Radiation Calibration Lab: Optimizing Instrument Calibration

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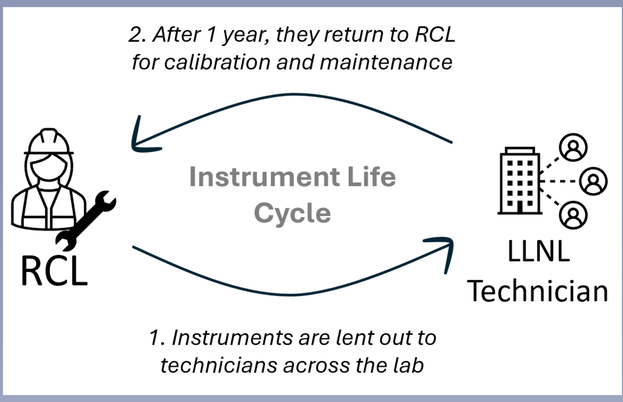
ABSTRACT

The Radiation Calibration Laboratory (RCL) within ES&H loans a high volume of radiation detection instruments to radiation workers across LLNL, enabling routine site checks to promote worker safety.



To better support day-to-day laboratory activities, this project analyzes historical calibration data and aims to optimize RCL procedures through the reassessment of recalibration schedules per instrument type.

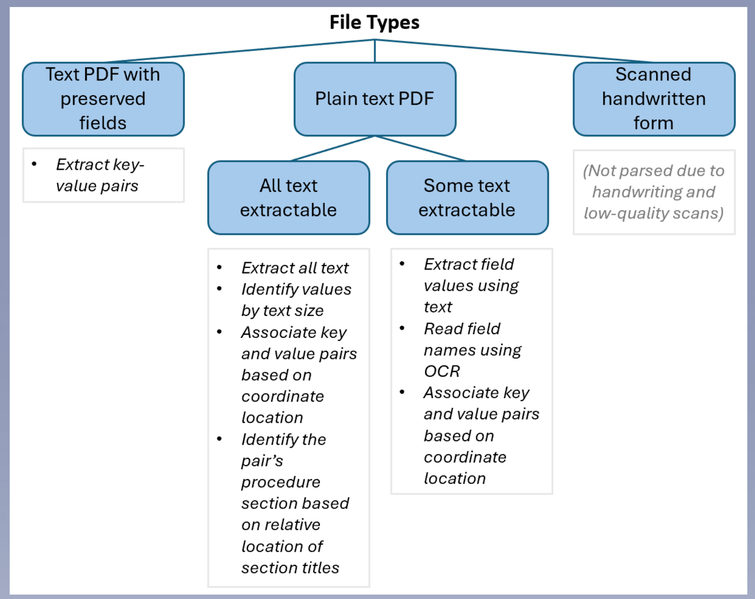
OBJECTIVES

Our goal was to:

- Process unstructured data from calibration worksheet PDFs
  - Pre-calibration: performance metrics as-found
  - Calibration: metrics during calibration procedure
  - Quality Control: verification metrics after calibration to ensure instrument accuracy
- Combine data with other database data to analyze trends of instruments and identify areas of improvement

METHODS

1. Parse Calibration Worksheet PDFs



Challenges

- High volume of corner cases in data format
- Messy, incomplete data
- Handwritten forms → inability to parse
- Data accessibility
- Data availability

2. Analysis

- Instrument-probe combinations
- Instrument-specific quality issues
- Make/model trends
- Reasons for early calibration
- Common repairs per model
- Location of instrument use

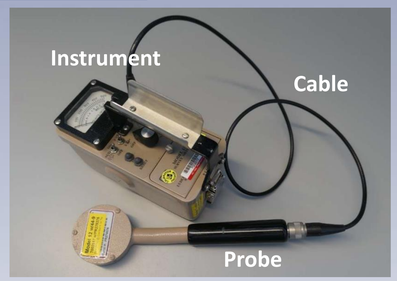


Figure 1: example instrument and probe combination (Model 12 w/ 44-9)

PRELIMINARY RESULTS

Data analyses illustrate patterns in certain model-probe combinations, showing:

- Higher rates of repair requests
- Higher failure rates before calibration
- Reasons for as-found failure
  - High background readings
- Common repairs made
  - Replacement of probes, mylar, desiccant

Model	Probe	percent_failure	n_calibrations
EPD-N2 V5	INTEGRAL	0.000000	122
451B-RYR	INTEGRAL	0.246002	811
MODEL 12	MODEL 44-9	4.807692	931
MODEL 12L	MODEL 43-40-7	9.969559	1295

Figure 2: snapshot of failure rates per model-probe combination

DISCUSSION

We've identified certain instruments and instrument-probe model combinations with higher levels of unsatisfactory tests before calibration, informing us of a need for reassessment of their return frequency schedules.

FUTURE DIRECTIONS

In our continued data parsing and analysis of instrument performance, we hope to investigate:

- Data limitations
  - Data analyzed is incomplete due to difficulty handling poor-quality scans and handwriting
  - Certain instrument calibrations are not incorporated in data depending on their lent location
  - Data availability limited to what is routinely tracked by the RCL
- Duration of service
- Use case
- Early repair requests

Our goal is to outline RCL procedure improvement measures from analyses to better serve the lab's safety measures.

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