RadComm Systems: Prevention of Radioactive Scrap in the Steel Industry.

Potential incidents at Steel Plants will increase in the future …

RADCOMM
RADIATION DETECTION SYSTEMS

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- *RadComm Systems was incorporated in April 1992*  *25 Year Anniversary*
- *Owner Steve Steranka has over 34 years of experience with radiation detection and has carved our a unique niche by specializing in the metals industry*
- *Privately owned with no other business units (Competitors multi-billion $ with Radiation only a fraction)*

Radiation Detection is our ONLY Business

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*In the **1970s and 1980s***

a significant number of

Sealed Highly Radioactive

Gauges went into various

industries.

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^{192}Ir
GAMMAMAT
max. 100 Ci Ir-192
Typ B (U)
RADIOACTIVE
100 Curies


^{241}Am
CAUTION
RADIOACTIVE MATERIAL
AMERICIUM - 241
RadComm
Radiation Detection Systems


^{137}Cs

^{137}Cs (Sealed Gauges can be small)

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An Old Intact Radioactive Gauge with Low Exposure Rate

SHIELDED RADIOACTIVE SOURCE

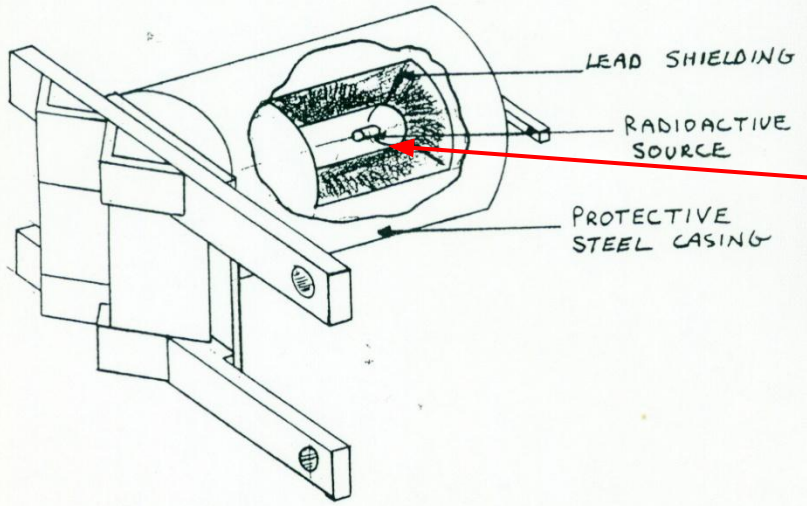
EXTREMELY DIFFICULT TO DETECT

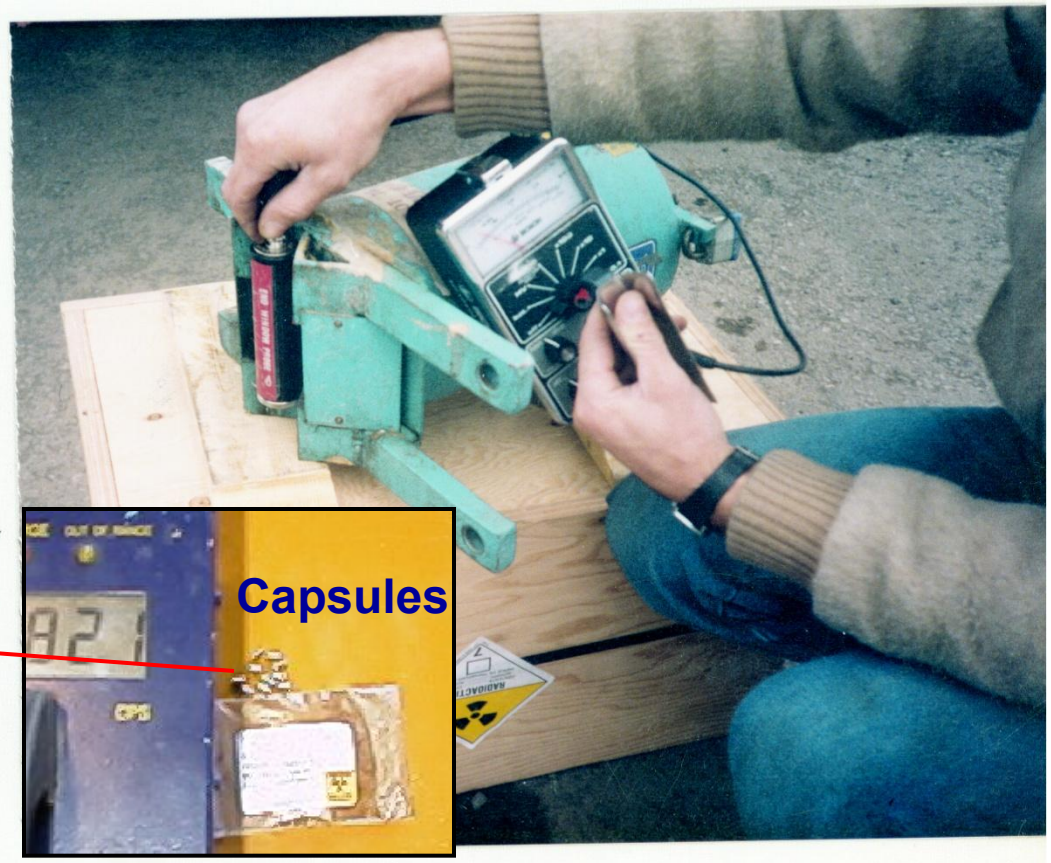
SIZE - TYPICAL SIZE 25 x 25 x 25 CMS

WEIGHS - TYPICALLY 30 KGS. (75 LBS.)

DESIGNED FOR SAFE PERSONNEL HANDLING

HIGHLY RADIOACTIVE IF SAFETY SHIELD IS MELTED





!!! VERY HIGH CLEAN UP COSTS !!!

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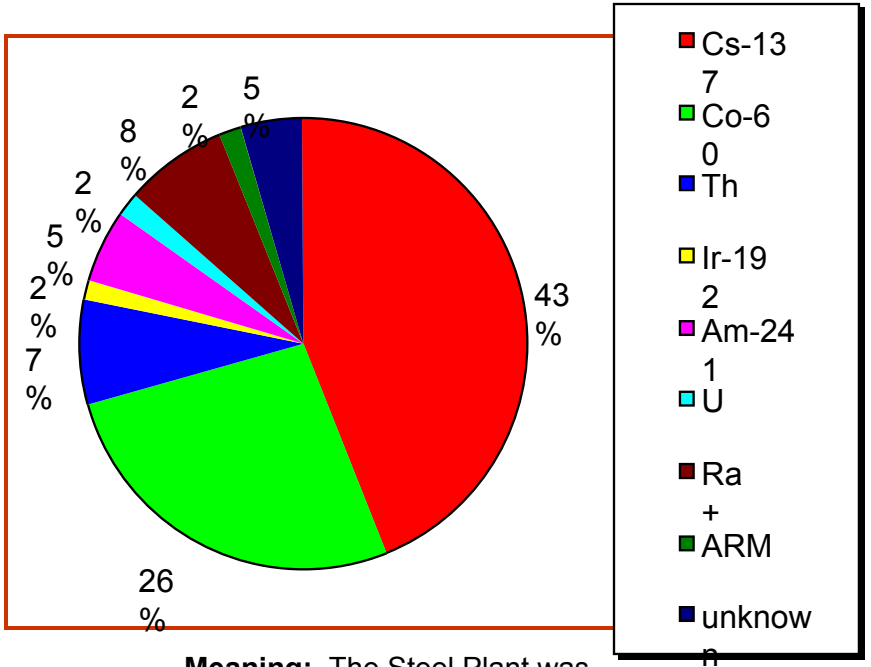
Short List of Radioactive Gauge Smelting ….

2008	**TISCO, Stainless**	*China*	**Co-60**
2008	**Carbon Steel Plant**	*Germany*	**Cs-137**
2007	**Outokumpo**	*Finland*	**Am-241**
2007	**Carbon Steel Plant**	*China*	**Co-60**
2004	**Acciaierie Beltrame**	*Italy*	**Cs-137**
2004	**Sidenor**	*Cantabria, Spain*	**Cs-137**
2004	**Aser**	*Erandio, Biscay, Spain*	**Cs-137**
2004	**Wu Yang Steel**	*Shan-Xi, China*	**Cs-137**
2004	**Capegate**	*South Africa*	**Cs-137**
2004	**Timken**	*Canton, OH, USA*	**Cs-137**
2004	**Stainless Steel**	*India*	**Co-60**
2004	**Ovako**	*Sweden*	**Am-241**
2004	**Outokumpu Stainless**	*Sheffield, UK*	**Am-241**
2004	**NUCOR Steel**	*Jewett, TX, USA*	**Cs-137**

+140 sealed radioactive source accidents in the metals industry



Meaning: The Steel Plant was monitoring with large scale radiation detection systems at the time of the accident.

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Detection of these highly radioactive gauges can be a serious problem ….

It is a FACT…

that greater than 90% of the Steel Plants were monitoring when the accident occurred !!!

