Key elements for creating a sustainable radiological security framework

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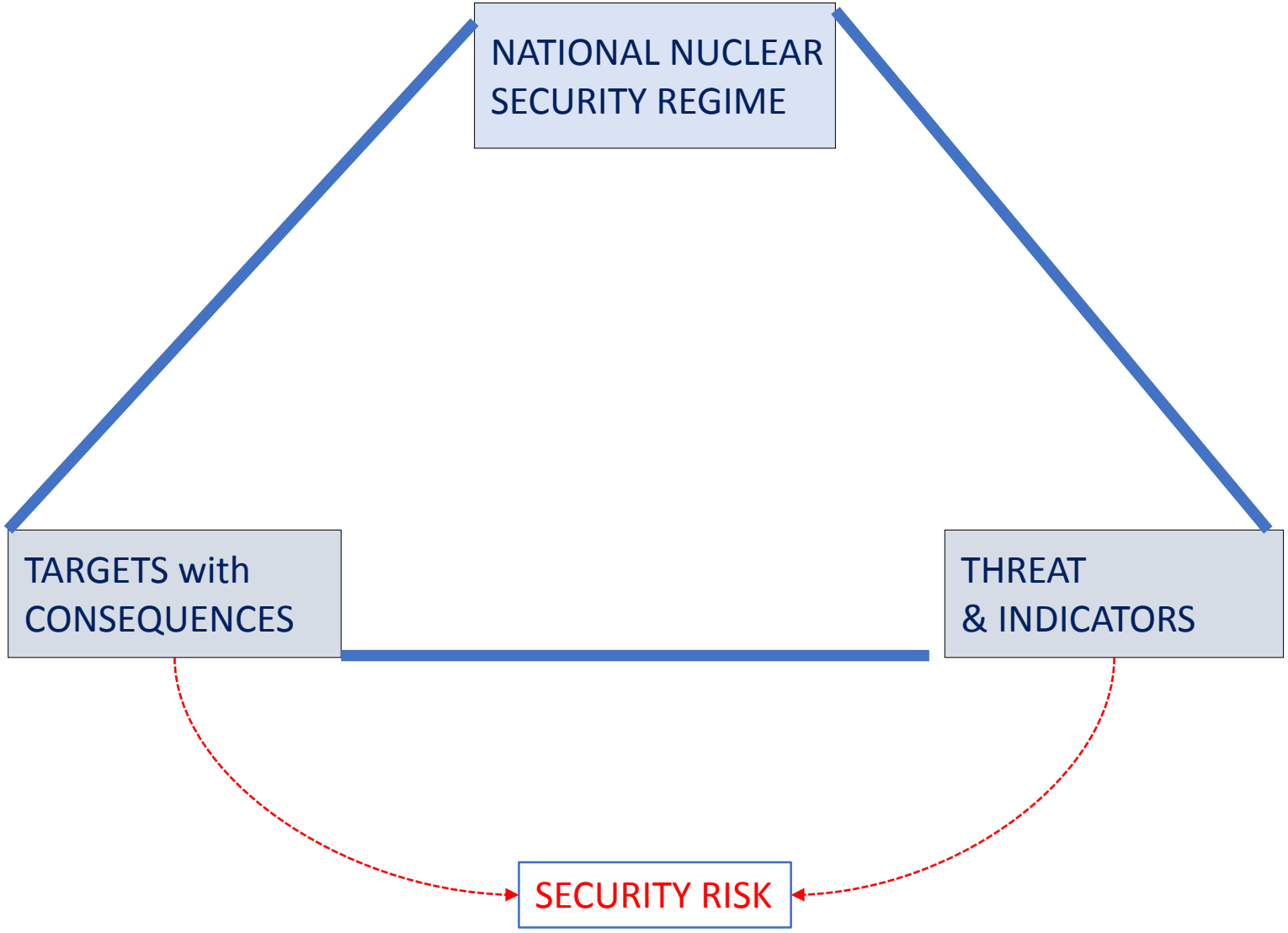
WINS Regional Workshop on Ensuring the Resilience and Sustainability of Radioactive Source Security
Vienna 13 and 14 February 2019

