Examples of Regulations and Regulatory Processes Related to Remediation:

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Information requested
(action from Sept 09)

- Policy on environmental and human health protection, and industrial safety in relation to strategic objectives for final end-state for remediated nuclear legacy sites
- National law on safety requirements, etc., intended to support achievement of national policy.
- Technical and derived standards.
- Guidance documents explaining how to comply with technical and derived standards
- Rules developed by operators for internal operation within their organisations, by which control is exercised.

Examples from:

- Brazil
- France
- Bulgaria
- Belgium
- Canada
- Russia
- UK
- USA

Not comprehensive

Brazilian Basic Standards of CNEN

- Addresses an intervention level of 10 mSv/y and this level must be considered in the optimization of the remediation of NORM legacy sites.
- Up to now, in fact the adopted limit is 1 mSv/y
- Radionuclide concentration reference limits have been derived based on dose assessment by modelling.
- The owner of the site must present the scenarios and parameters used in the model and the regulatory body must approve it.
- The owner must carried out the remediation activities and at the end of the remediation process and the regulatory body must carry out a final radiological survey.

During the remediation process:

- An environmental monitoring program has to be carried out by the owner of the site and its results must comply with the Brazilian requirements (dose limit of 1 mSv/y and constraint of 0.3 mSv/y)
- Similarly, a worker monitoring program must be established, approved by CNEN, performed by the site owner and checked by CNEN. The dose limit for workers is 100 mSv/5y, average 20 mSv/y.
- NB: Radiological health risk has not been considered by Brazilian legislation.

Non-radiological impact

- CNEN is not the only regulatory body involved in legacy site remediation issues. ***Some*** Brazilian States have enforced a law about contaminated soils in industrial areas. According to this law, the owner of the site is responsible for the remediation of the site.
- In addition, a Brazilian standard provides levels for conventional pollutants in soil (value of concentrations).
- In consequence not only the nuclear agency is involved in the process, but also the conventional pollutant State agencies.

French regulatory approach to contaminated-land management

- Requirements prepared by the Ministry of Ecology and Sustainable Development in three ‘annexes’ applies to chemical and radiological pollution
- Annex 1. National Policy on Management of Polluted Soils and Sites
- Annex 2. How to identify contaminated sites and develop a management plan (including use of risk analysis and analysis of residual risks)
- Annex 3. Tools for support of site management (including documents relating to modelling)

Different approaches based on assumptions for possible land use.

See:

www.sites-pollues.developpement-durable.gouv.fr/OutilsMethodologiquesOutils.asp

Bulgarian approach

- Policy for environmental protection is carried out by the Minister of Environment and Waters, and developed in coordination with the Minister of Health, the Minister of Regional Development and Public Works, the Minister of Transport, the Minister of Agriculture and Food and the other interested Ministers and heads of state agencies
- Technical liquidation of the uranium mining facilities in the Republic Bulgaria has been completed (Reference BG-7/09)
- Monitoring for radioactive non-radioactive contamination at the sites is required including waters (surface and underground), soil and air
- Results indicate levels above prescribed limits, e.g.
  - *"The radon and aerosols emitted in the atmosphere as well as the dust loading from the open, non-vegetated portions of the dumps stimulate the mechanical accumulation of radioactive dust in the adjacent agricultural and forest areas and the accumulation of long living and radiotoxic alpha- and beta-active nuclides such as Pb-210, Po-210 and Th-230 in values exceeding the permissible levels."*

Belgium approach (1)

Follows Euratom Directive in which legacy site is considered as an **intervention situation** (more precisely intervention in cases of **lasting exposure**):

- *Where the Agency* has identified a situation leading to lasting exposure resulting from the after-effects of a radiological emergency or a past or old practice or work activity, it shall, if necessary and to the extent of the exposure risk involved, ensure:*
- *(a) that the area concerned is demarcated;*
- *(b) that arrangements for the monitoring of exposure are made;*
- *(c) the coordination of the implementation of any appropriate intervention, in agreement with the concerned authorities, including regulation of the access or use of the grounds and buildings located in the demarcated area and including the use of the contaminated or activated materials*

*Federal Agency for Nuclear Control, the Belgian radiation protection authority.

Belgium approach (2)

Two new Guides from FANC describe how legacy sites (radioactively contaminated land) must be characterised and described.

Description guide requires dose assessment with at least three exposure scenarios must be taken into account:

- a scenario which corresponds to the current use of the site;
- a worst-case scenario; it is the (realistic) scenario which leads to the highest exposure (typically an intrusion scenario such as the construction of dwellings on the site);
- a “likely” scenario which doesn’t necessarily correspond to the current use of the site but corresponds to a likely evolution in the use of the site.

