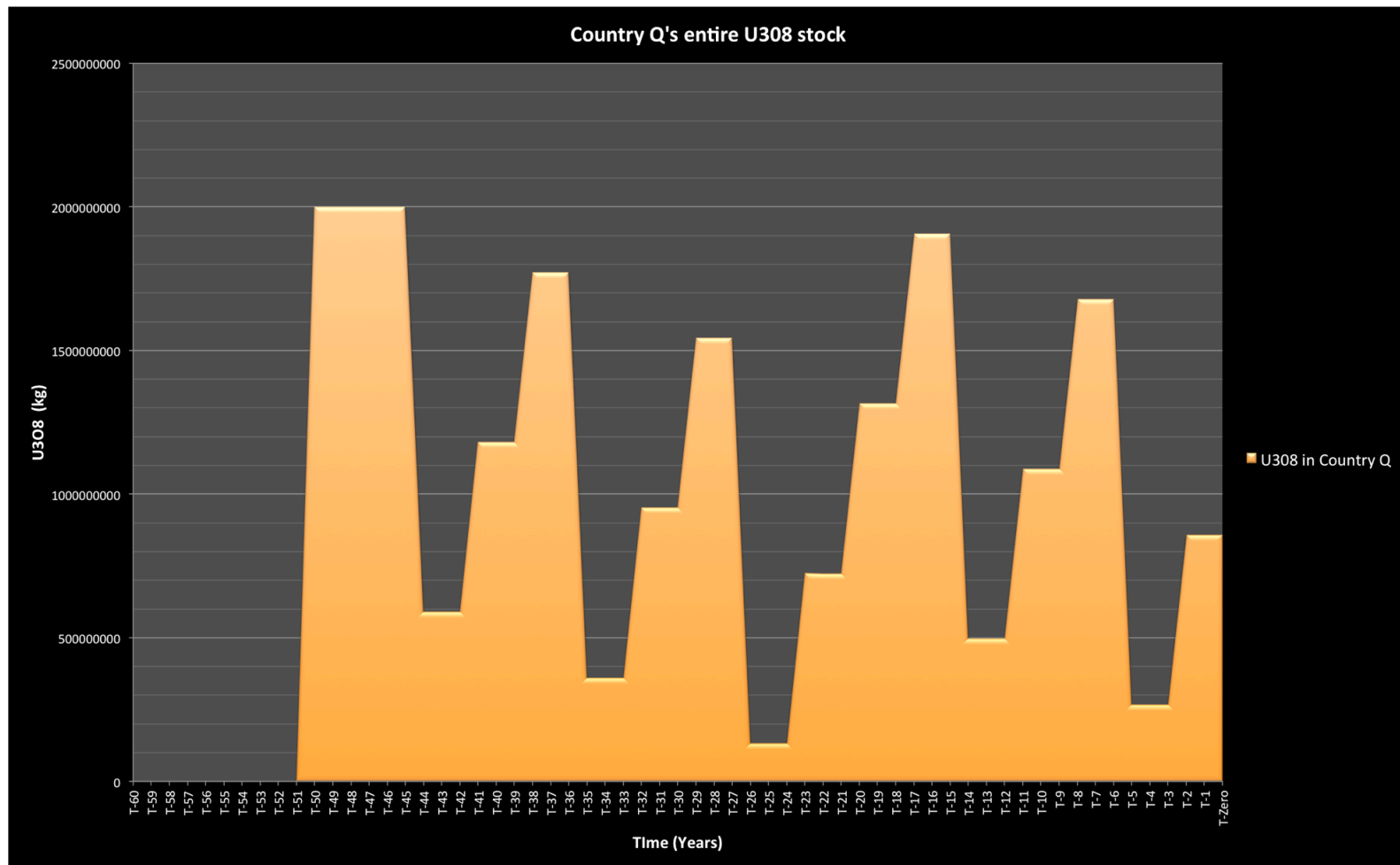
Results: military stocks of U_3O_8



