



International Atomic Energy Agency

**Uranium production: Best practice of
nuclear security measures**

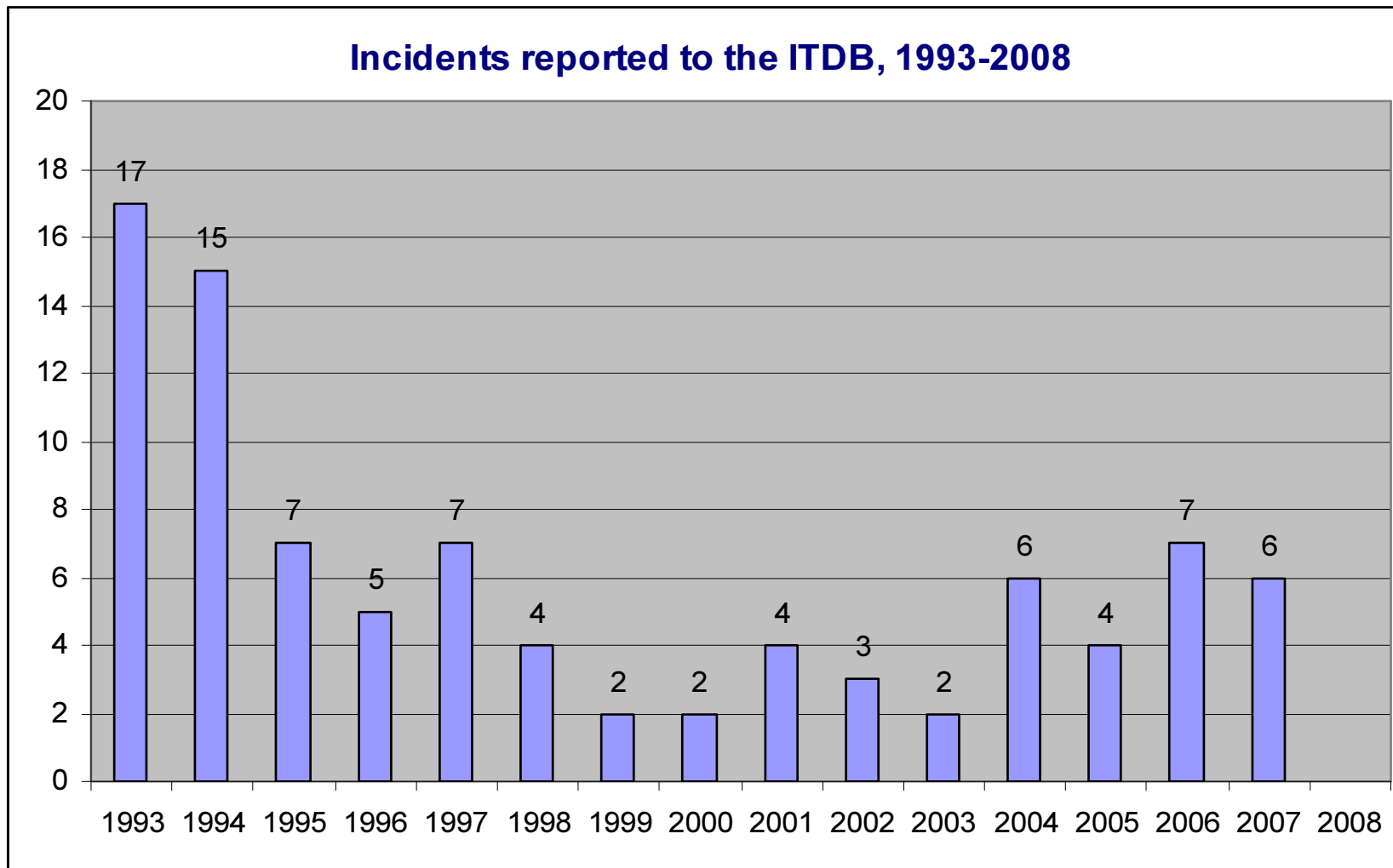
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Natural Uranium

- Natural uranium production (mining and milling) - starting point of nuclear fuel cycle as well as weapon grade nuclear material production
- 10 t NU is one significant quantity (1 SQ)
1 barrel of U_3O_8 ~ 400 kg NU
25 barrels ~ 1 shipping container ~ 10 tU (1 SQ)



Illicit trafficking of natural uranium



Related international instruments

- **Additional Protocol (INFCIRC/540)**
 - States should provide estimated and current annual production of uranium mines and concentration plants
 - Quantities, chemical composition and destination of each export out of country
- **CPPNM amended**
 - Punishable offences shall be made under national law for an act which constitutes the carrying, sending, or moving of nuclear material out of or into State without lawful authority
- **International Convention on the Suppression of Acts of Nuclear Terrorism**
 - Criminalization of unlawful possession of nuclear material
- **Security Council Resolution 1540**
 - Domestic control over nuclear material; effective measures to account for and secure such items in production, use, storage or transport; effective physical protection measures; effective national export and trans-shipment controls of such items
 - Call upon all States to prevent illicit trafficking



