

# Applications of Portable X-Ray Fluorescence in Problematic Drywall Investigations

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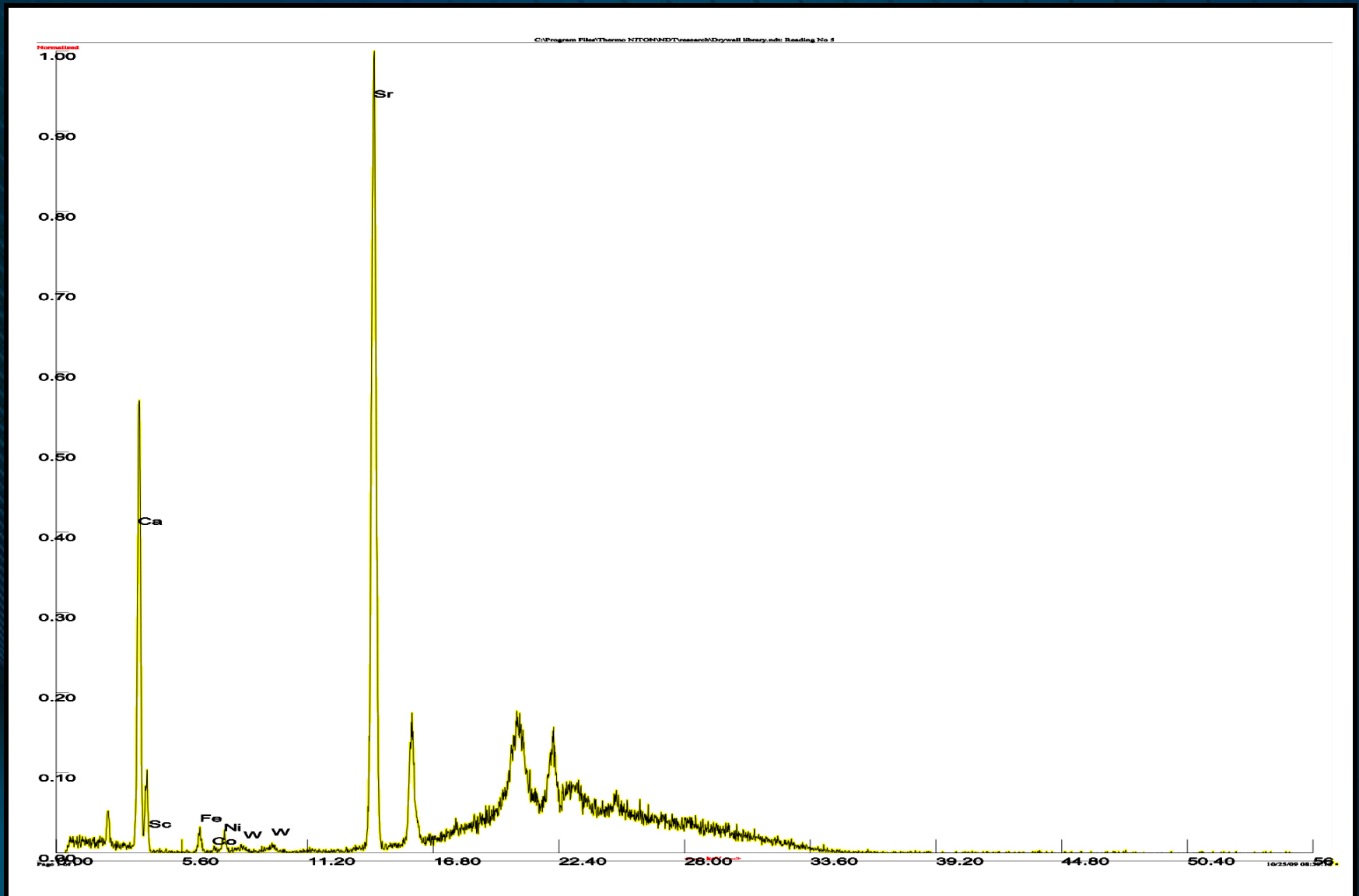
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# What is XRF?