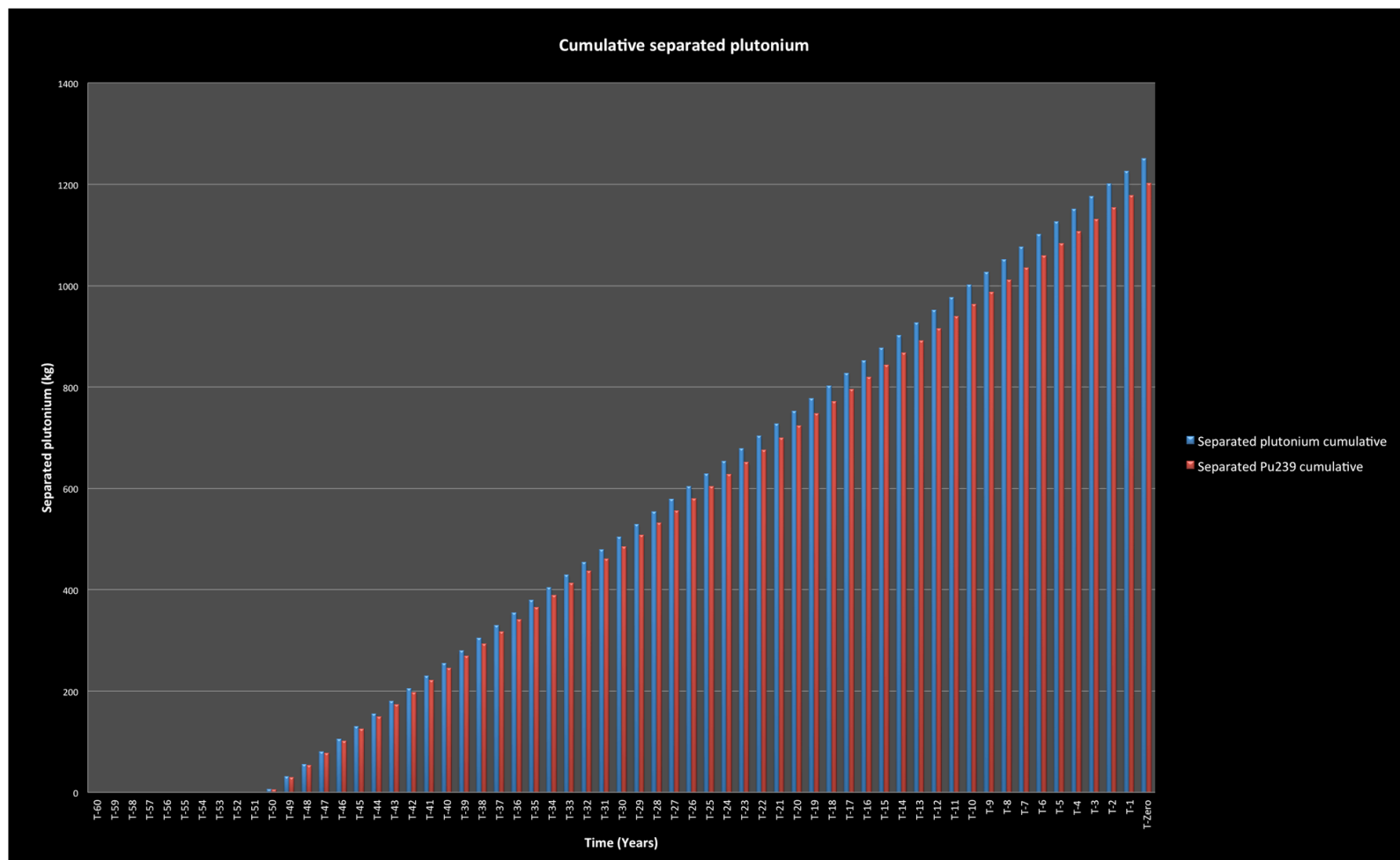
Results: civilian stocks of U_3O_8 in Country Q