Intervention level criteria

- dose < 0.3 mSv: never intervention (unless the intervention work is trivial: application of the ALARA principle)
- 0.3 < dose < 1 mSv: intervention rarely justified
- 1 < dose < 3 mSv: intervention generally justified
- Dose > 3 mSv: intervention always justified

Canadian examples (1)

Reclaimed Industrial Sites Act imposes requirements on Monitoring and Maintenance of Industrial Sites after Reclamation and prescribes

- conditions to accept a site as closed
- for monitor a closed site
- for continuing site maintenance
- for controlling access to closed sites, and
- arrangements for institutional control

Guidance from Natural Resources Canada under the MEND program on design, construction, and performance monitoring of cover systems for waste rock and tailings, including:

- Theory and background
- Site characterisation
- Performance monitoring, and
- Case studies

Canadian examples (2)

Acceptance criteria and the content of a safety case for a radioactive waste repository are provided in Regulatory Guide G320. this addresses:

- Radiological Protection of Persons
- Protection of Persons from Hazardous Substances
- Radiological Protection of the Environment
- Protection of the Environment from Hazardous Substances

Consideration is given to the very long term

Russian examples

- Sanitary rules SP 2.6.1.1292-2003-Hygienic requirements for limitation of the public exposure due to NORM
- NRPA 2008:7 (English) and 2008:8 (Russian) includes examples of regulatory requirements developed for application to remediation of previous sites for temporary storage of spent fuel and radioactive waste, covering:
  - Development of radio-ecological criteria for monitoring and control of the marine environment during remediation, taking account possible end-state objectives, and
  - Development of the derived criteria for residual radioactivity in case of de-licencing (change in status of the sites for other uses)

UK Regulation of NORM and Waste Management

- Consultations and strategy documents on discharges, waste management decommissioning
- Regulations for control of radioactive material, applying to NORM, but with exemptions relevant to NORM – *currently under review!*
- Radioactive Substances Regulation (RSR) for the Environmental Permitting (England and Wales) Regulations 2010. Very New:
  - Dose limit for regulated activities is 1 mSv/y
  - Dose constraints for discharges
  - 0.5 mSv/y from any permitted site
  - 0.3 mSv/y from any single source
  - No further optimisation below 10 µSv/y, providing you continue to use Best Available Technology
- Assessment of rad contaminated land: CLR13

  www.defra.gov.uk/environment/land/contaminated/pdf/clr13.pdf

UK Management of Radioactively Contaminated Land

SAFEGROUNDS Learning Network is a broad based collaboration of many stakeholders, including regulators, which works to provide advice on:

- Regulatory framework and its interpretation
- Site characterisation
- Assessment of health and other risks
- Remediation methods
- Explanation of alternative site endpoints
- Comparison of management options
- Criteria for de-licencing nuclear sites

The documentation on these and other topics is freely available at www.safegrounds.com/

USA Example 1: Fernald Uranium Site

- ‘Final Record of Decisions for Remedial Actions at operable Unit 2’ : a solid waste landfill, sludge ponds and contaminated land. *US DOE FEMP-OUO2-6, 1995* provides a substantial explanation of:
  - the site history and description
  - regulatory background and requirements
  - threats presented by the site conditions
  - baseline risk and ecological assessments
  - description of remediation options
  - comparative analysis of the options
  - description of selected option and specific requirements for its implementation

USA Example 2: Idaho National Laboratory

"Proposed Plan for Radioactive Waste Management Complex" jointly issued by the US DOE, US EPA and the Idaho State Department of Environmental Quality, sets out:

- Site history and description
- Specific features to be remediated
- Risks associated with the site
- Remediation objectives
- Description and evaluation of the remediation alternatives
- Public involvement in the process

- Substantial further reference list: e.g.: *Remedial Investigation and Baseline Risk Assessment for OU 7-13/14, DOE/ID-11241,* US DOS Idaho Operations Office, 2006.

USA Example 3: Remediation of Buried Transuranic Waste (TRU)

40 CFR 191 Environmental Radiation Standards Requirements

- Containment
- Environmental monitoring and site control
- Individual Protection
- Groundwater Protection

Example application to TRU buried in error, conclusions:

- Limited quantities of TRU can meet the requirements
- Cumulative release is dominated by drilling intrusion release
- Individual dose dominated by inhalation of 222Rn progeny in air, not associated with the TRU, but incidental
- Groundwater pathway unlikely in the next 10,000 years even with the effects of climate change

Shott et al, WM2008 Conference, February 24-28, 2008, Phoenix, AZ

How can these examples be useful?

- Documents available for each case with more details
- Significant references on assessment methods several cases
- Together they illustrate how the assessments need to be constructed in order to be useful, e.g. relevant definitions of exposure and risk for humans and the environment, and how to assess them
- Some of the methods and data can be considered site or nationally specific, but there may be similarities with your situations
- Other aspects, such as monitoring methods, site characterisation techniques, radio-ecological data may be more generally relevant

We might consider a larger compilation and analysis to identify usefully common features to support guidance on assessment methods as already under development in the documents drafted by Richard and Danyl