Interrelations In Nuclear Security - Triangle

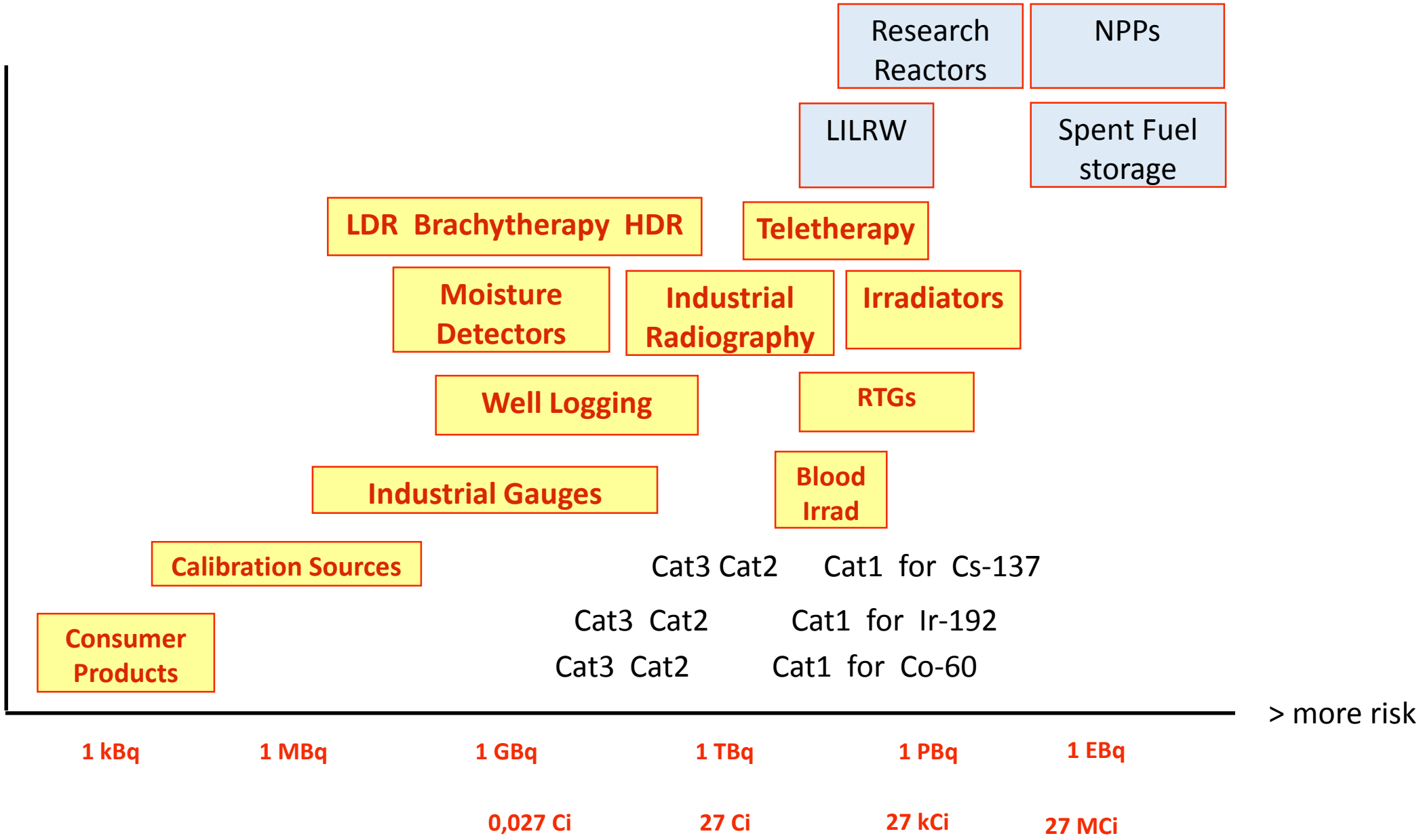


What are Potential Targets Worldwide

- **10.000 teletherapy units**
- **100.000 Cat I and II radioactive sources**
- **> 1.000.000 Cat III radioactive sources**
- **12.000 industrial sources for radiography supplied and transported annually (WINS)**

How many in Europe?

What radioactivity is available for potential consequences?



How many Ci will contaminate 1 km2 to 20mSv/year?

Assume perfect uniform dispersal:

10 Ci of Co 60 (0,37 TBq)

40 Ci of Cs-137 (1,48 TBq)

1000 Ci of Cs-137 source (or 37 TBq) could theoretically contaminate 25 km2

From:
DIRTY BOMB RISK AND IMPACT, SAND2017-9121R

https://prod-ng.sandia.gov/techlib-noauth/access-control.cgi/2017/179121r.pdf

Potential Consequence - Radiological Accident in Goiania, Brazil

1985: Private radiotherapy clinic closed down

50.9 TBq (1375 Ci) caesium-137 teletherapy machine left in abandoned clinic

1987: teletherapy head stolen, unit dismantled, Cs-137 source capsule ruptured causing major contamination

Many people were exposed:
- 112 000 people monitored
- 249 people contaminated
- 49 people 0.1 - 6.2 Gy
- 4 people died

Major contamination of property:
- 200 people evacuated
- 85 public places decontaminated
- 41 houses evacuated
- 7 houses were demolished

Total volume of waste = 3500 m3
- 3800 metal drums
- 1400 metal boxes
- 10 shipping containers

What are the possible consequences of malicious use of RS?