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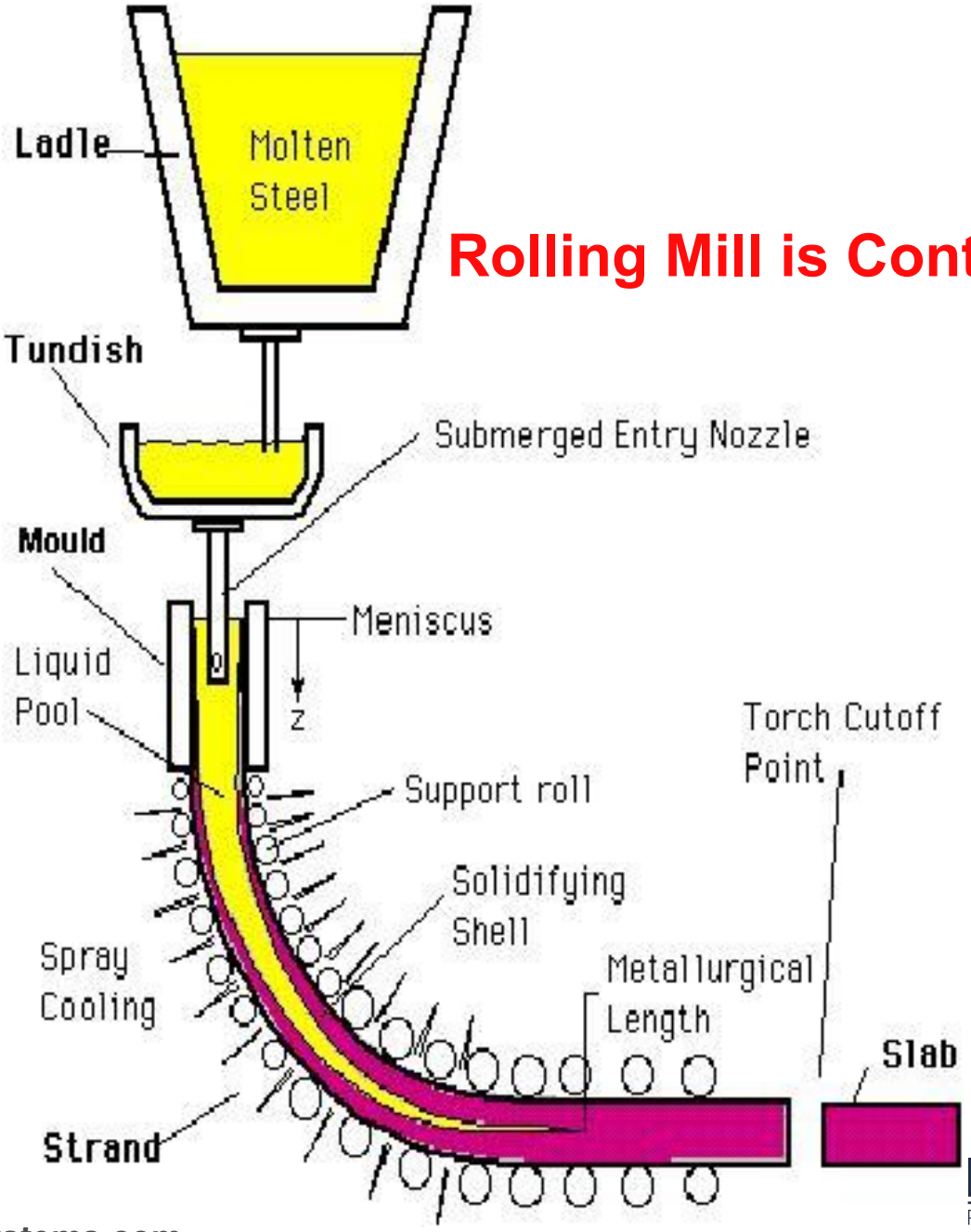
Furnace and Melt
shop are
Contaminated

Rolling Mill is Contaminated



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Slag Pit is Contaminated

Slag Pots are Contaminated


OffGas Ducting and
Baghouse are
Contaminated
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Slag Pit Cooling Area is Contaminated

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Slag Processing Area and Equipment are Contaminated

The following slides will show the primary reasons why accidents occurred and will ONLY become more frequent in the coming years.

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Radioactivity has a Half Life Issue (example: After 30 years)

The amount of detectable radiation decays over time

^{192}Ir (73.8 day Half Life) - after 30 years (148.4 Half Life's)

^{60}Co (5.27 years Half Life) - after 30 years (5.7 Half Life's)

^{137}Cs (30.7 years Half Life) - after 30 years (0.98 Half Life's)

^{241}Am (432.2 years Half Life) – after 30 years (0.07 Half Life's)

OLD radioactive gauges still in their original manufactured safety shield emit less radiation levels than the day they were manufactured making them EXTREMELY hard to detect.

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Most Radioactive Elements have Gamma Rays …

The Lower the Gamma KeV Energy level the more difficult it is to detect

^{192}Ir (317/468 KeV Primary) - 100% blocked by 1.7” (43mm) of Steel

^{60}Co (1187/1332 KeV Primary) – 100% blocked by 12” (305mm) of Steel

^{137}Cs (662 KeV Primary) – 100% blocked by 6” (152mm) of steel

^{241}Am (59.9 KeV Primary) – 100% blocked by 0.6” (15mm) of steel

Gamma Energies from a heavily buried, Intact, old radioactive gauge can be totally BLOCKED.

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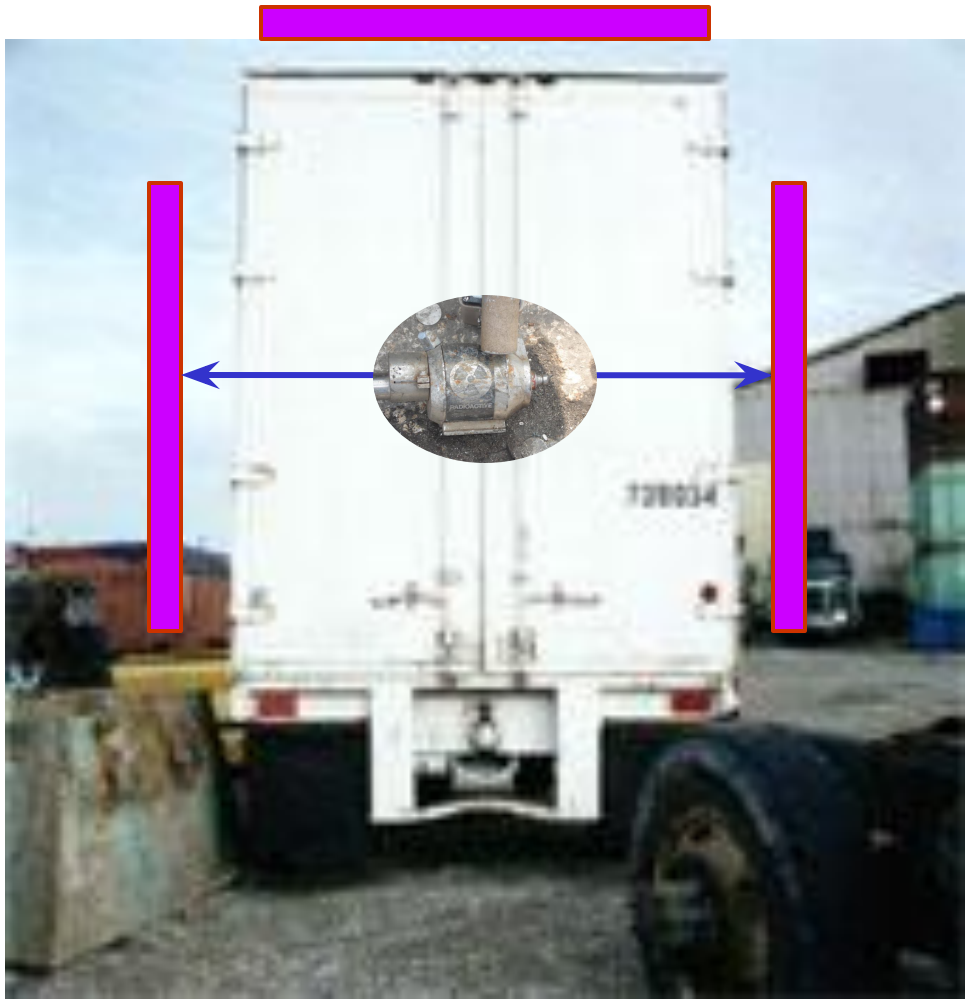
Heavily Shielded and Buried Radioactive Sources

It is possible to completely stop all radiation emissions



There is little that can be done to detect this radioactive source when it is heavily buried in this location of the vehicle.

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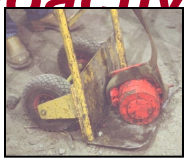
Radioactivity Dissipates in Air

The amount of detectable radiation decreases as distance Increases

Inverse Square Law Applies…. $I \sim 1/r^2$

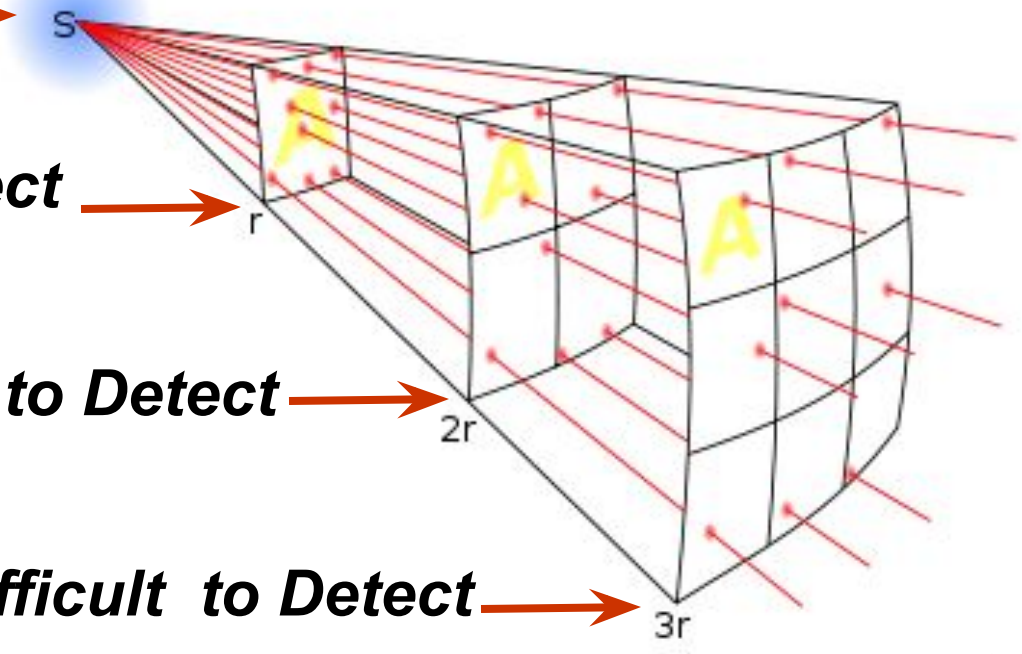
Radioactive source



Easy to Detect

Harder to Detect

Extremely Difficult to Detect



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Measured Ambient Background Radiation Levels are Severely Affected by the Vehicle Entering and Exiting the Scanning Area