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- X-ray Fluorescence (XRF) employs the use of a primary X-ray beam hitting a material and causing each element in that material to produce (fluoresce) a characteristic X-ray.
- Since each characteristic X-ray has its own unique energy, a solid state detector in conjunction with a microchip can produce an energy spectrum.

# Example of Spectra



# Example of Data Output



12750 Commonwealth Drive  
Fort Myers, FL 33913

## Certificate of Analysis

XL3t-36951

Reading No 5  
Mode MINING  
Time 2009-08-14 11:11  
Duration 76.93  
Sequence Final  
SAMPLE Knauf Tianjin  
NOTE grey

	%	±	Error
Bal	44.358	±	4.321
Zr	< LOD	:	0.002
Sr	0.190	±	0.003
Zn	< LOD	:	0.002
Cu	< LOD	:	0.003
Fe	0.121	±	0.008
Ti	0.005	±	0.002
Ca	24.433	±	0.285
K	0.070	±	0.025
Si	0.447	±	0.088
Cl	< LOD	:	0.027
S	30.336	±	0.247

Performed by: \_\_\_\_\_



# Examples of XRF Applications

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- Environmental – Soil contamination assessments.
- Plastics / Paints - Lead in paints and lead in plastics consumer goods screening.
- Alloys – Metals recycling.
- Positive Material Identification (API 578).
- Mining – Trace metals.
- Cement industry – Elemental composition of gypsum.

# How is Portable XRF Different?

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- A portable or handheld XRF is not significantly different than the 50 year old laboratory versions.
- The components have taken advantage of the improvements in electronic and solid state miniaturization.

# How Does the Portable XRF Determine the Elemental Composition in a Sample?

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- Using the energy spectrum and a computer processor, the elements and the number of counts for each element are classified.
- When this information is further processed through a mathematical algorithm, the spectral information can be turned into actual data.
- The data includes the element and the percentage of each element in the material.