- **Direct Harm or Loss**
- **Delayed Harm or loss**
- **Social, Economic, Psychological, and Political Damage**
  - Denial of access , denial of area
  - Panicking, self evacuation, asking for medical help
  - Malfunction of social system and transportation infrastructure
  - Other non-radiological consequences (rumor, bad reputation)
  - Loss of business, loss of GDP, cost of decontamination, cost of medical treatments
  - Loss of tourism
  - Costs of evacuations and sheltering
  - Costs of demolishing and rebuilding
  - Liability issues

A typical area denial dirty bomb

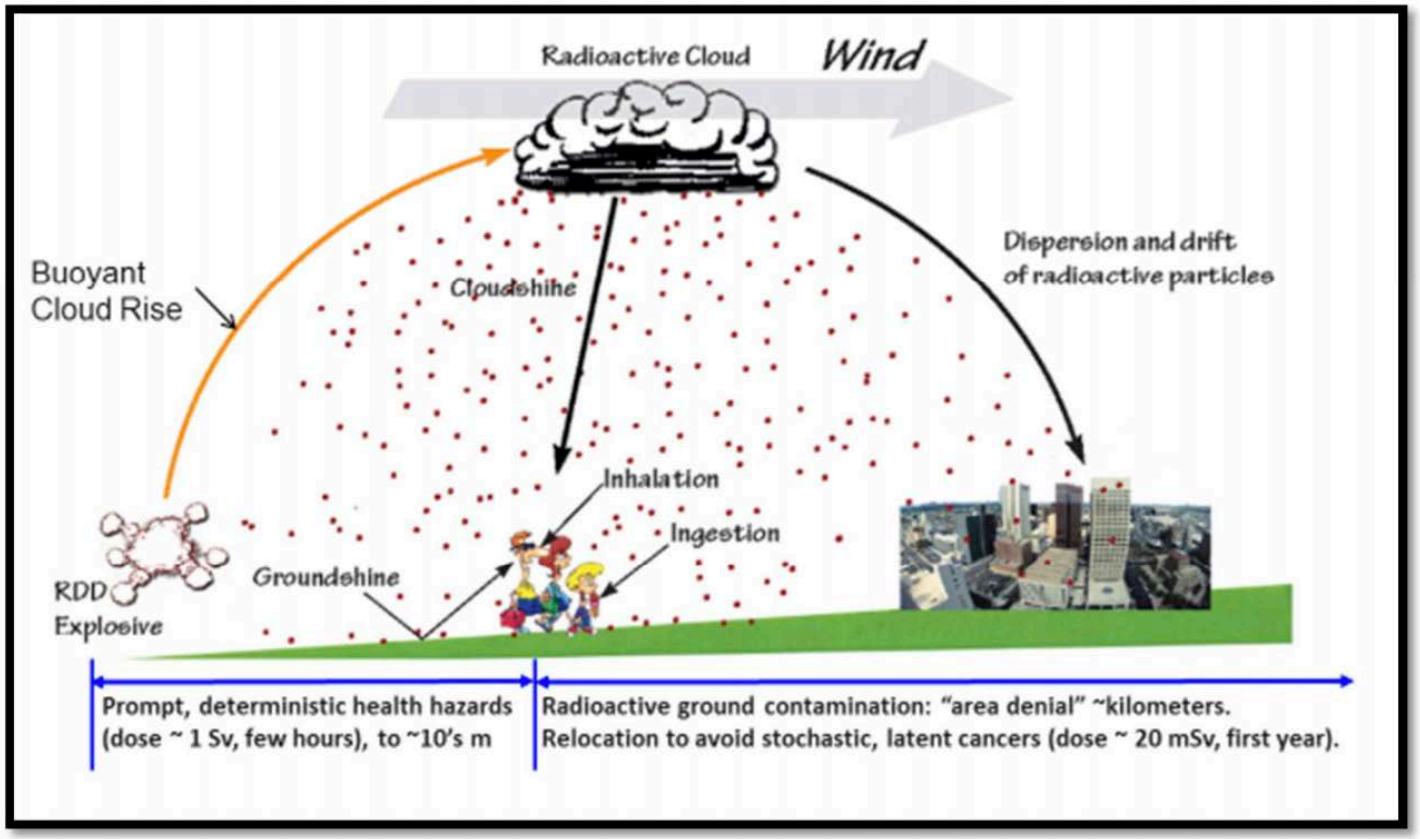


Figure 2. A typical area denial dirty bomb.