Entering | **Vehicle In** | **Exiting**

Vehicle Out: Average Ambient Background Radiation Level

Vehicle Enters monitoring area Background Decreases

Point where Loss in Detection Capability occurs

Vehicle In: Infrared Sensor Trip Point

Vehicle Out: Infrared Sensor Trip Point

Suppressed and Changing Background from Vehicle and Scrap

Vehicle Exits monitoring area Background Increases

Point where false alarms occur

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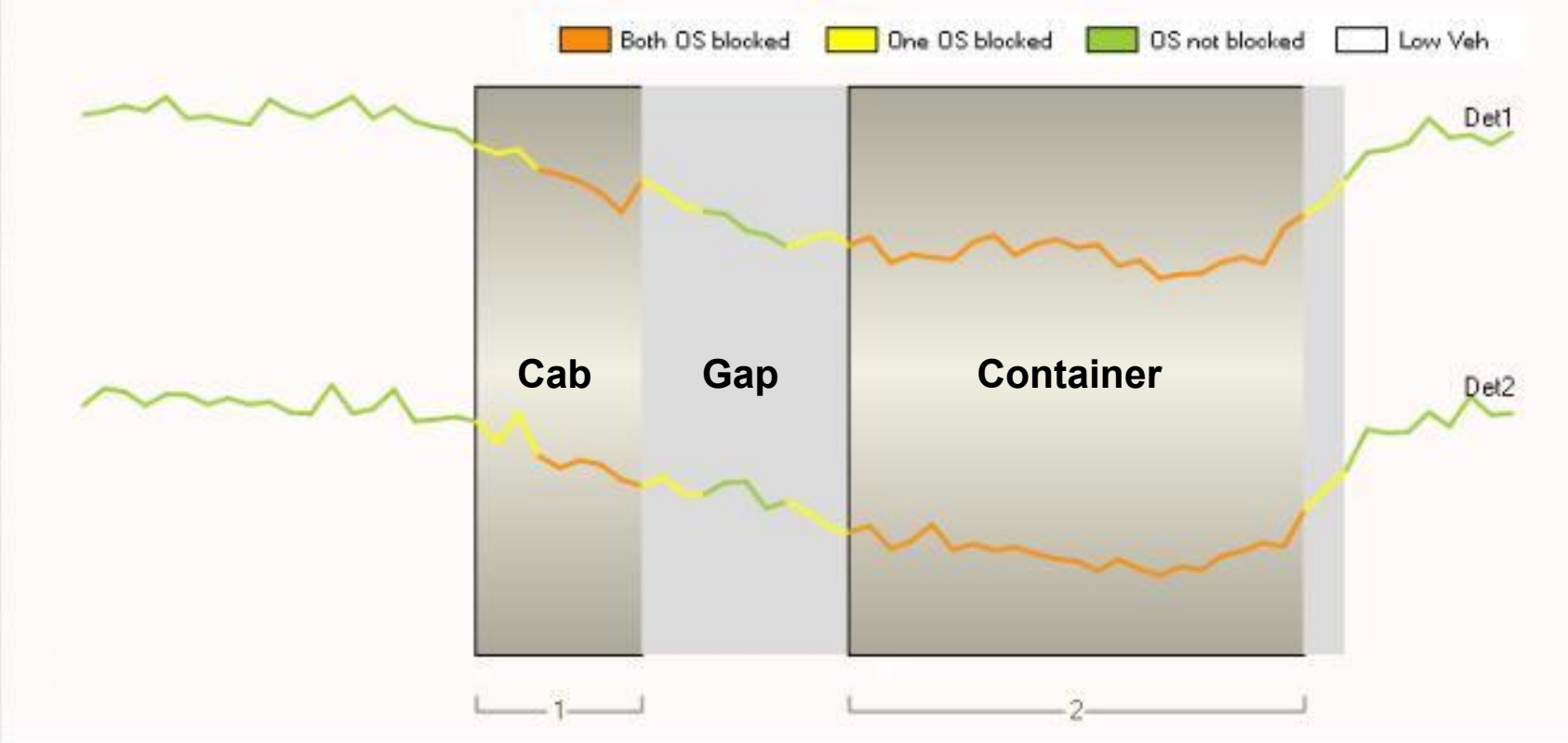
Depression of Measured Background Radiation Caused by the Vehicle and Scrap Metal



Depression in Measured Ambient Background Radiation Levels as the Vehicle Passes can be up to 70%.

Graph shows a Vehicle Clean Scan with no Radiation

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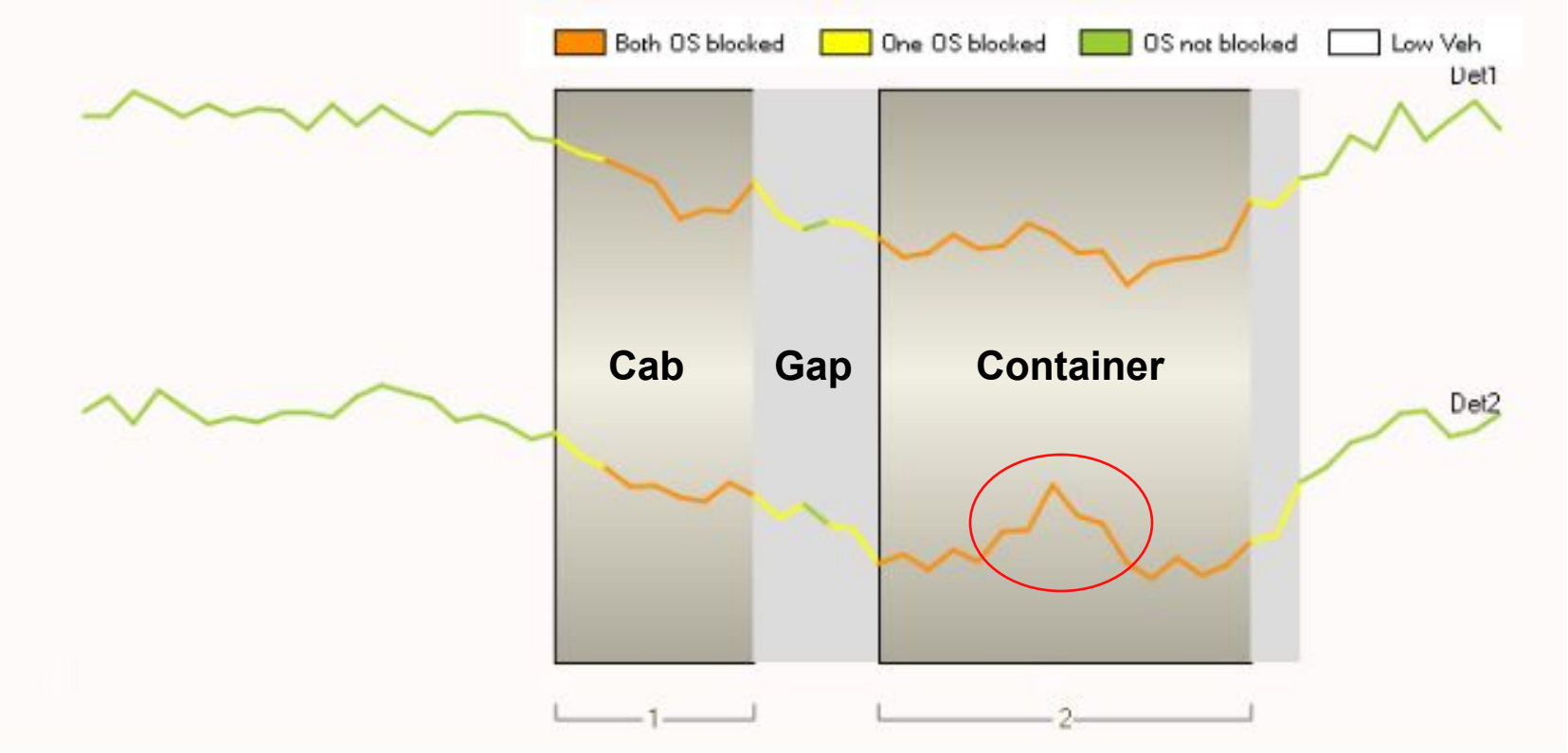
Depression and Increase in Measured Background Radiation Caused by the Vehicle and Scrap Metal



Depression in Measured Ambient Background Radiation Levels with an <u>increase caused by a density change.</u>

Graph shows a Vehicle Clean Scan with no Radiation

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Changes in Vehicle and Scrap Densities Cause Severe Changes in the Measured Ambient Background Levels

Heavy Density **Light Density** **Heavy Density**

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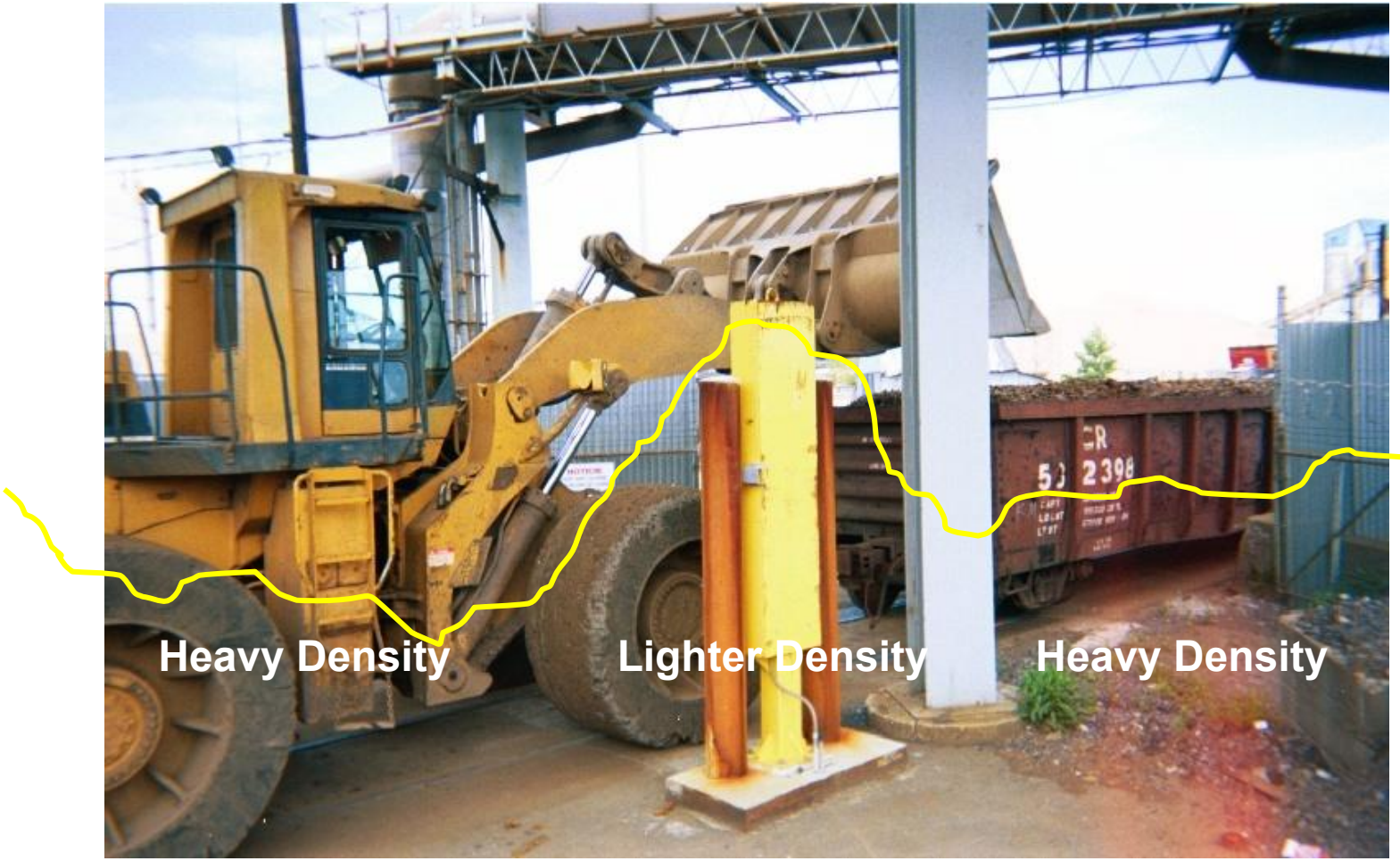
Changes in Vehicle and Scrap Densities Cause Severe Changes in the Measured Ambient Background Levels



