



Radiological TRIAGE

U.S. Department of Energy



What is Radiological TRIAGE?

Radiological TRIAGE is 24/7 on-call support to first responder teams for analysis of nuclear data (especially gamma-ray spectra) and includes:

- Acknowledgement of request within 10 minutes and an answer in 30-60 minutes
- Ready access to a cadre of nuclear scientists
- Independent laboratory assessment by two nuclear scientists using different advanced spectroscopy analysis tools
- Scientific review of analysis via telephone conference call

Radiological TRIAGE helps prevent an unnecessary full-scale response when there is no threat, or can "pull the fire alarm" if the threat appears to be serious.

Origin of TRIAGE

- Jan 2002
 - Toy soldiers found containing powder, early results suggest highly-enriched uranium
- Scientists from three National Laboratories reviewed the data:
 - Analysis indicated <u>depleted</u> uranium (0.25±0.05%) ²³⁵U; low threat
- Triage program begins
 - Nuclear expertise available on short notice



Radioisotope Identification

High Resolution versus Low Resolution Gamma Spectroscopy

"ability to resolve adjacent gamma peaks"



Comparison of a sodium iodide spectrum (low resolution) to a high purity germanium spectrum (high resolution)

Detection Hardware Supported

TRIAGE supports a wide array of radioisotope identification instrument file formats and routinely evaluates new instruments.



Identification Problems

Many of the commonly used low resolution identification instruments often give incorrect or incomplete analysis

Examples include:

False Positives - incorrectly reporting a threat where none really exists

False Negatives – incorrectly not reporting a threat when there is one

No answer or ambiguous answer, e.g., "not in library," or "unidentified peak"

Operator inexperience such as low count rates or high dead times



15 models tested, 1827 results

Worldwide TRIAGE Events



Radiological TRIAGE Team

Under the direction of the DOE Office of Emergency Response, the TRIAGE Team consists of:

- DOE Emergency Operation Center in Washington, D.C.
- DOE On-Call Emergency Response Officer
- Nuclear scientists from:

Los Alamos National Laboratory Lawrence Livermore National Laboratory Sandia National Laboratory

What does TRIAGE provide?

The TRIAGE assessment provides:

- Radionuclide identification using advanced spectral analysis tools
- Review for the presence special nuclear materials
- Isotopic analysis of special nuclear materials identified
- Estimate of the amount of radioactivity
- Analysis of neutron data
- Shielding materials
- Potential risk

Requesting TRIAGE analysis

1. Call DOE Emergency Operations Center (EOC) at +1-202-586-8100 and request TRIAGE support.

Provide the name and phone number of a contact person.

2. The EOC will advise on the method of submitting the data either by email or the TRIAGE web site.

Type of detector (make/model) Isotopes identified Distance to source Data collection time (at least 300 seconds) Description of unknown Any shielding Neutron count rate data Spectral files – unknown, background, calibration Photographs – detector and suspicious package

First Responder Example

Scenario

During a pre-event radiological search, a team locates a suspicious wooden box. Measurements with a radiation pager give low level readings. A gamma spectrum with a Radioisotope Identifier is acquired for analysis.





High Resolution vs Low Resolution

Gamma-ray spectra



Comparison of a sodium iodide spectrum (low resolution) to a high purity germanium spectrum (high resolution)

Spectrum for TRIAGE

Low resolution spectrum from radioisotope identifier



Type of detector Isotopes identified Distance to source Data collection time Description of unknown Any shielding Neutron count rate data Spectral files Photographs Bicron Fieldspec – Identifinder-N Cs-137 30 cm 600 seconds Wooden box 50 cm x 50 cm x 50 cm Plywood 1.5 cm 0 unknown, background, calibration

detector and suspicious package



https://triage-data.net



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For a real world event, you would receive a call back from a DOE Official in 15 minutes and an analysis in 1 hour. Continued assistance is available and a final report in 24 hours.

TRIAGE Assessment

TRIAGE technical assessment based on data provided:

- Isotope is Cs-137
- Activity is 5 Ci (185 GBq)
- Heavily shielded
- No evidence of special nuclear materials
- No evidence of neutron activity
- Risk concern of high activity source

Is this a concern, what is your assessment?

TRIAGE Report

The National Nuclear Security Administration Triage system has received spectra through the Triage Web for evaluation. The following is a report on the spectra by our Triage Analyst. The quality of the spectra is good. The spectra evaluation indicates there is a presence of moderately shielded Cs-137. There is no evidence of Special Nuclear Material. That is we do not see any spectra lines that would suggest the presence of U-235, Pu-239, Np-237, or Am-241 and there is no evidence of neutron interactions.

The spectrum is from a Bicron Fieldspec Identifier-N instrument. The detailed analysis of the spectra shows there is a shielded Cs-137 source present. The best fit for this source from the information available utilizing the GADRAS program is 5 Curies (Ci) of Cs-137 behind 1 cm of Lead (Pb) shielding. All the normal background lines are present. K-40, Th-232 and daughters, Ra-226 and daughters are present in the spectra. No other isotopes are visible. This amount of radiation activity should cause concern for the Health and Safety of personnel within the area.





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