# How is Portable XRF Used for Screening for Drywall Types?

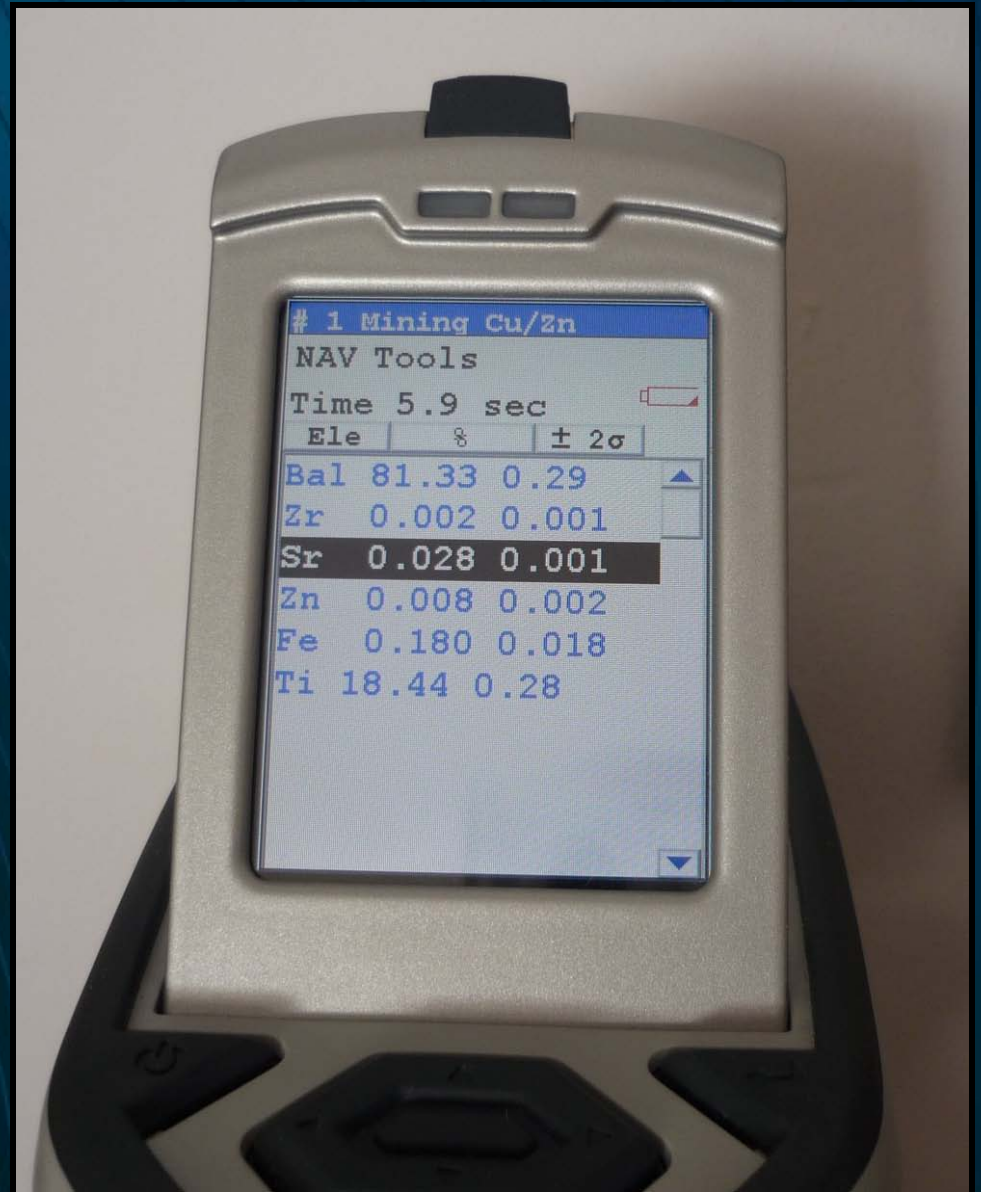
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- Houses have more than one type of drywall.
- 5 or more different types of drywall in a single residence have been identified.
- It is also common to find different drywall types in a single wall.
- The instrument can be used to quickly screen for different types of drywall.

# Identifying Types of Drywall

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Using a single filter, the instrument can be set up to view selected elements and the data can be used to quickly screen residences for different types of drywall.



# 8 Mining Cu/Zn

NAV Tools

Time 1.9 sec 

Ele	%	$\pm 2\sigma$
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Bal	99.11	0.32
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Sr	0.258	0.021
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Fe	0.258	0.091
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# The Advantages

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- The analysis is non destructive.
- The results can typically be obtained within a few seconds per test.
- The test can be performed through wall finish.
- The data is logged and stored and can be downloaded at a later date.
- The entire house, including ceilings, can be screened for similar elemental values that correspond to the different types of drywall.

# Cautions

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- Drywalls with similar elemental signature.
- The drywall finish = variability.
- Evaluate the effect of each wall finish = additional readings.
- The data is not conclusive until it can be further confirmed against a sample of the drywall either through a direct reading at the edge of the drywall or through collection and preparation of a sample.

# Determining Problematic Drywall

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- Verify if a residence meets the State of Florida Case definition criteria.
- Use XRF or other methods to determine types of drywalls used in the residence.
- Obtain samples of the different types of drywall.
- Run copper exposure aging test or similar on the samples to verify sulfur attack in controlled conditions.
- Run independent Carbon Disulfide verification test or equivalent.
- Use data from steps 1, 2 and 3 to classify the drywall as problematic and prepare a standard XRF sample for spectral fingerprinting.