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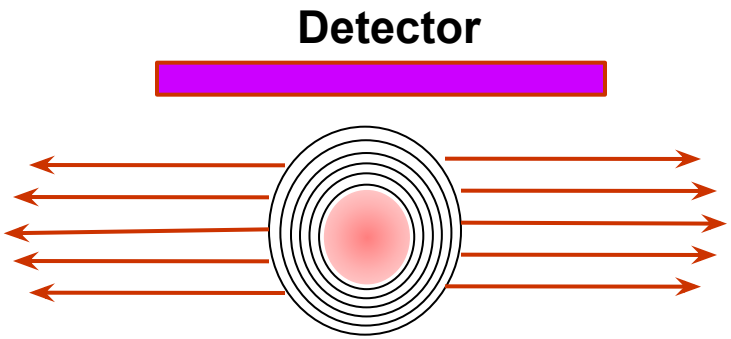
Scanning (Dwell) Time for a Radioactive Source is Critical…



Moving radioactive source

The most practical travel speeds for scanning a radioactive source in a moving vehicle is between 5 to 8 Km/h

Detector Widths

Wider detector panels provide increased “Dwell Time”. Dwell Time allows increased sampling time for more accurate alarm threshold level settings.

Narrow Detectors and Increased Vehicle Speed

--- Decrease detection capability

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Narrower the Detector Panel the Slower the Speed

<5 Km/h **<10 Km/h** **<15Km/h**

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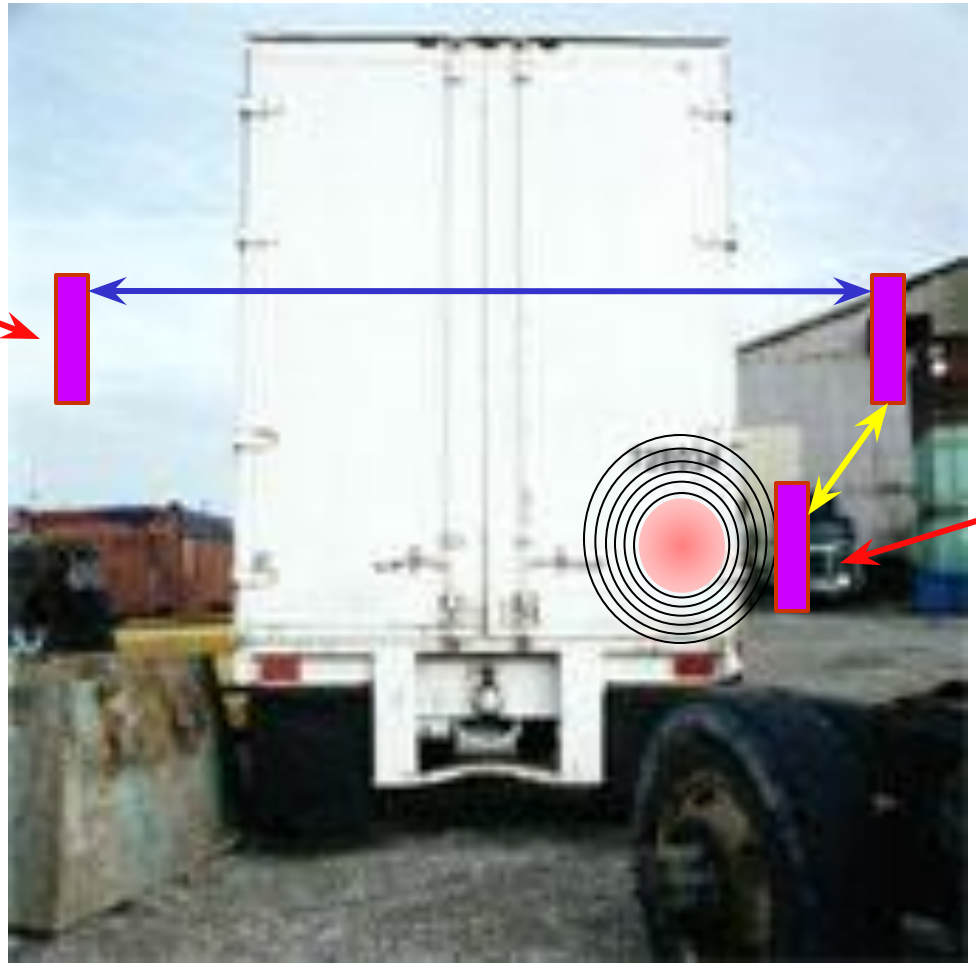
Reliable Detection of a Radioactive Source Depends On…

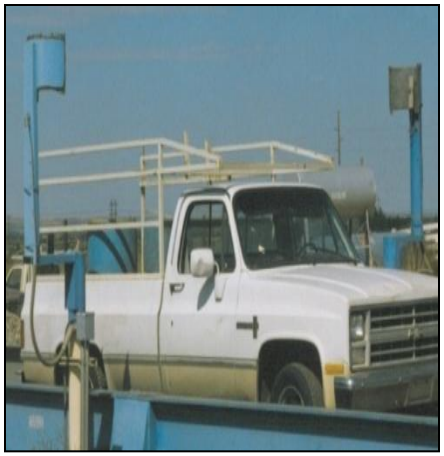
Detector Size, Location, Strength of Radiation and Shielding

Small physical size and shielded radioactive source

Small Sized Detectors



Moving the detector to this location closer to the source would have resulted in a detection



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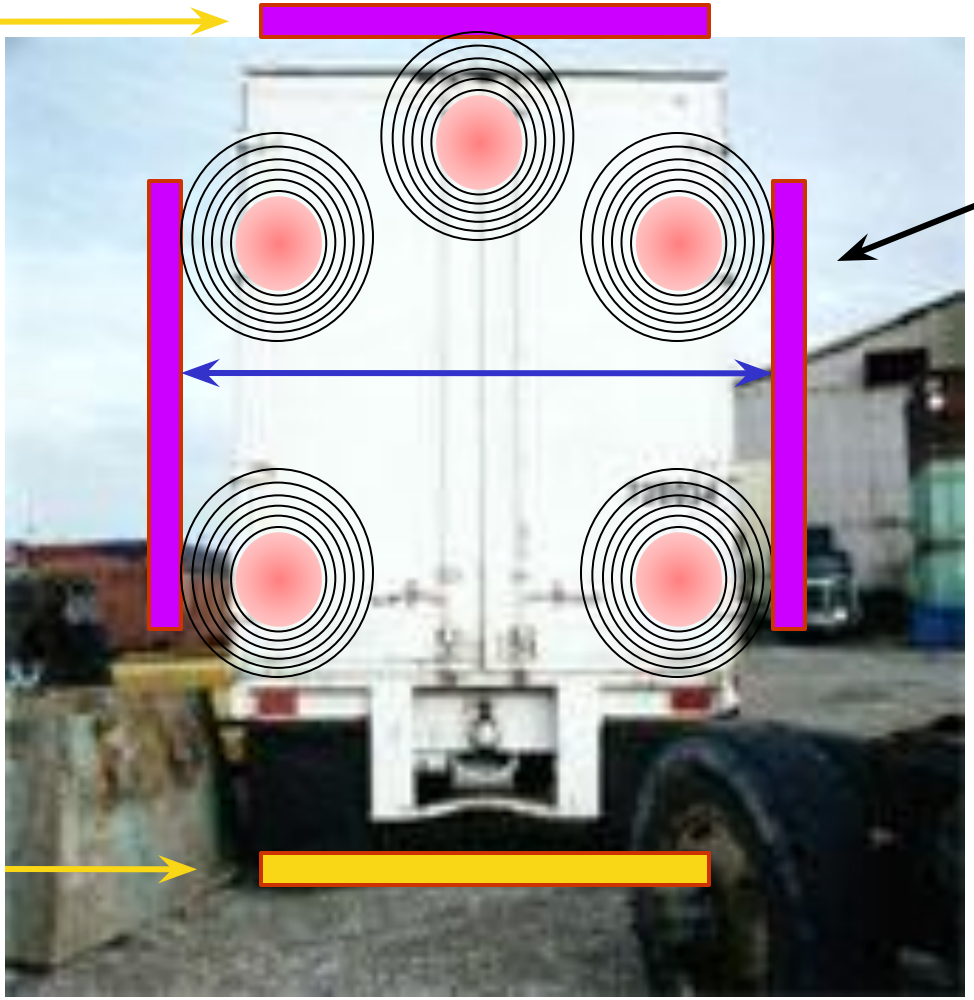
Detectors Panels must be Situated as close as Possible to the material that will be scanned…

They are too far apart, too small and improperly placed.

Significant loss in detection capability.