https://prod-ng.sandia.gov/techlib-noauth/access-control.cgi/2017/179121r.pdf

Consequences of RDD? National Planning Scenario #11

Terrorist purchase 3 disused seed irradiators each with 2300 Ci Cs-137 (85 TBq)
Load 3 vans with 1,5 ton fertilizer and diesel oil and insert one Cs source in each van
Detonate each van in downtown of City A, B and C, few hours apart
Estimated consequences:
180 fatalities, 270 injuries, 20.000 persons contaminated
10.000 evacuated,
75.000 instructed to shelter in place
100.000 self evacuated in anticipation of more attacks
36 blocks contaminated in each city
Economic impact up to 1 billion $
Recovery time: months to years

From US Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response https://www.phe.gov/Preparedness/planning/playbooks/rdd/Pages/scenario.aspx

Consequences of RDD? Another scenario analized

Scenario:

Blood irradiator with 2300 Ci of Cs-137

45 kg of explosives

Site: business and industrial area of a midsize city

Total economic impact in one year: 1,2 billion $

Le Brun: Thesis: Economic impact of a radiological dispersal event,

AIR FORCE INSTITUTE OF TECHNOLOGY

https://apps.dtic.mil/dtic/tr/fulltext/u2/a500525.pdf

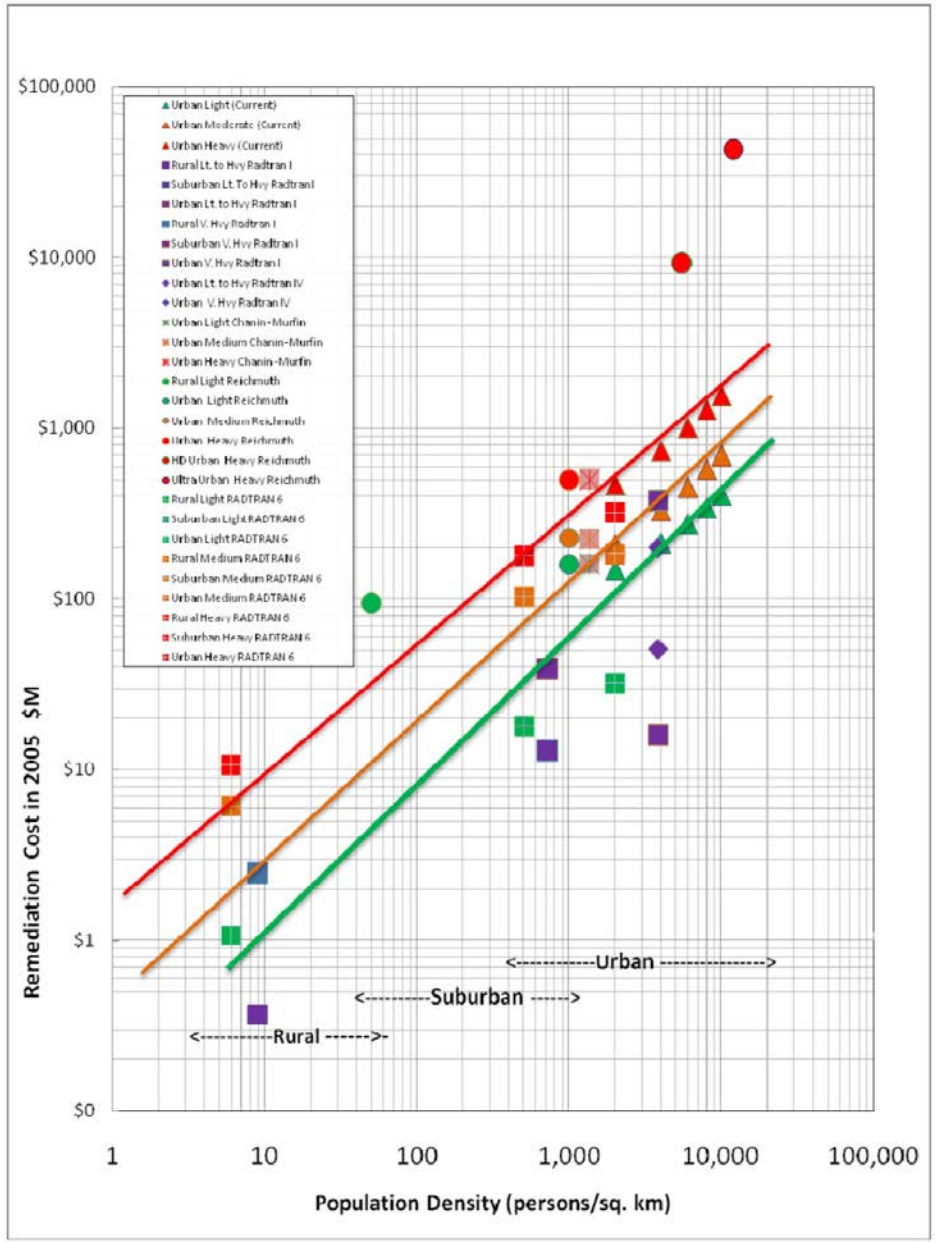


Figure 1: Remediation Cost Estimates Compared.

Robert E. Luna, H. Richard Yoshimura and Mark S. Soo Hoo :

Survey of Costs Arising From Potential Radionuclide Scattering Events,

WM2008 Conference, February 24-28, 2008, Phoenix AZ

Estimated remediation cost for RDD in a city would depend on the city and population density. To remedy parts of a city with with 10.000 persons/km2 could cost over 1 billion $/km2

Threats to Nuclear Security

Are threats real?

