SnT 2025
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

Seismoacoustic Monitoring of Pyroprocessing Equipment

Kenton Hummel, Edna Cárdenas, Luis Ocampo Giraldo, Jay Hix, James Johnson, Mike Patterson

Idaho National Laboratory

INTRODUCTION AND MAIN RESULTS

Pyroprocessing, a method to process spent nuclear fuel, utilizes a hot cell introducing challenges regarding safeguards.

Seismoacoustic monitoring directly outside the hot cell was able to measure the initial step of pyroprocessing. This type of monitoring offers a method to aid in safeguards by validating a facility's schedule and identifying activity that does not align with records.

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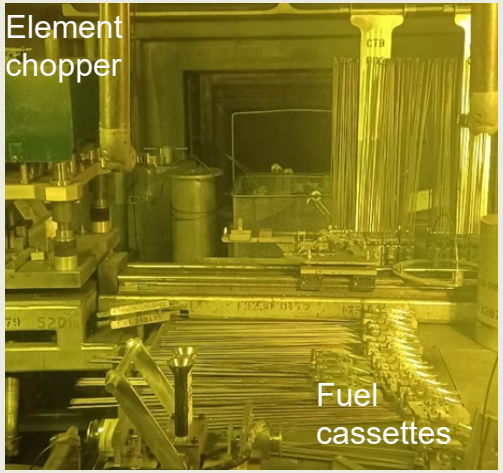
Introduction

Pyroprocessing spent nuclear fuel introduces nuclear safeguarding challenges including high temperatures, radiation levels, and equipment confided to a heavily shielded hot cell limiting access. One concern would be material diversion, thus requiring material accountancy.

The goal of this work is to determine the capability of seismoacoustic monitoring of pyroprocessing for safeguards. An element chopper used in the initial step to chop fuel pins into smaller segments, in preparation for electrochemical separation, was identified for monitoring in this study.

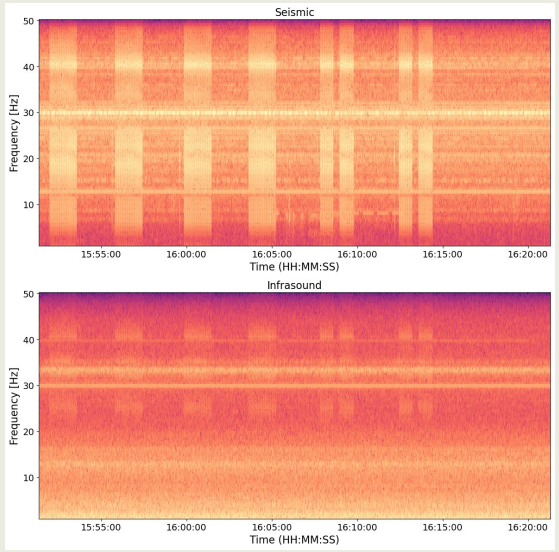


Methods

Seismic and infrasound Raspberry Shake & Boom sensors were placed directly outside of a hot cell approximately 10 meters from a chopper used to treat sodium-bonded metal fuel. Up to 5 fuel pins are cut at once held together in a cassette. There are 61 chops to cut the tip, fuel, and any additional swell for each cassette. Operator logs were collected giving operation time of chopping a batch.

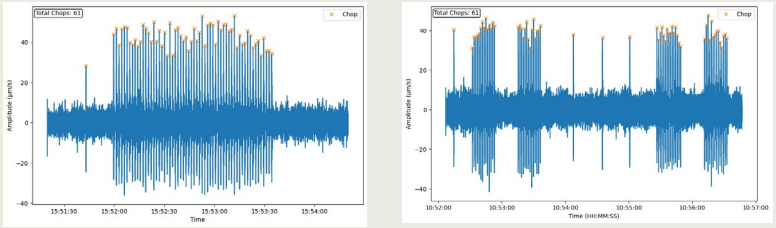
Results

Both seismic and infrasound were able to measure the chopping, though seismic was more prominent.

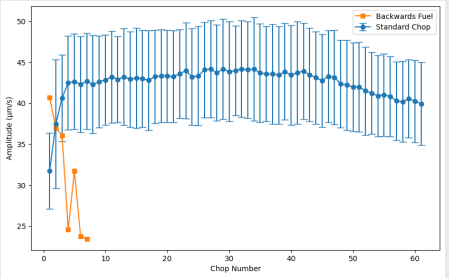


Results

A total of 412 cassettes were measured with gaps indicative of a rotating fuel storage basket and fuel sampling.



Standard condition cassettes were averaged by chop number and compared against an anomalous case showing the large divergence in fuel fed backwards.



Conclusion

Seismoacoustic monitoring can aid safeguards of pyroprocessing through material accountancy. This monitoring provides an upper limit of the amount of fuel cut for electrorefining and can be used to identify anomalous use.

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