Most Reliable Detection of a Radioactive Source…
Proper Detector Area Coverage and Placement

An upper detector can be installed but extreme caution should be taken for high vehicles



Detectors should be located within 1 meter (39”) of the vehicle surface area which is the best working solution for Truck and Railcar applications

A detector in the ground below the vehicle usually results in water damage and very limited detection capability

Not Recommended

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The BEST Detector Panel Placement is to have the entire surface of the vehicle/material being scanned in Direct View of the detector Panel…

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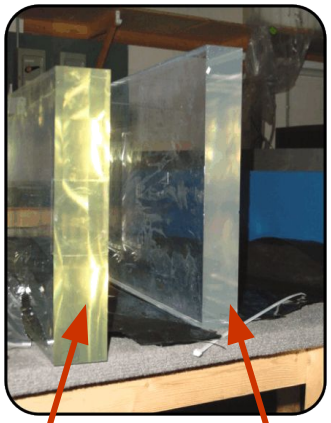
Detectors Panels must be Situated as close as Possible to the material that will be scanned…

Old Aging PVT Scintillation Material



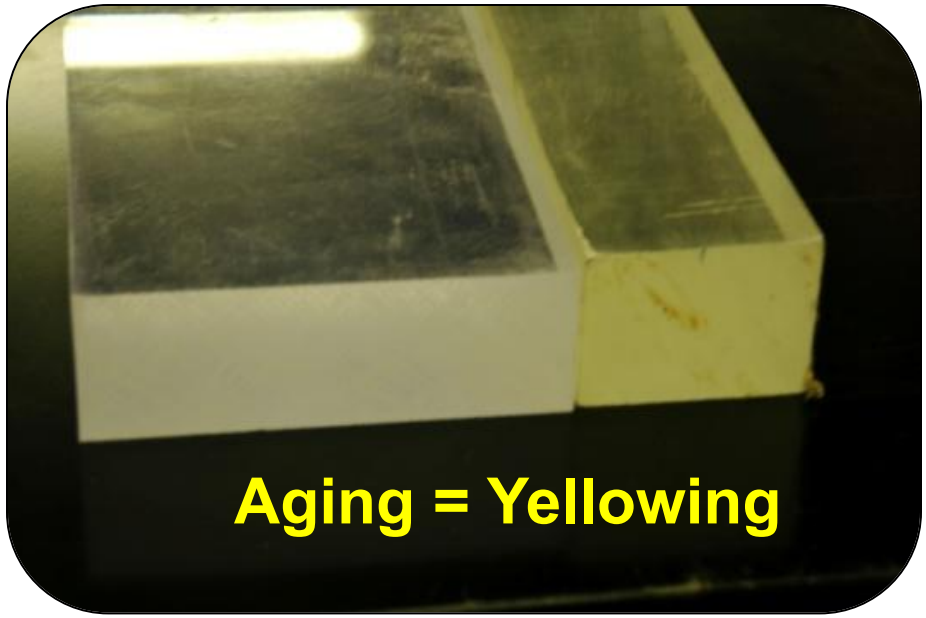
Aged - PVT - New

+8 year old detection systems aging becomes very noticeable

- Aging, yellowing PVT scintillators

  " St. Gobain estimates the performance degradation of plastic scintillators (PVT) to be in the order of 3% per year…"

- Up to 10% degradation per year for energies below 100KeV



These are the primary reasons Radioactive Sources have gone undetected by CONVENTIONAL radiation detection systems resulting in multi-million Plant Contaminations.

1. Half Life of Radioactivity.
2. Gamma Energies and Shielding.
3. The Inverse-Square-Law (fall off in intensity with distance).
4. Severe changes caused by the vehicle entering and exiting.
5. Severe changes caused by varying vehicle and scrap densities.
6. Vehicle Speed.
7. Proper Detector Size and Placement.
8. Old Aging Detection Medium.

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RadComm's Advanced Technology for detecting Heavily Shielded Old Radioactive Gauges in Scrap Metal

RadComm has 25 years of experience with more 5,000 system installations with a proven safety record.

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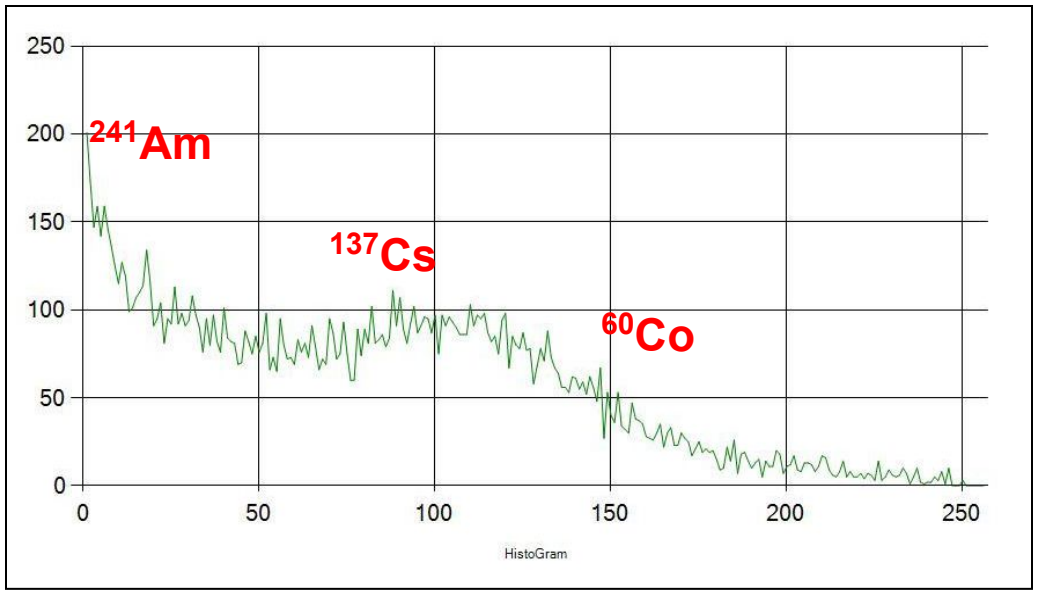
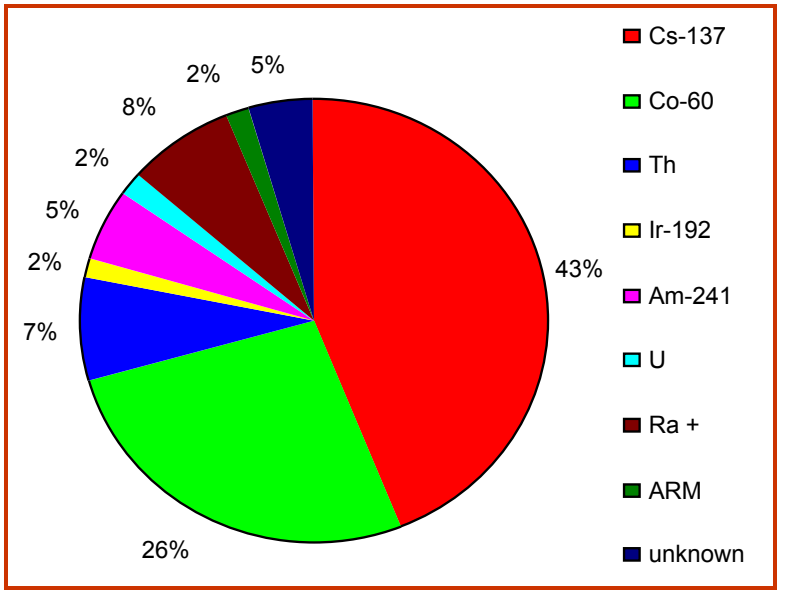
RadComm Systems Utilizes a Specially Designed Histogram of Isotopic Energy Distribution …..





