Global Material Security

Facilitated Panel Discussion – Determining Acceptable verses Unacceptable Consequences SARTT

Office of Global Material Security

U.S. Department of Energy

National Nuclear Security Administration

NNSA National Nuclear Security Administration

U.S. DEPARTMENT OF ENERGY

Overview of Consequences Associated with Class 7 Transports

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There are positive and negative consequences to every action we take in any transportation process and this is especially true in the movement of radiological materials.

With regard to nuclear and radioactive material we assign a value to the loss of material based on several factors:

- Type and form of the material
- The amount and specific activity levels
- And the theft, unauthorized removal or sabotage of the material

It's the responsibility of the State to assign consequence values to each radiological material stored, in use, or in transport

Acceptable verses Unacceptable

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We categorize both nuclear (Category I - IV) and radioactive (Category 1 – 5) materials and subsequently consequence values are assigned based on their attractiveness levels as targets of malevolent acts and other relevant factors.

Consequence values are assigned from high to low with 1 having the highest unacceptable consequence and incrementally lower responding to the lower category number.

- Question:
  - Does a high consequence value affect the security measures we apply to our shipments? Should it?

Consequence values affect risk.

Risk and Consequence Values

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We evaluate Risk through a simple equation: $R = P_A * C * (1 - P_E)$.

Consequence values play an important role in the way we classify Risk and based on the Risk ratings, we apply protection measure by using a graded approach to security.

- Questions:
  - Does a low consequence value affect the security measures we apply to our shipments?
  - What do we consider as an acceptable consequence if our material is lost to a malicious act?
  - Within your respective countries, are consequence values considered as part of your security planning?

Consequence Values and Risk

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- System effectiveness and consequence values are important in determining risk
- Once system effectiveness is quantified and consequence values are assigned, risk can begin to be measured
- Here is an equation to provide an indication of risk:

$$R = P_A * C * (1 - P_E)$$

R – Risk

P_A – Probability of Attack

C – Consequence

P_E – Security System Effectiveness

Risk Equation Values

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- When values are assigned to the risk equation we need to understand where the values originate:
  - Probability of Attack (P_A) is always Very High (0.99) because it is never known when the attack will occur and must always plan every shipment as if an attack is eminent.
  - Consequence (C) is the consequence of a radioactive material lost to an adversary and is used as a Radiological Dispersion Device (RDD). Consequence values range as follows for this example:
    - Category 1 quantity of Cs^{137} is 0.89 (VH)
    - Category 1 quantity of Co^{60} is 0.81 (VH)
    - Category 2 quantity of Am^{241} is 0.65 (H)

Rating	Range
Very Low (VL)	0.00–0.20
Low (L)	0.21–0.40
Moderate (M)	0.41–0.60
High (H)	0.61–0.80
Very High (VH)	0.81–0.99

Risk Equation Results

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- It is possible to determine results for a hypothetical shipment of a Category 1 Cs^{137} using the consequence guide and our security system effectiveness rating of 0.65

$$R = P_A * C * (1 - P_E)$$

$$R = 0.99 * 0.89 * (1 - 0.40)$$

$$R = 0.52 \text{ is a Moderate Risk}$$

- This risk analysis states that you will lose an encounter with an adversary force 50% of the time.

$$R = P_A * C * (1 - P_E)$$

$$R = 0.99 * 0.21 * (1 - 0.40)$$

$$R = 0.12 \text{ is a Low Risk}$$

- Take a closer look at both consequence values and security syste effectiveness in the second equation . This is a false results
- If you manipulate the rating levels of the consequence and system effectiveness – you will never know what the true risk to your shipment is

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Questions

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- Based on assessment you can determine what your overall Shipment Security System Effectiveness is …
- Using the appropriate Consequence Values established by the competent authorities within your countries …
- You can determine with some certainty what the Risk is for your shipments of nuclear and radioactive materials