# Developing Spectral Fingerprint

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- Prepare standard XRF sample.
- Run XRF analysis using four filters to create accurate spectral fingerprints.
- Add spectral fingerprints to the library.
- Once the fingerprint is entered into the library, the instrument can be used to match unknown samples to samples in the library.
- Library will be included with the instrument.



mm

KT  
190

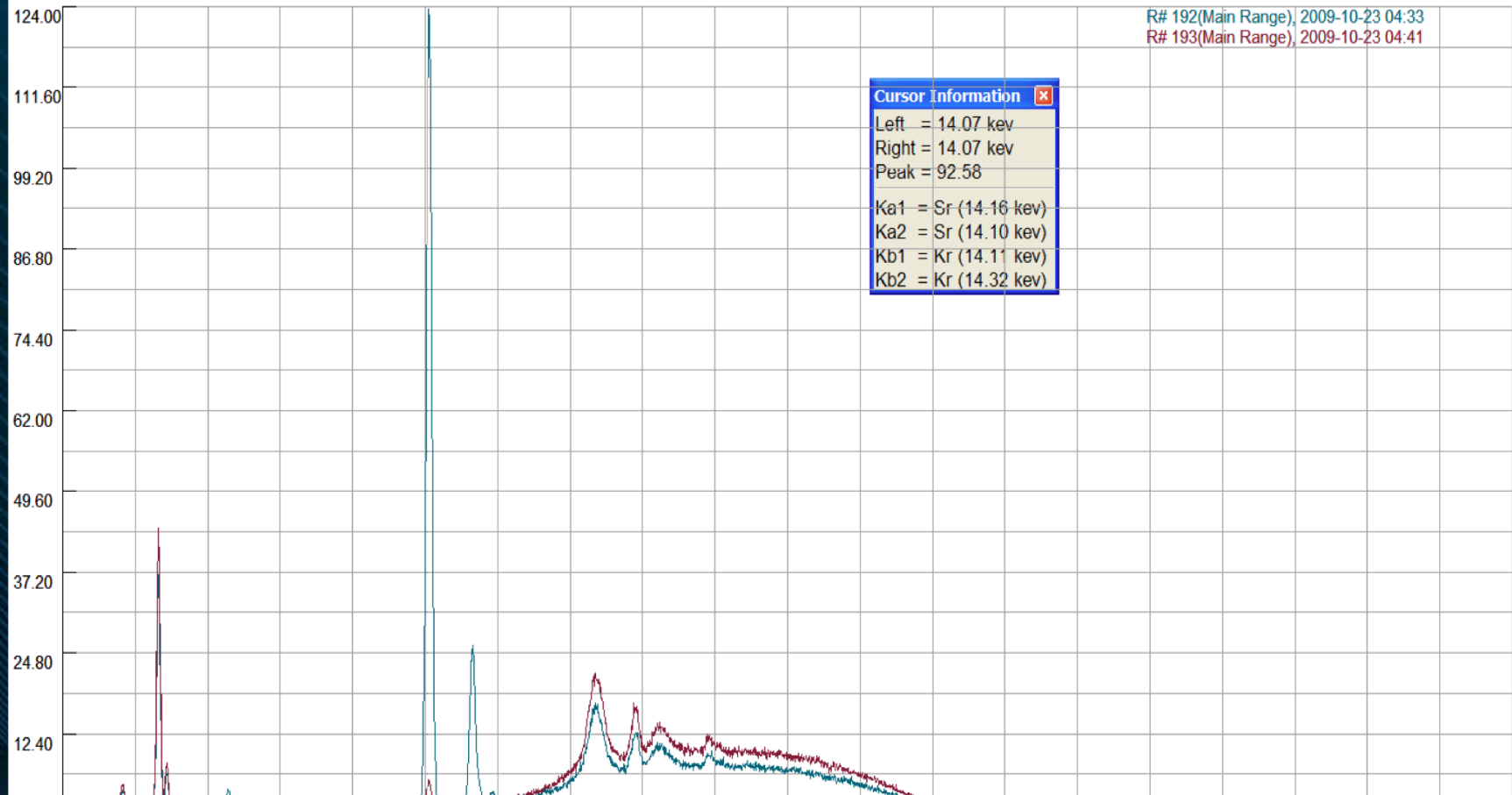
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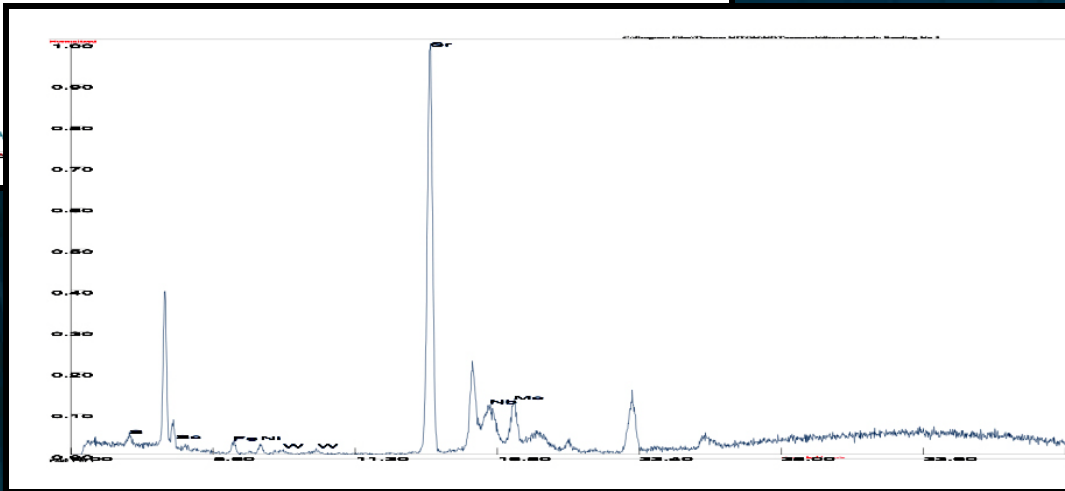
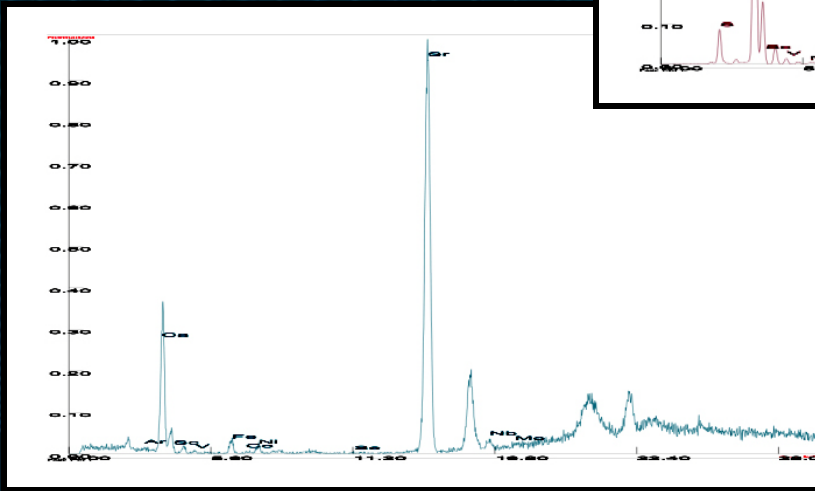