RadComm Processed Histogram of Gamma Energy

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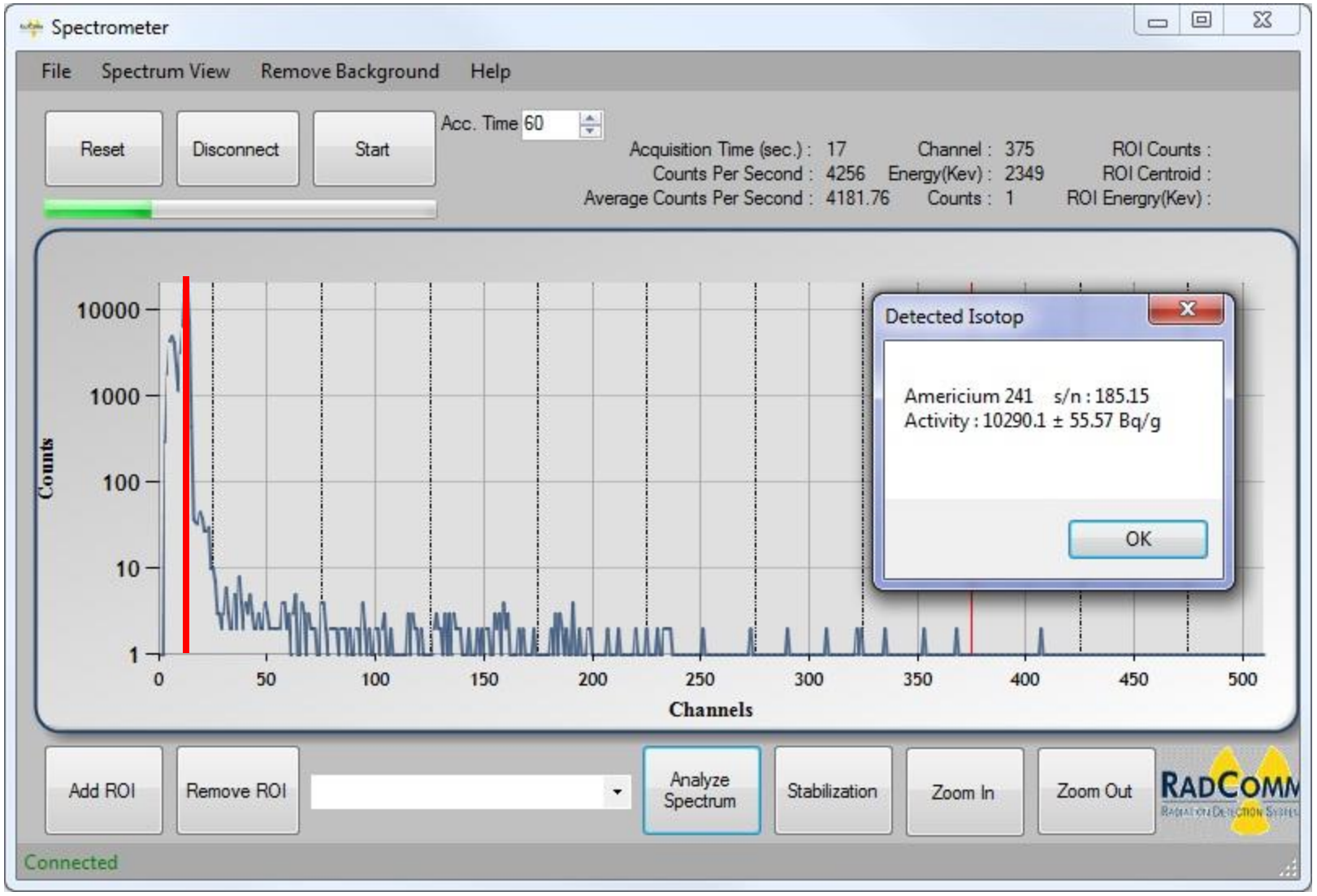
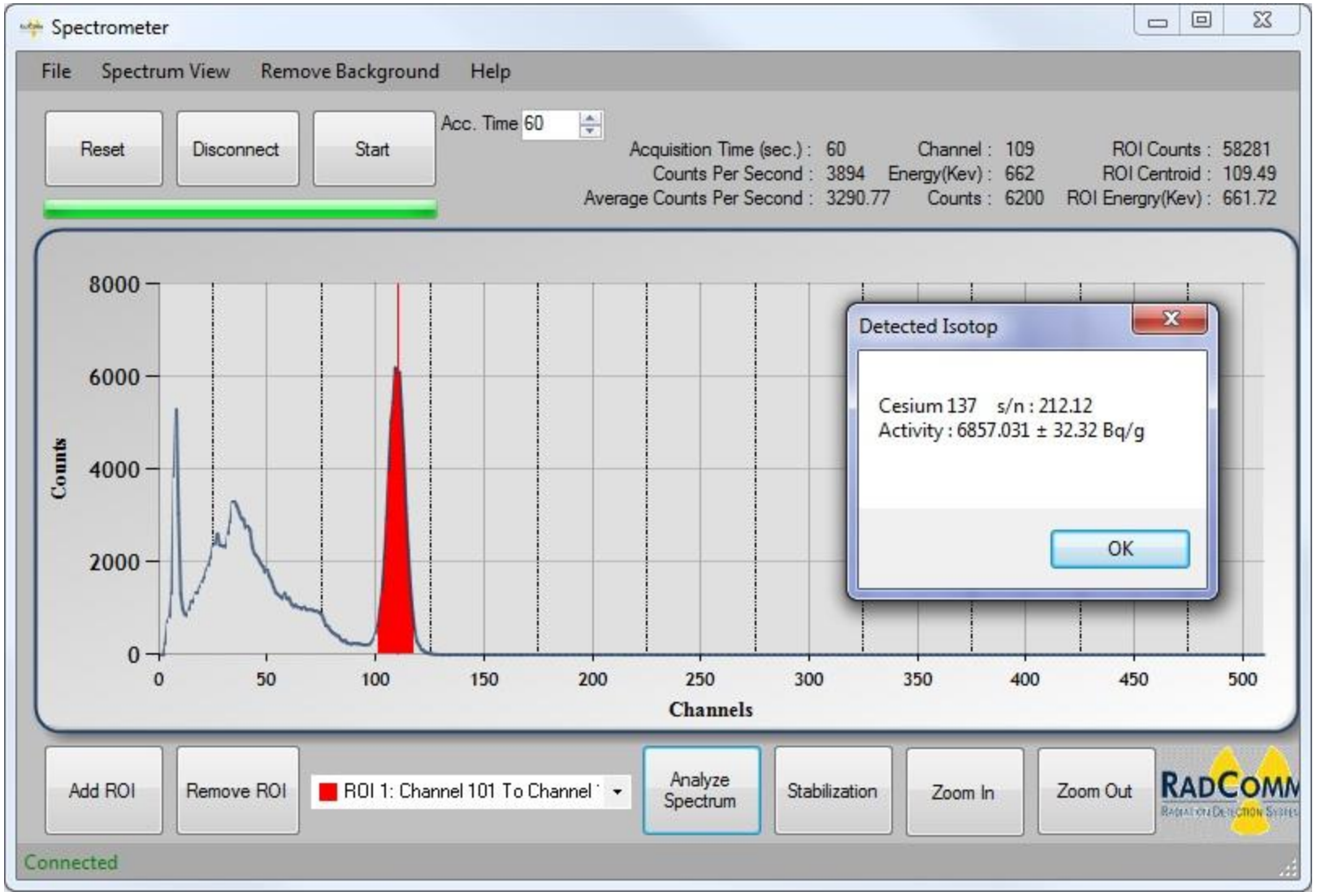
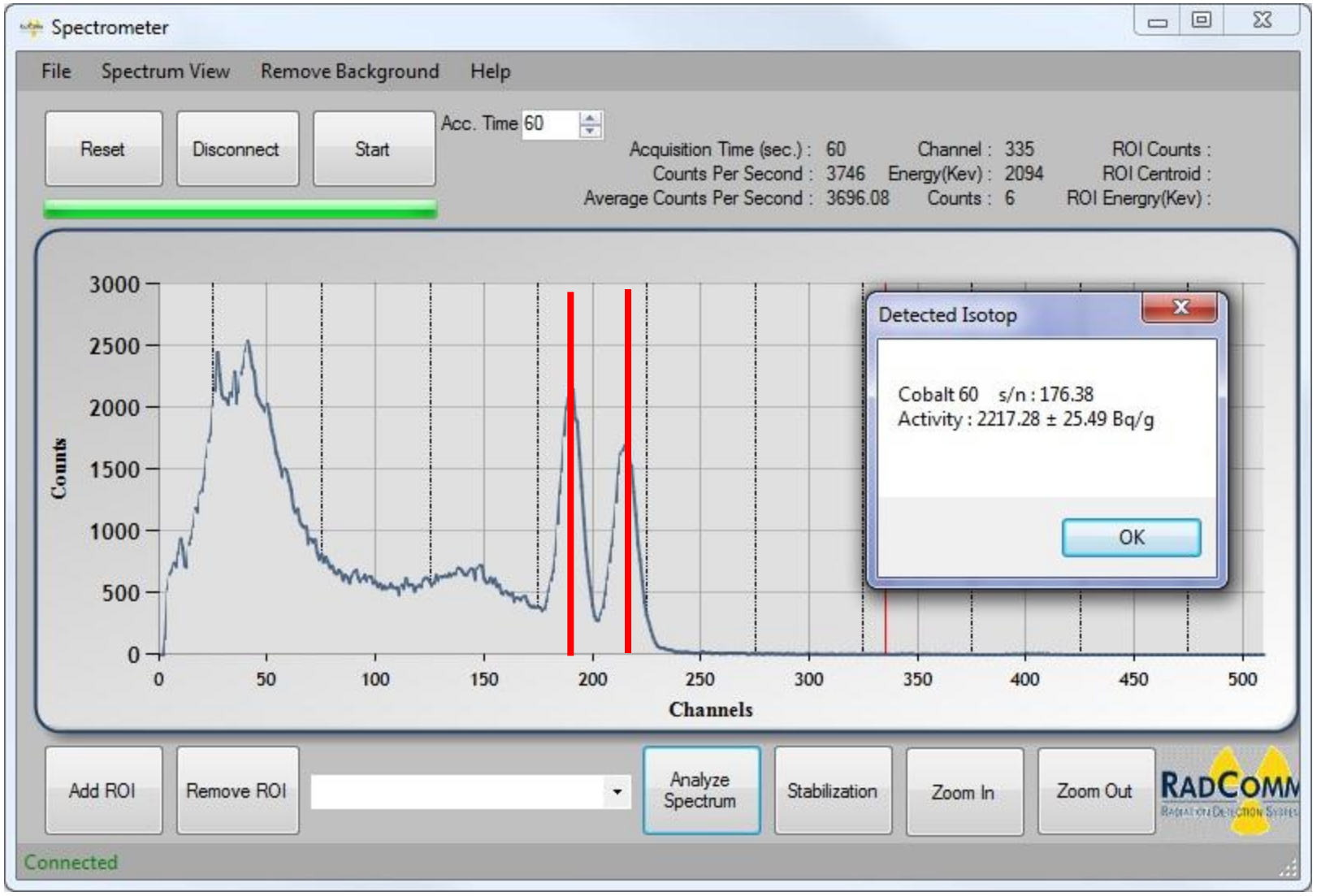
Region of Interest (R.O.I.) Energy Distribution of ^{241}Am…



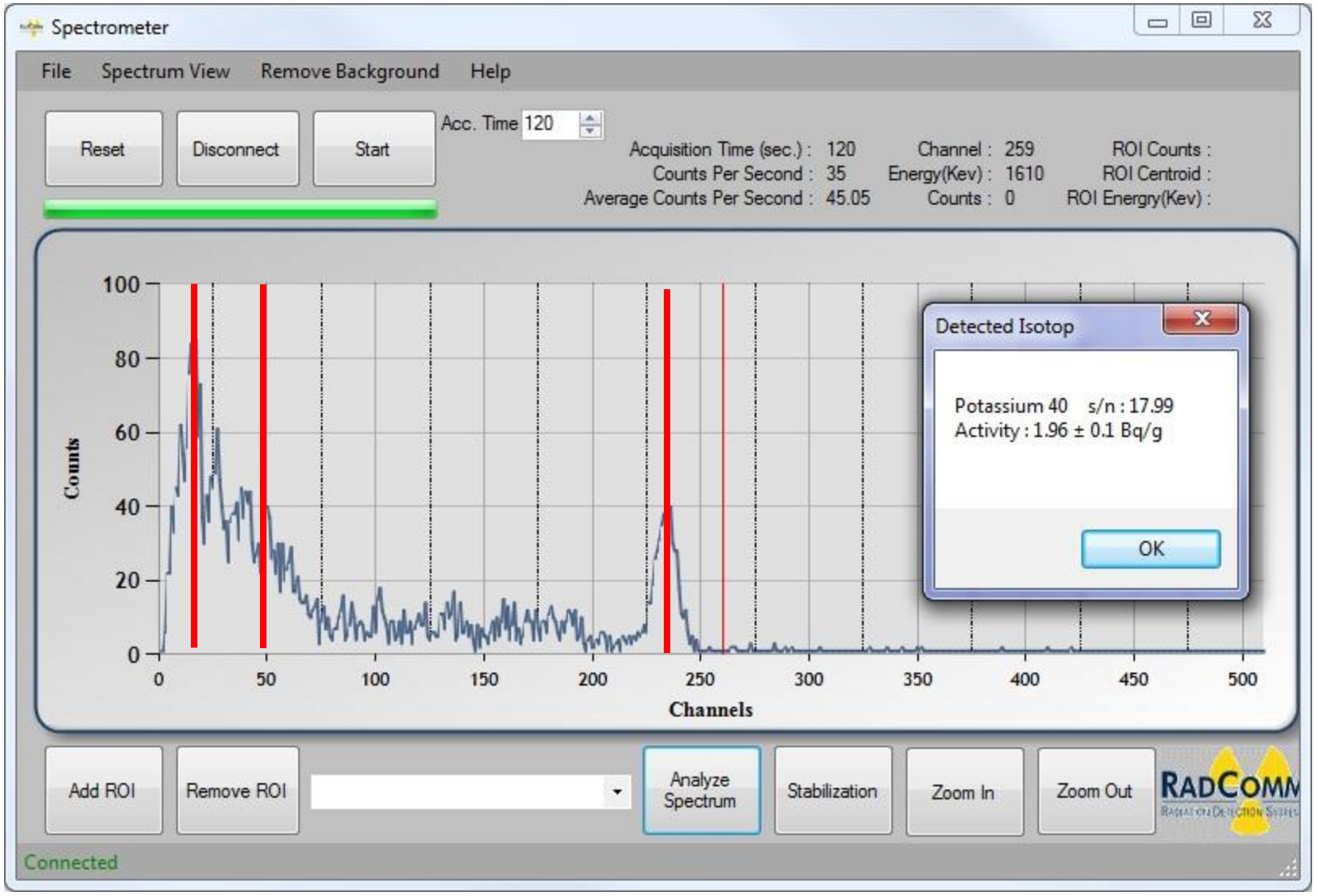
Region of Interest (R.O.I.) Energy Distribution of ^{137}Cs…