Possible concerns

- **Misuse of operating mines and mills**
- **Use of closed down mines and mills**
- **Uranium as by-product**
 - Non-ferrous ore
 - Phosphate ore
 - Monazite – bearing sands, etc
- **Theft from storage, transport**
- **Unauthorised export / import**



Possible concerns

- Misuse of operating mines and mills
 - Understatement of uranium production during long period of time within usual uncertainties of uranium balance calculations and regular theft of small quantities of uranium

Example: ~30 tU (3 SQs) could be stolen from uranium mill within average uncertainties (~ +/- 3%) of measured 1000 tU of annual production.
Motivation: 30 tU could cost about \$3,000,000 (considering \$100 per 1 kg)
 - Understatement of uranium production during a short period of time and theft of significant quantities of uranium during a transition period in regular uranium production (upgrading of production process, equipment replacement, etc.)



Possible concerns

- Theft from facility territory or during transport
- Uranium production as by-product
 - Limited uranium control if no commercial uranium production

Example: Phosphate fertilizers (a plant with average production of 500 kt P₂O₅ could also produce ~160 tU per year)



Examples of best practice: State control

- **Objectives of nuclear security measures**
 - To have good control of uranium production
 - Prevent theft of uranium from facilities and during transport
 - Prevent unauthorised export of uranium
- **State nuclear security measures**
 - Identification of feasible sources of uranium production in the State
 - Evaluation of possible scenarios of illegal acquisition of uranium and involved quantities of uranium
 - Evaluation of possible transport routes for unauthorised export



Examples of best practice: State control

- **State nuclear security measures (cont'd)**
 - **Periodic evaluation of effectiveness and improvement of State measures to prevent illegal uranium production, transport and export:**
 - National legislation and regulations
 - Licensing, authorization of all nuclear related activities
 - Verification of compliance with licence requirements
 - Appropriate criminal or civil penalties for violation
 - MC&A system (State and facility levels)
 - Physical protection measures at facilities and during transport
 - State export control (incl. quantitative verification of legal U shipment)
 - Border control (illicit trafficking)
 - State control of possible uranium production from non-conventional uranium sources (low U concentration or no commercial interest), etc.



Examples of best practice: mines and mills

- **Nuclear security measures at mines and mills**
 - **Evaluation of feasible scenarios of uranium theft and possible quantities of uranium involved in these scenarios**
 - **Development of nuclear security measures preventing feasible scenarios including**
 - **Establishment of effective management of uranium accounting**
 - **Evaluation and upgrading of physical protection system**
 - **Development of nuclear security culture**



Examples of best practice: mines and mills

- **Effective management of uranium accounting**
 - **Clear responsibilities of staff**
 - **Separated functions of accounting staff from facility operation**
 - **Established record system incl. procedures, computerized accounting records, inventory changes, operating records**
 - **Established measurement system incl. procedures, calibration, sampling, quality control of measurement results, analysis of measurement uncertainties**
 - **Introduction of material balance areas (MBAs), key measurement points (KMPs) for effective calculations of uranium balance and uranium flow**



Examples of best practice: mines and mills

- **Effective management of uranium accounting (cont'd)**
 - Accounting system could be automated to extend practical including automated data entry
 - Established procedures for regular physical inventory taking (PIT), material balance evaluation, shipper-receiver differences (SRD), material unaccounted for (MUF), cumulative MUF and cumulative SRD
 - Established accounting procedures for transition periods in regular uranium production
 - Timely resolution of anomalies, etc



Examples of best practice: mines and mills

- **Evaluation and upgrading of physical protection system**
 - **Definition of system objectives and requirements**
 - **Facility characteristics**
 - **Target identification**
 - **Threat assessment and risk management**
 - **Consequences analysis**
 - **Vulnerability assessment**
 - **Performance tests**
 - **Contingency plan**



Examples of best practice: mines and mills

- **Physical protection**
 - Independence of security staff from facility administration
 - Screening of personal, recruitment
 - Established procedures
 - Access control
 - Uranium shipment control
 - Radiation monitoring of vehicles, containers
 - Facility perimeter control
 - Training of security staff



Conclusion

- **Growing value of natural uranium security for prevention of nuclear proliferation by States and non-State actors**
- **Need for sharing the best State and facility practices in prevention of illegal uranium production, transport and export**
- **State responsibility to establish effective nuclear security regime including SSAC and physical protection of nuclear material**





Thank you..