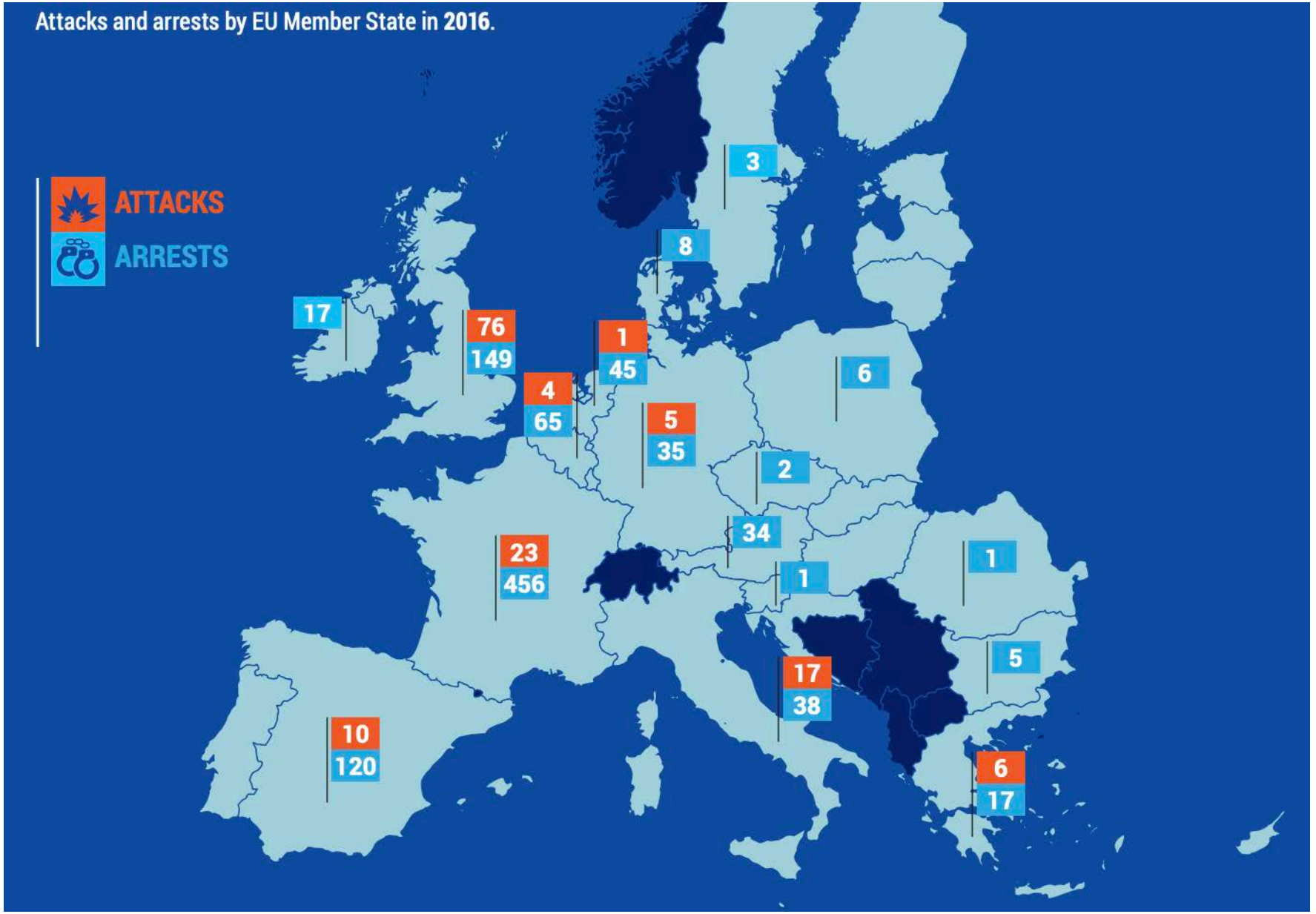
Some past terrorist acts

Some Recent Examples for Terrorist Bombings targeting multiple sites

- 2004 Madrid commuter train bombing, 10 explosions from backpack bombs by suicidal, at 4 train stations, 193 dead, 2000 injured
- 2005 London metro bombings, 4 suicidal terrorists, home made explosives, 3 backpack bombs in 3 places in metro one in a bus, 52 dead, 700 injured
- 2008 Mumbai, multiple shooting and grenade attacks and hostage takings at a hotel, railway station, community centre, 165 dead, 370 injured, 9 terrorists killed
- 2015 Paris concert hall+4 restaurant, +hostages at concert, shooting plus 3 suicide bombers, home made explosives, 130 dead, 368 injured
- 2016 Brussels airport and a metro station, 3 suicide bombings, home made explosives, 32 dead, 300 injured

What if these improvised explosive devices were RDDs?