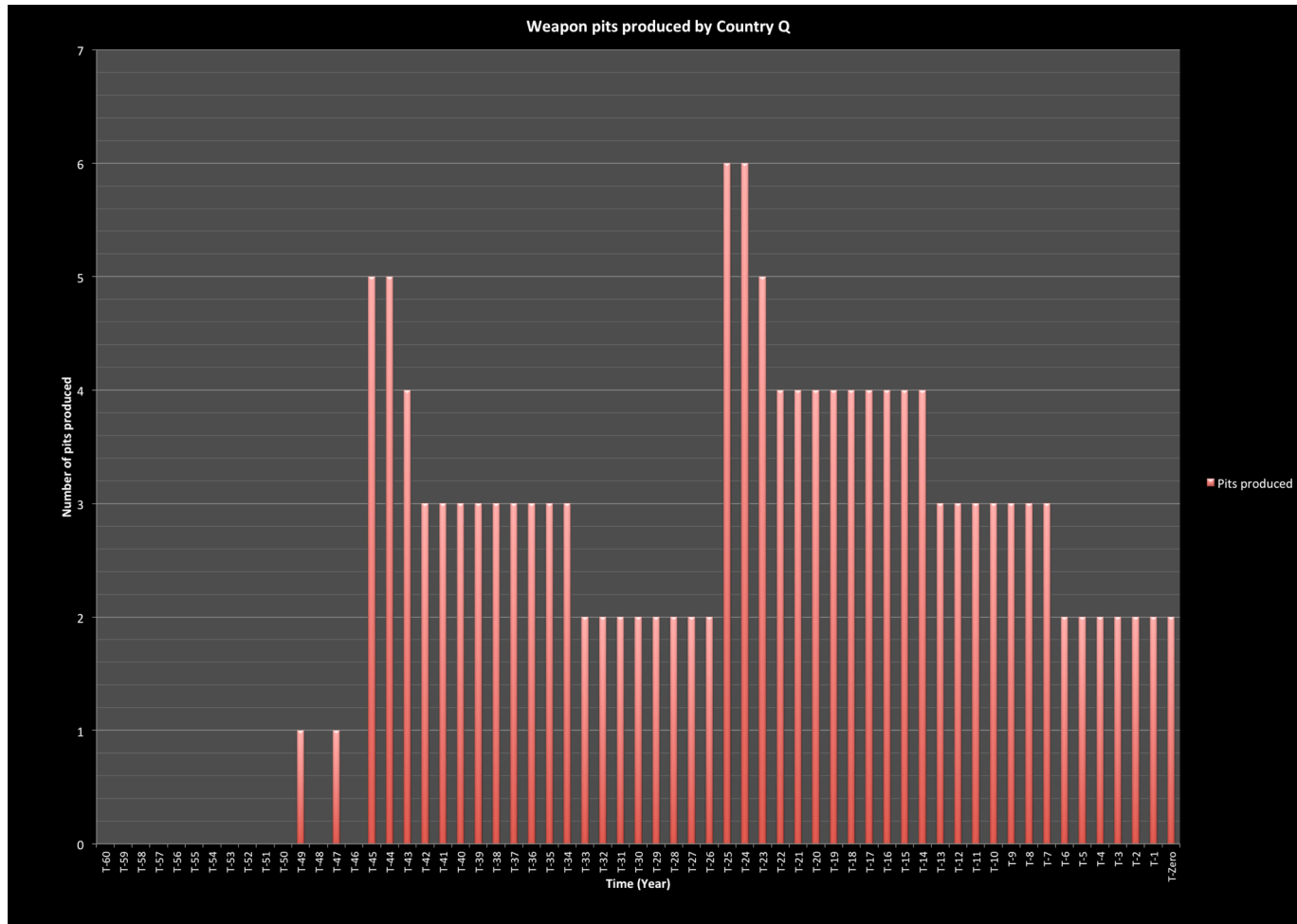
Results: all stocks of U_3O_8 in Country Q



Results: Country Q's military production of plutonium:



Results: pits produced by Country Q



Scenarios can include:

- Military programmes are scaled down;
- Military programmes are restrained or discontinued;
- Facilities from military programmes are converted to civilian use or otherwise decommissioned;
- Special fissionable materials have previously been weaponization and are being placed under safeguarded storage; or,
- Simulations could focus on the safeguarding of previously-undeclared activities or material or broader constraints on nuclear activities.

Scenarios can:

Say:

- Is there an agreement or treaty governing the activities in the scenario?
- Who is involved in the verification process?
- What is the agreed timescale for the activities taking place?
- Are there any safeguards in place in the disarming country at baseline (prior to the verification process)?

Do:

- Lay out the conditions and demands for the verification solutions activity;
- Provide the legal and political context for the simulation.

Simulations: table-top exercises

- The quantitative data produced by the model provides the foundation upon which an arms control scenario can be played out; simulating the movement or transformation of nuclear materials and activities.
- Participants in this verification ‘simulation’ can then identify key aspects of this scenario (from baseline declarations through to long-term monitoring). It allows the simulation participant to explore potential ‘verification solutions’ for these aspects through table-top, live, or virtual exercises, and ultimately test these solutions against modelled data.

Thank you