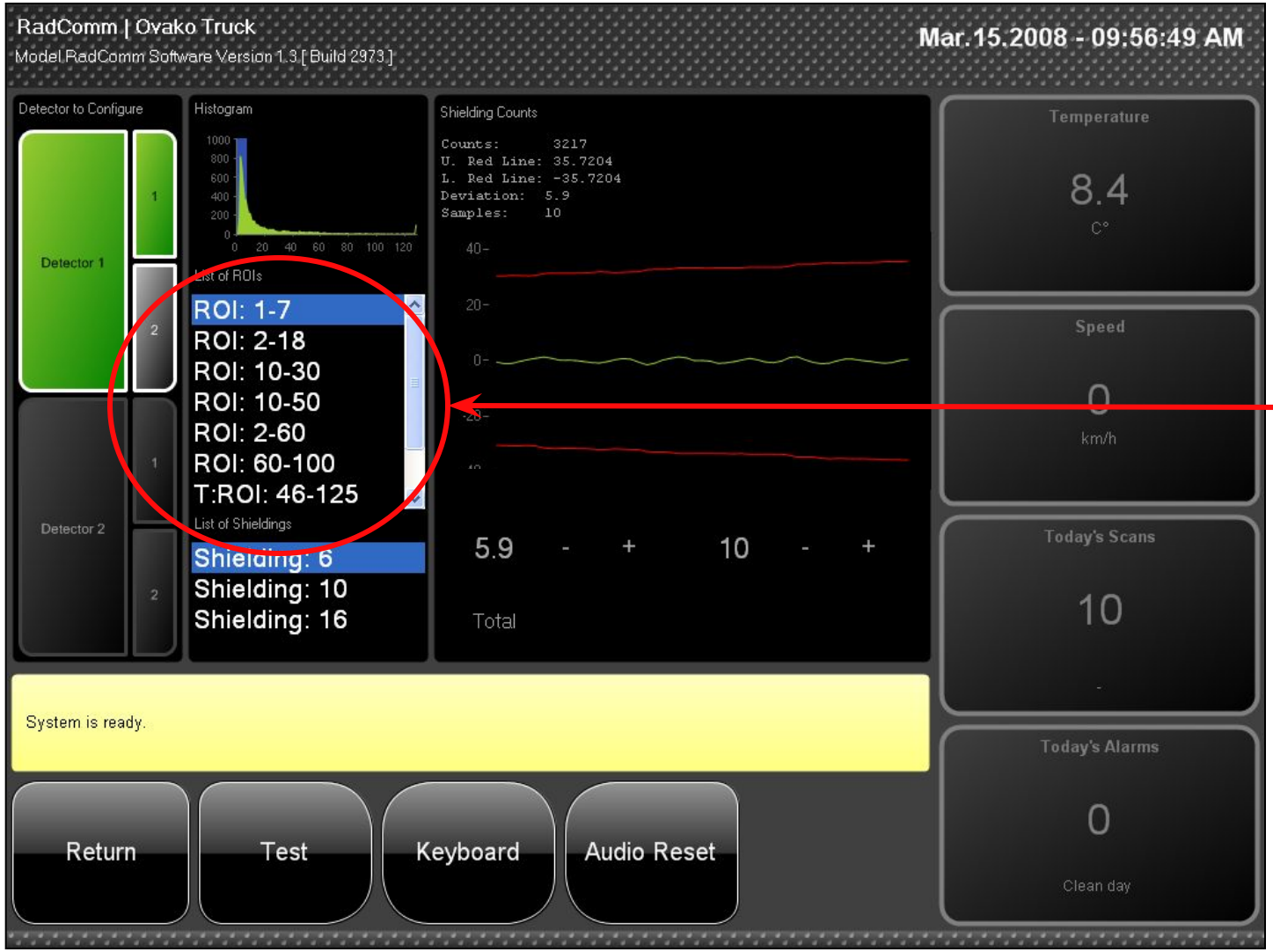
Region of Interest (R.O.I.) Energy Distribution of ^{60}Co…



N.O.R.M. Region of Interest (R.O.I.) Energy Distribution of ^{40}K…



RadComm Systems Multiple Region-of-Interest (R.O.I.) Alarm Threshold Analyses for Specific Energies …..



Significant increase in detection capability

Energy Regions

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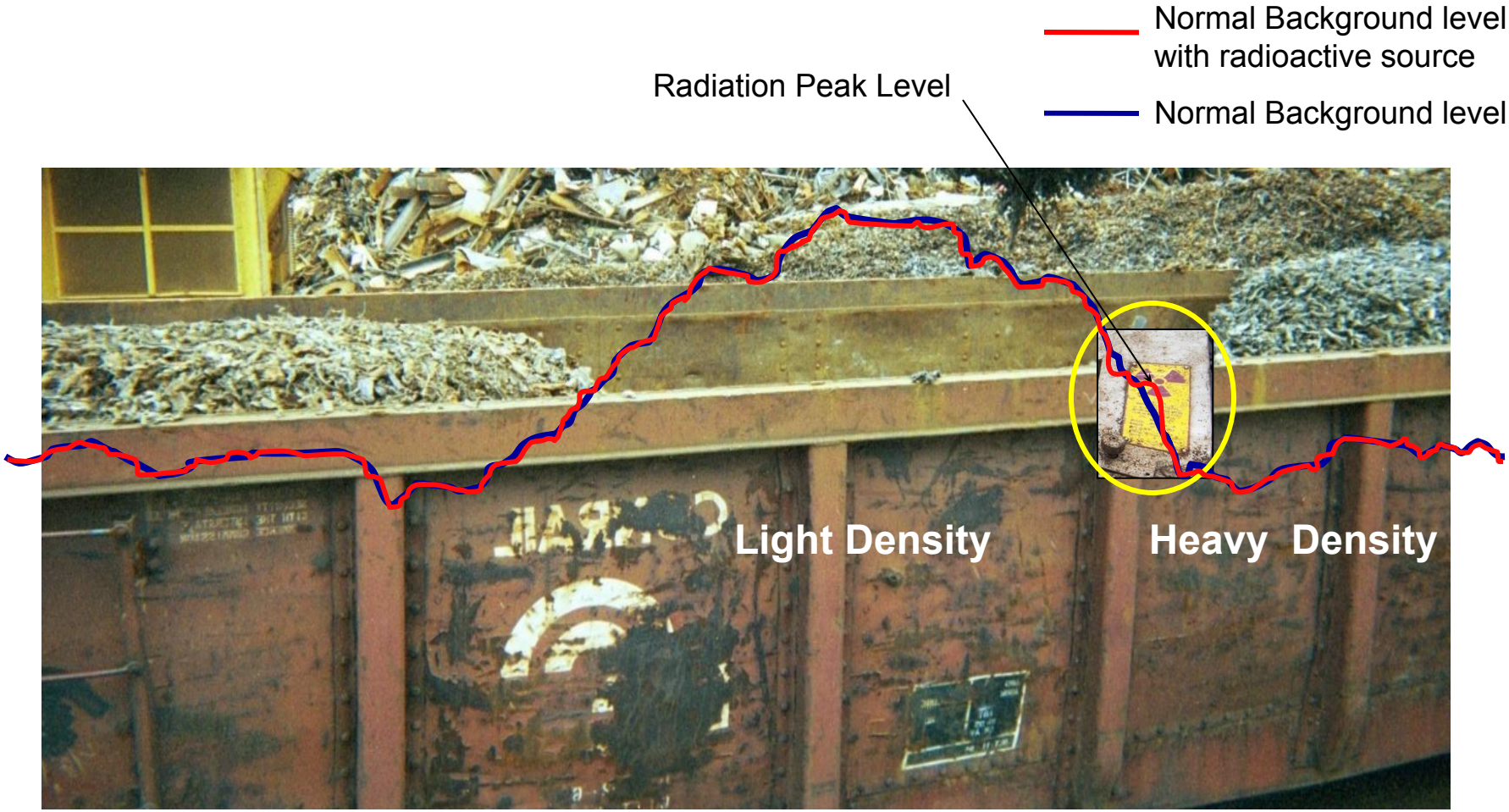
Potential for Missing a Radioactive Source

A Radioactive Source located in the area where the scrap density is <u>Increasing</u> is extremely difficult to detect…



