Keynote Lecture 7a

The Lessons to be Learned from Incidents & Accidents

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Health Protection Agency (HPA)
Learning the Lessons: the basics

• First recognise there are lessons to be learned
  – Accidents, incidents, near misses, exercises etc.
• Capture and disseminate
• Feed into risk assessment - controls – training – review cycle
• Fundamental element of RP programmes
  – International
  – National
  – Use sector
  – organisational
Focus of Presentation

• To what extent are we learning?

• Are there new threats?

• What initiatives are being pursued?

• Common lessons

Focus on the non-nuclear sector
AWAKENING: Goiania 1987
IAEA Radiological Accident Reports
Important Root Causes

Lack of effective

- Regulatory infrastructure
- Critical mass of appropriately trained staff
- Source security measures and culture
  - Orphan Sources
Major International Initiatives

- IAEA’s Model Project
- IAEA’s Conferences on Safety & Security of Sources and National Infrastructures
  - Dijon 1998
  - Buenos Aires 2000
  - Vienna 2003
  - Rabat 2003
- IAEA Action Plan
- EU High Activity Sealed Source (HASS) Directive
IAEA Action Plan on Orphan Sources

• Regulatory infrastructures
• Management of disused sources
• Categorisation of Sources
• Response to abnormal events
  – National strategies: TECDOC 1388
• Information exchange
  – RADEV, Accident Investigation Reports
• Education and training
  – Courses and training packages
• International undertakings (Code of Conduct)
IAEA Action Plan on Orphan Sources

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RATE OF PROGRESS
Terrorism Changes the Range of the Credible

Extendibility and resilience of emergency plans

CBRN threat from terrorists
Sarin Attack on the Tokyo Underground

PA NEWS PHOTO
IMPACT

• Focus of effort and Political commitment
  – To improve our collective ability to prevent and respond to terrorist threats

• Recognition that a range of agents could be used
  – Chemical, Biological, Radiological and Nuclear (CBRN)
Impact on Radiological Protection

- Threat of Improvised Radiological Devices (IRD)
  - “Dirty bombs” and emplacement devices
- Increased focus on source security
  - Vienna Conference
  - Balance between security and utility
- Speeding up of implementation of Code of Conduct and HASS Directive
- Programmes to
  - Bring Orphan sources back under control
  - Deal with disused sources
Preparedness for IRDs: the Goiania Benchmark
UK: Getting Ahead of the Curve

- Need for an integrated Public Health Service
- emerging infectious diseases
- ability to respond
- Impact of “9/11”
- Rising terrorist threat
- CBRN spectre
- Consultation process
The Health Protection Agency

Communicable Disease Control

Surveillance Centre
Reference Laboratories
Regional Laboratories

Chemical Hazards (4)
National poisons
Information Service

Reference Laboratory
Vaccine
Research
Strategic Response

Radiation Hazards

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Keeping ones eye on the ball

• Current focus on CBRN well merited

• Beneficial in dealing with pre-existing issues

HOWEVER

• Conventional accidents and incidents still occur

• Important that we continue to learn the lessons
FEEDBACK MECHANISMS

• Development of Incident Databases
  • Reporting systems
  • Disseminating the lessons

• IRID
• RELIR
• RADEV
• EURAIDE

Nuclear Density Gauge Crushed by Road Roller whilst Operator Temporarily Distracted
Common Root Causes

Lack of, or ineffective

• regulatory bodies
• regulations
• regulatory enforcement

Lack of

• national radiological protection services
• training of workers and management
• commitment of management
• effective radiological protection programme
Effective Control

- Authorisation/licencing
- Purchase/installation
- Normal usage
- Increased risk modalities
  - Challenging events
  - Maintaining knowledge
    - Disused sources
    - Planned authorised disposal

Increased Risk of Loss of Control

- Illegal acquisition
- Long term storage before use
- Poor safety/security
- Maintenance
  - Use of mobile sources
- Lack of emergency preparedness plans
- Loss of key staff
- Bankruptcy
  - No clear future
  - Disposal costs
  - Dismantling of plant
  - Orphan sources
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Juarez, Mexico: 1977 - 1983/4