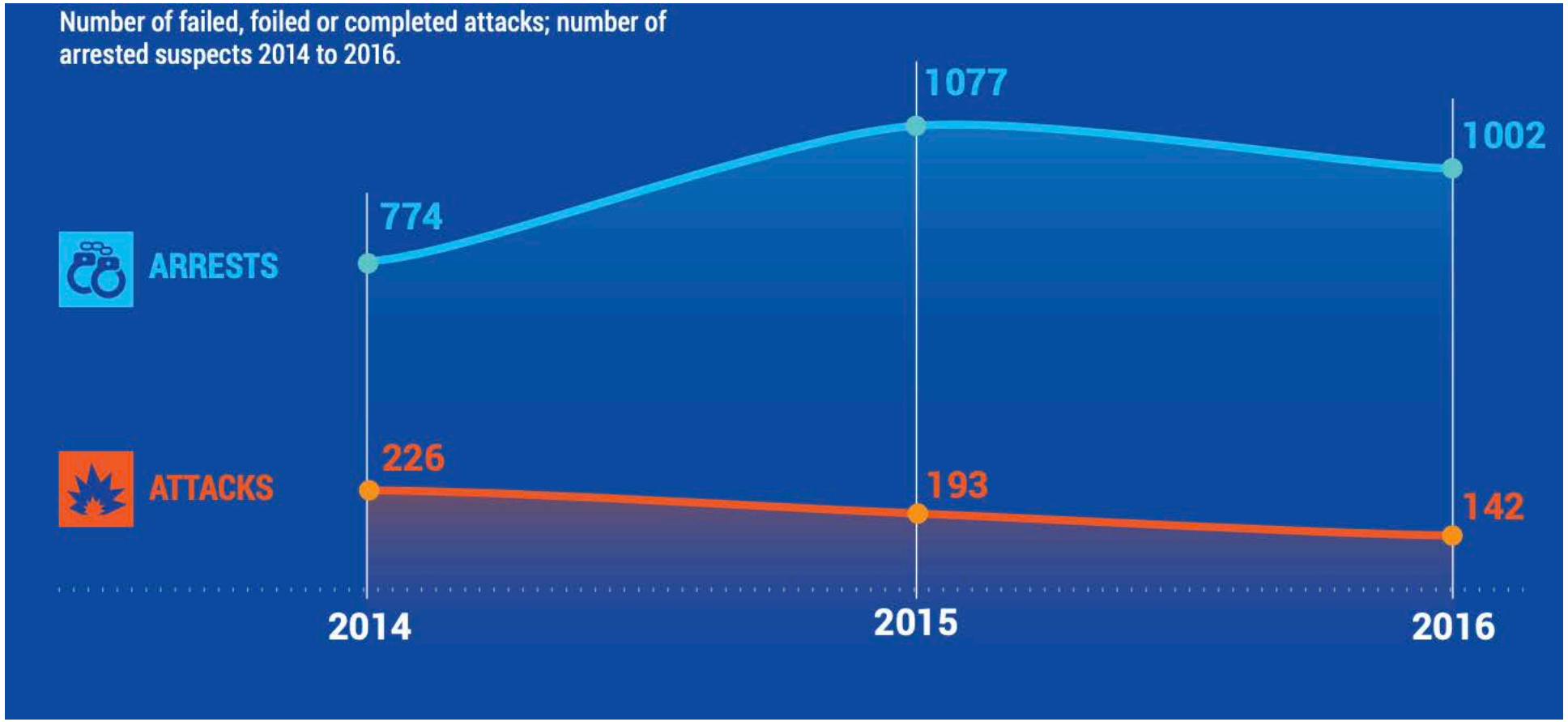
EUROPOL - EUROPEAN UNION TERRORISM SITUATION AND TREND REPORT 2017



142 Total number of attacks

1002 Total number of arrests

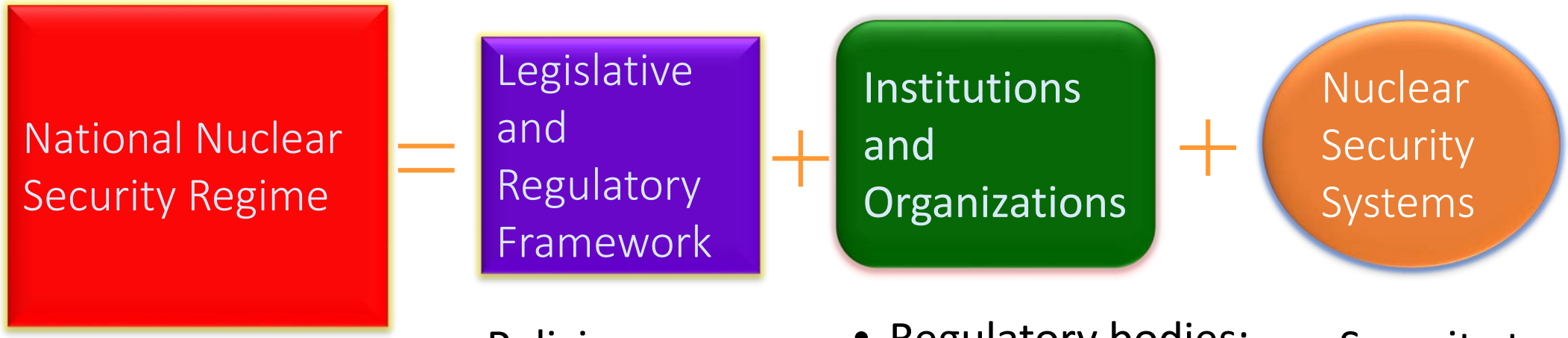
EUROPOL - EUROPEAN UNION TERRORISM SITUATION AND TREND REPORT 2017
40% of attacks were with explosives



Nuclear security regime

To cope with security risk

State's Responsibilities to establish National Nuclear Security Regime



- Policies
- Laws
- Regulations
- Administrative measures
- Guides

- Regulatory bodies:
  - Assess&Licence
  - Inspect&Enforce
  - Sanction
- Licence holders
- Shippers-Carriers

- Security technical systems and components
- Security measures

National Nuclear Security Regime for RS
State Responsibilities in Practice

- Laws and Regulations
- Assign responsibilities
- Make operators responsible
- Evaluate National threat
- Coordination for security, safety and RP, non-proliferation, emergency planning and response
- Protect sensitive information
- Process for trustworthiness
- Inventory/registry and export/ import control
- International Cooperation
- Promote nuclear security culture

