Improving Facility-Specific Safeguards with Data Analytics

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Introduction

There are over 180 research reactors around the world under safeguards by the IAEA. Research reactors have a **variety of purposes** and often **flexible operation**, which presents special concerns and challenges, demanding a different approach for safeguards[3].

Safeguards concerns for some research reactor designs:

- Easy access to core
- Use of HEU fuel
- Routine target irradiation

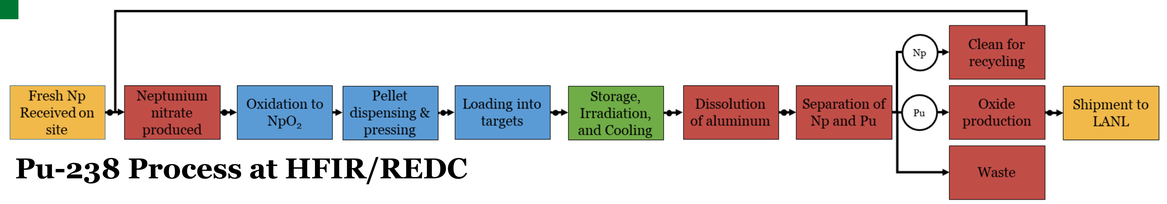
Measures to increase the efficiency of safeguards methods can help the IAEA address these challenges more effectively.

Can data analytic techniques improve the efficiency of facility-specific safeguards?

Methods

Focus on Pu-238 production at HFIR/REDC

- Convert data from HFIR/REDC into a useable and analyzable form
  - NMC&A forms
  - Operational data
  - Tank card readings



Pu-238 Process at HFIR/REDC

Safeguards Relevant Questions at HFIR

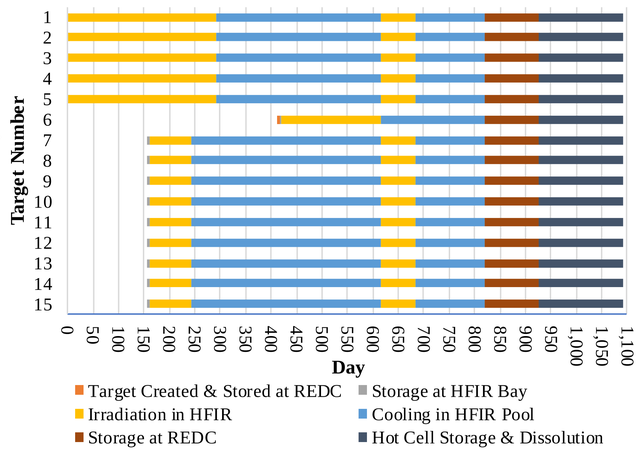
- Is the reactor being operated as normal?
- Is there a pattern in operation?
- Were all declared targets loaded and removed?
- Have the targets been irradiated as declared?

Safeguards Relevant Questions at REDC

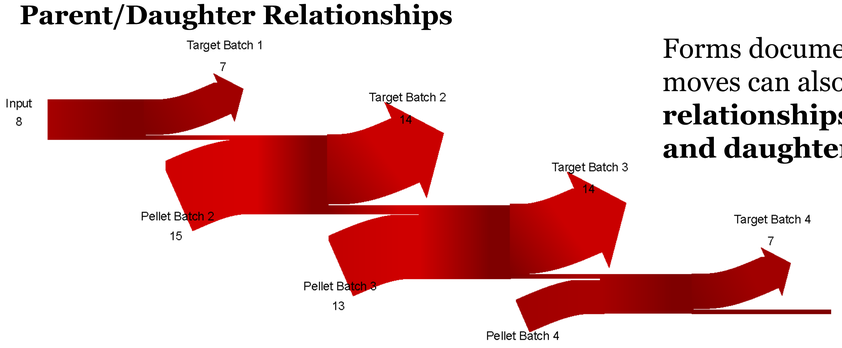
- What input/output materials would indicate undeclared separations activities?
- What is typical Np recovered as a function of burnup/Pu-238 production?

Results

Forms documenting material moves can be used to **determine locations of targets during given dates**. These dates can then be used to **understand how operations work at research reactor and hot cell facilities**, which will allow monitoring for anomalies.



Parent/Daughter Relationships



Forms documenting material moves can also be used to find **relationships** between **parent and daughter materials** through the production processes.

Conclusions

Sample data from Pu-238 at HFIR/REDC is being used to develop algorithms that could benefit international safeguards application at nuclear facilities

Relevance/Future implications

Data analytics techniques could improve international safeguards at research reactors by:

- Providing a framework to evaluate how well individual technologies answer safeguards relevant questions
- Reduce the number of repetitive tasks that inspectors must perform so that they can spend more time on higher level analysis

Future work:

- Obtain operational data from HFIR during target irradiation and target package data from REDC
- Identify and characterize predictive signatures in datasets useful for identifying safeguards-relevant events of interest

References

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