- Unreported importation of teletherapy source
- No resources to use to use insecure storage
- Key staff leave
- 37 TBq $^{60}\text{Co}$: 6000 metal pellets
- Removed to sell for scrap: source ruptured in transit
- What happened to the pellets
  - abandoned pick-up,
  - roadway
  - most to foundry
Juarez: Dose Rates around Pick-up, mGy h$^{-1}$

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Juarez: Detection and Non-Health Consequences

• Contaminated foundries and metal products
• Lorry sets off Los Alamos alarms
• ‘Rebars’: 814 houses demolished
• Tables and chairs: 2500 items

• Waste
• 16,000 m$^3$ of soil
• 4,500 tonnes of metal

• Economic consequences
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Brachytherapy Sources

50 - 500 MBq usually $^{137}\text{Cs}$: interstitial

$\geq$ 400 GBq $^{192}\text{Ir}$ remote after-loading

Many sources, frequent use
  – losses in refuse, patients, cadavers
  – installed monitors

Complacency and poor management
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Nuclear Density Gauge
Industrial Radiography
Morocco 1984

- 1.1 TBq $^{192}$Ir industrial radiography source
-Disconnected from drive cable and fell out
- Picked up and taken home
- Out of control March - June
- 8 died
- Initially diagnosed as lung haemorrhages: poisoning
Yanango, Peru 1999

• 1.37 TBq $^{192}\text{Ir}$
• industrial radiography
• source

• Similar causes
• Welder took home
• Recovered in 24 hours
• Welder lost leg
• Family also exposed
Cairo, Egypt 2000

• 1.85 TBq $^{192}$Ir industrial radiography source

• Similar causes and scenario

• Picked up by farmer

• Farmer and son died
Radiography Accident, Bolivia 2002
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Tammiku, Estonia 1994

• 0.15 - 7.4 TBq $^{137}$Cs
• Recovered from imported scrap metal in Tallin
• Taken to National Waste Disposal Facility
Tammiku, Estonia 1994

- Poor security
- Stolen for scrap metal value by 3 brothers
- 1 died
- Other 2 brothers and 2 members of family suffered serious deterministic effects

- Prompted search for other sources
- 1.6 TBq $^{137}$Cs in container
- Found near main road
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Lilo Military Training Centre, Georgia 1997

- 1992: Centre transferred from Soviet army to Georgian army
- 1997: 11 Georgian soldiers developed radiation-induced skin lesions and acute radiation syndrome

12 abandoned $^{137}$Cs sources:
in coat pocket; on building site; buried in grounds; in buildings; in refuse
Goiania: What you can do with an Orphan Source
Effective Control

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Planned authorised disposal

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Orphan sources
Istanbul, 1998/99

- Disused teletherapy
- Sources stored for >4 y
- Awaiting return to supplier

Packaged containers ready for shipment

Warehouse where sources were kept

Inappropriate storage facilities
Istanbul, 1998/99

- 2 containers sold as scrap and broken open
- 3.3 TBq $^{60}$Co source unshielded
- Containers dumped
- 10 people with acute radiation syndrome
- 404 people medically examined
- 23.5 TBq $^{60}$Co source unaccounted

Source containers found at scrapyard

Original source container
Monitoring for 2nd source, Istanbul 1999
Thailand, 1999/2000

- 3 teletherapy sources stored at unsecured parking lot
- Unauthorised removal of one unit - dismantled for scrap

15.7 TBq $^{137}$Cs source
10 people highly exposed
3 die
no contamination
Scale of Storage of Disused Sources

USA  ~  500,000 from 2M

EU  ~  30,000

England and Wales  ~  5,000
Legacy issues : Intact RTG
RTG Sources: Georgia
RTG Recovery: Georgia 2002
Effects of Conflict and Political Change

Beirut, Lebanon 1992
Deserted Hospital: Beirut 1992
Conclusions

• Initiatives to capture lessons and learn from them are bearing fruit
  – But still someway to go
• Orphan sources continue to be a problem
  – Significant legacy of orphan sources
• Terrorist threats have changed the range of the credible
  – Being addressed
  – Security: shift to include prevention of malicious intent
• Must keep our eye on the ball for conventional accidents and incidents