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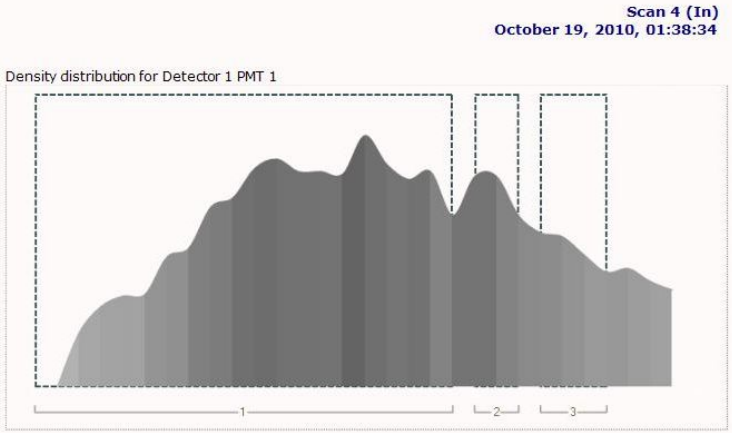
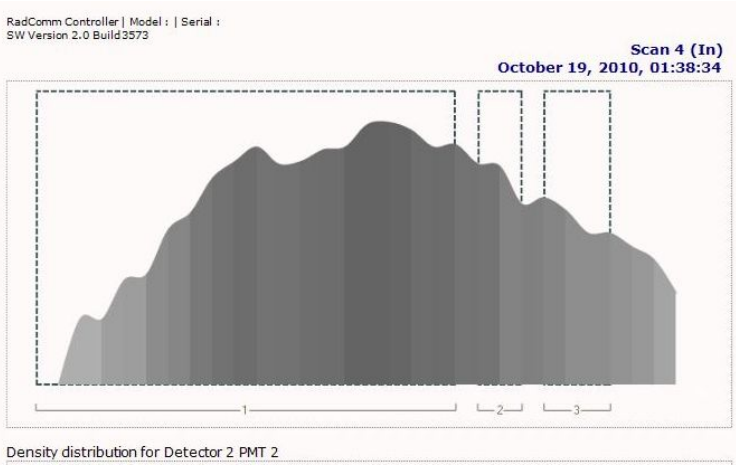
RadComm Systems Real-time Tracking of Energy Distribution Provides Critical Density Information…

Detector #1 Density Distribution



	Det. 1	Det. 2
Highest	5570	6515
Lowest	3390	4040

Detector #2 Density Distribution



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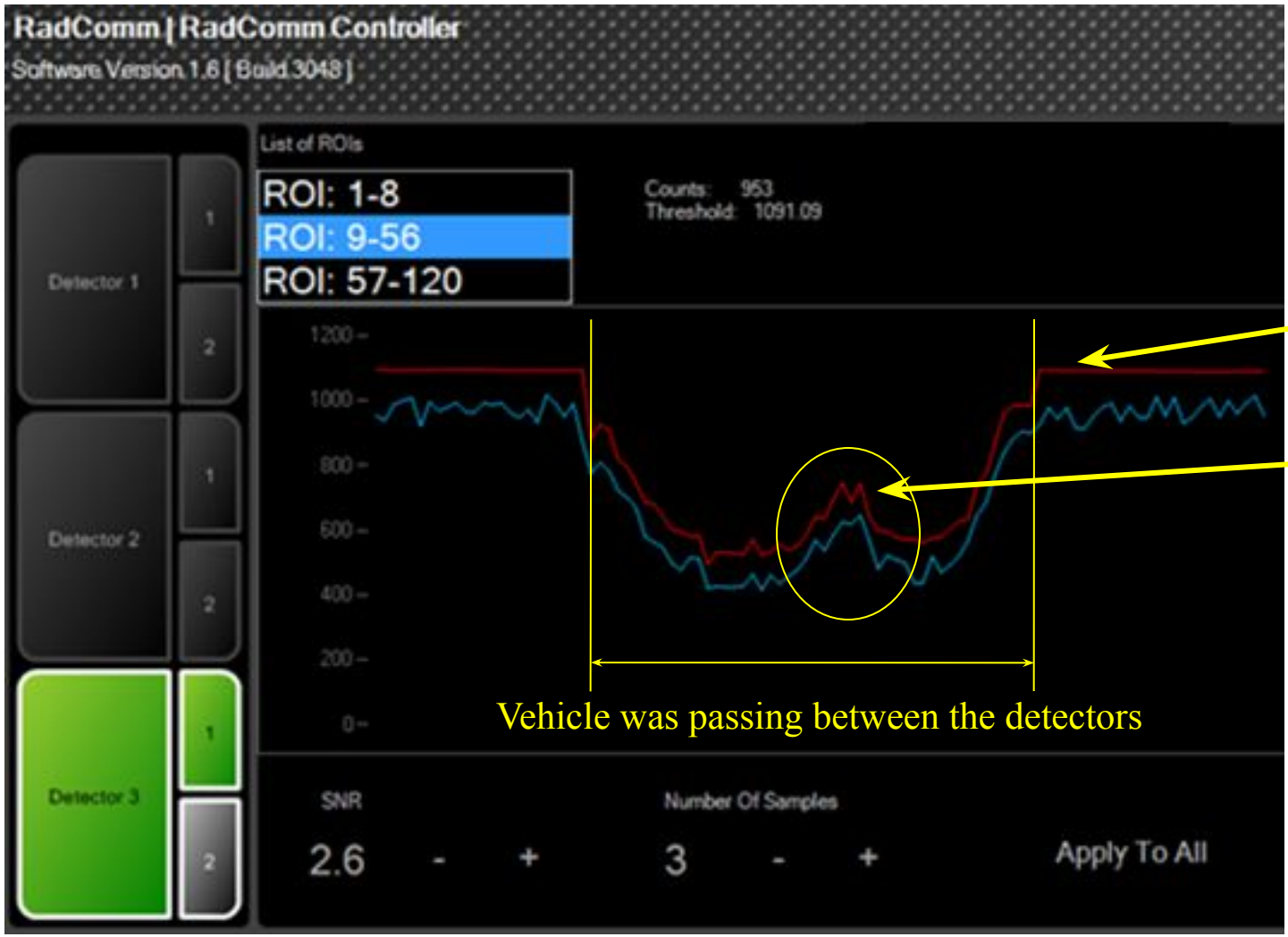
SNR Energy Specific Density Compensating Real-Time Alarm Analyses cont…



SNR Alarm Threshold Setting is automatically tracking the changes in Background in Real-Time.

Peak caused by a density Change, <u>not</u> a radioactive source

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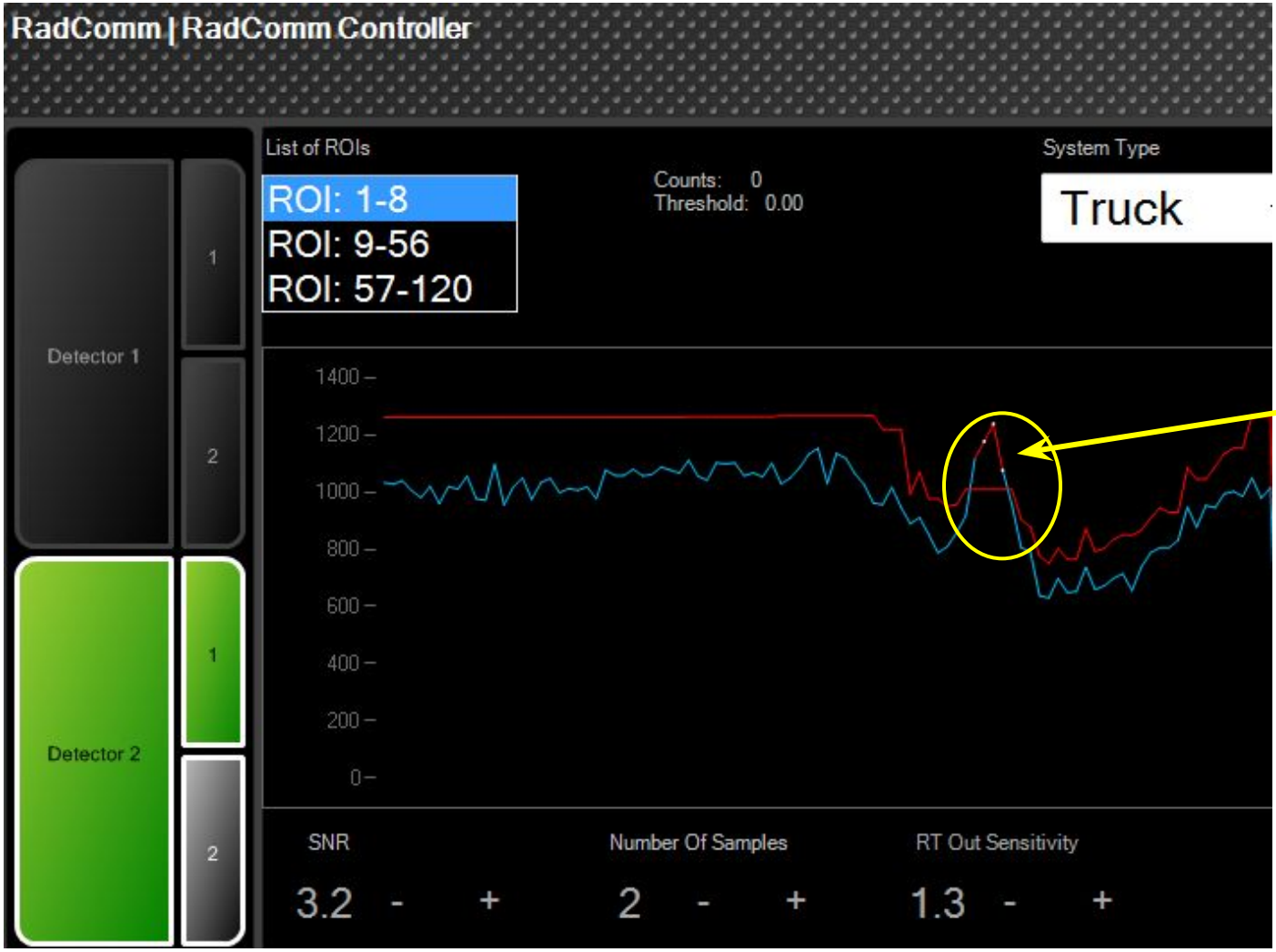
SNR Energy Specific Density Compensating Real-Time Alarm Analyses cont…



Peak caused by a radioactive source and was easily detected in Region 1-8 with the SNR Alarm Thresholds

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Bury a heavily shielded <u>OLD</u> radioactive gauge in scrap being carried in a fast moving vehicle…..

It becomes extremely hard to detect if not impossible !!!

Example of Rejected Container caught in Rotterdam

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RadComm at the end of 2016 has seen a 22% YOY increase in the number of calls from customers and non customers who have had containers of scrap material refused or seized for radioactive sources/contamination

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What does this mean to SE Asian Steel Companies?

Steel manufacturers in North American, Europe, Japan, and South Korea all invest heavily in protecting their facilities from potentially contaminated scrap.

Scrap companies look for countries to "dump" potentially "hot" scrap

No Detectors = Opportunity to still sell "hot" scrap

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The RADCOMM difference…

- *Innovative products*
- *Reliable, responsive service*
- *Dedicated personnel*

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