NSS 20 Nuclear Security Fundamentals

Essential Elements of an effective and appropriate *nuclear security regime*

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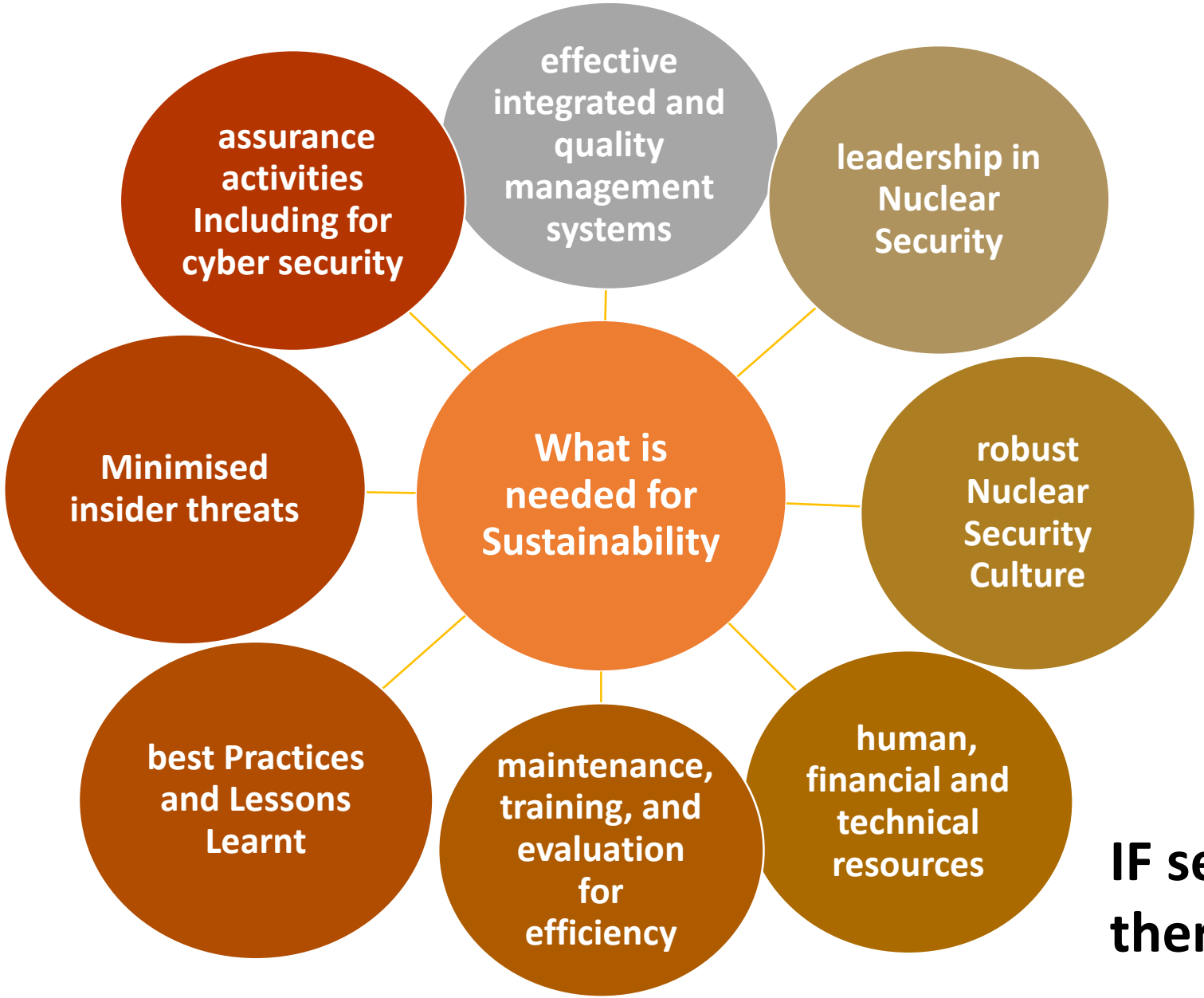
12. Sustaining a *Nuclear Security Regime (includes* Developing, fostering and maintaining a robust nuclear security culture);

Nuclear Security Essential Element 12

Sustaining a Nuclear Security Regime : Components



Each competent authority and authorized person should contribute to the sustainability of the NS regime by:

IF security is not sustained there is no security

Is guidance for establishing a sustainable security regime for radioactive sources available?

The answer should be yes:

Code of Conduct with supplementary guidance on import-export and guidance on disused radioactive sources

NSS-20 on Essential elements of a State Nuclear Security Regime

NSS-14 on security of radioactive material

NSS-15 on security of MORC

NSS-11 on security of radioactive sources (Rev in publishing: NST048 on security of radioactive material in use..)

NSS-9 on security in transport of radioactive material

NSS-30-G on sustaining nuclear security regime

NSS-7 on nuclear security culture

NSS-28-T on self-assessment of nuclear security culture in facilities and activities

NSS-31-G on building capacity for nuclear security

NSS-23-G on security of nuclear information

And several Guides from WINS

So where is the problem?

Lack of political will at highest levels?

Lack of security culture?

Lack of recognition that a credible threat exists?

Lack of awareness of all potential consequences of misused RS?

Lack of awareness of importance of human factor?

Lack of resources –human, financial, technical?

Difficult to maintain security focus over time (complacency)?

We will have two days to investigate the problems of sustainable and resilient security for RS and possible solutions at this workshop.