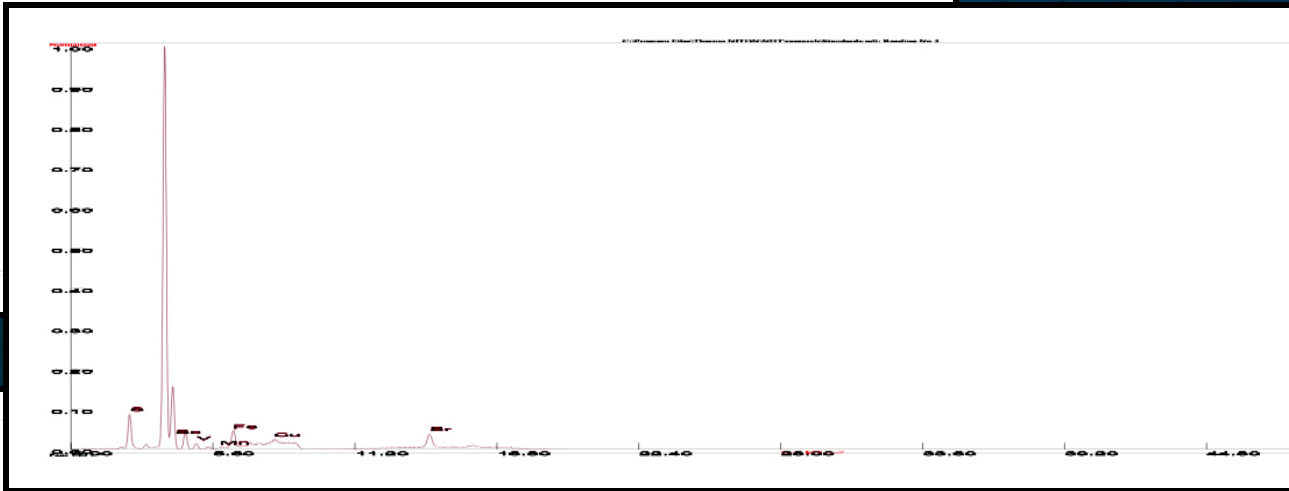
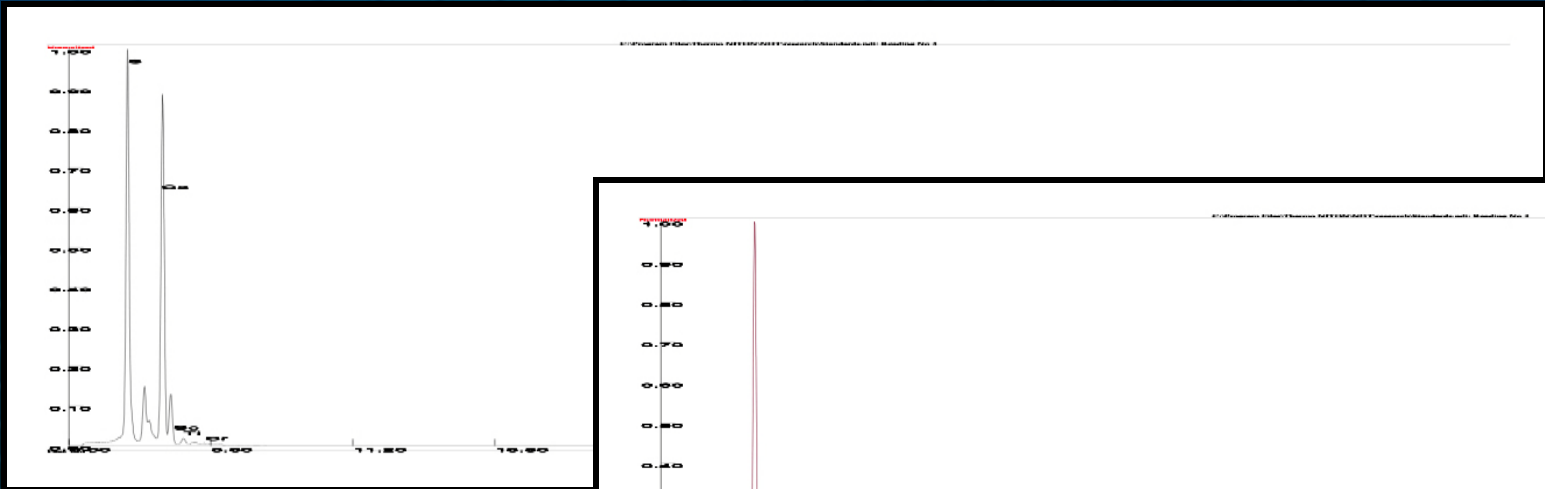
Counts/Sec



Cursor Information

Left = 14.07 keV  
Right = 14.07 keV  
Peak = 92.58

Ka1 = Sr (14.16 keV)  
Ka2 = Sr (14.10 keV)  
Kb1 = Kr (14.11 keV)  
Kb2 = Kr (14.32 keV)



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