The IAEA's Programme on Environmental Modelling for RAdiation Safety (EMRAS II)

EMRAS II
Reference Approaches for Human Dose Assessment
Working Group 2
Reference Approaches to Modelling for Management and Remediation at "NORM and Legacy Sites"

M I N U T E S

of the Fifth WG2 Meeting held at IAEA Headquarters, Vienna
24–28 January 2011
(during the Third EMRAS II Technical Meeting)

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*Initials used to refer to participants within minutes and actions as appropriate.

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Welcome and introduction

AL welcomed the group and a short introduction of all participants was given. The action list from the last meeting was mainly fulfilled, although a bit delayed. Suggestions for presentations were accepted and added to the detailed WG2 agenda, a copy of which is given at the end of these Minutes.

Modelling of the Gela site, using RESRAD-OFFSITE

ROB presented the results showing that building a house on the site would exceed dose recommendations for about 1000 years. A recreational scenario could possibly be acceptable. The highest doses are from external radiation and radon.

Former modelling with ReCLAIM and RESRAD-ONSITE presented during the last meeting shows results of a similar magnitude (in the same order of magnitude).

It is clear that the site can be remediated, but not released for unrestricted purposes. It is important to keep the history of the former site use so that in the future no intrusion will happen.

CN and LM: 10 of the 55 hectares will be used for a solar power plant, the rest will be covered by soil and vegetation. The demolition of the production facility will render pipes, material, scales, etc., that they would like to bury on site. This approval is not yet given. Italy does not currently have a repository for NORM waste.

The fish pathway is probably fictitious for the Gela site due to the retainment wall, but ***HN*** reminded participants that Po-210 in sea food is an important pathway if there is leaching to the sea.

Modelling experience with the Gela site

JCM showed some results for Gela, repeated from the last meeting. Screening for human dose from plant ingestion showed >1.9 mSv/y. A more detailed assessment done: recreational use = 144 microSv/y for Ra-226 or 299 microSv/y for Pb-210, Po-210 + Ra-226. Since 0.3 mSv/y is the dose limit, modelling with MICROSHIELD was done to see how thick soil cover (over a plastic liner) was necessary to reduce the doses to an acceptable level → 2 m soil cover sufficient. Peak dose after 1000 years according to RESRAD-OFFSITE due to the complete erosion of the soil cover. Then Rn is not taken into account.

The plastic liner only lasts for 20–30 years, so there will be additional dose from Rn. This will lead to 2 mSv/y from the start, increasing to 3.25 mSv/y after 1000 years (if no plastic cover) according to RESRAD-ONSITE.

KI showed some results for Gela, repeated from the last meeting. *Pathways according to radionuclide in water showed 0.06 mSv/y with ReCLAIM and pathways according to radionuclide in soil showed 0.04 mSv/y with ReCLAIM. Total dose was 0.8 mSv/y with RESRAD 6.5*

AL suggested two actions with Gela:

(1) All who have carried out modelling from Gela to write up what they have done, i.e.: scenario chosen, screening criteria chosen, input parameters chosen, model used and the results. Send description to ***AL***.

(2) Define a standard scenario and standard parameters, so that the group could carry out a model-model intercomparison (start during this meeting – standard scenario and input parameters will be discussed on Thursday).

Point (1) would show the variability due to the human factors in the assessment, whilst point (2) will show the variability between models.

GL asked about the uncertainty in the modelling results. It would be very important to present the uncertainty if the group are to perform model-model intercomparison. It was agreed that the uncertainty must be assessed, and could be a just a range or carried out by using more sophisticated models such as probability distributions.

MS said that regulators need to comply with the ICRP principles of justification, optimisation and individual dose limits. Assessors would need to communicate their results in relation to these three principles if they want the decision makers to easily understand the assessment results.

Overview of the monitoring data around the Bellezane site potentially usable for the modelling

TD made a thorough presentation of the site and all the monitoring data available. The data also include hydrometeorological data for the site. The dataset provided, distributed to the group by email previously, is shown in the following table:

Environmental compartment	Type of data available
Groundwater	Average groundwater level (for each year within the period 1994–2006) Average monthly rainfall (for each year within the period 1996–2006) Average soluble U-238 and soluble Ra-226 concentration (for each year within the period 1994–2006) Ground level at the measurement point
Surface water	Average soluble and non soluble U-238 and soluble and non soluble Ra-226 concentration (for each year within the period 1994–2006)
Air	Average gamma dose rate (for each year within the period 1994–2005) Average Rn-222 progeny PAEC and Rn-220 progeny PAEC (for each year within the period 1994–2005)
Sediments	Average U-238, Ra-226 and Pb-210 concentration (for each year within the period 1994–2006)
Aquatic plants	Aquatic plants species collected (for each year within the period 1994–2005) Average U-238, Ra-226 and Pb-210 concentration in dry and fresh matter (for each year within the period 1994–2005)
Fish	Average U-238, Th-230, Ra-226 and Pb-210 concentration in fresh matter (flesh, skeleton and viscera of Barbel and Chub) (for a few years between 1993 and 2005)
Milk	Average U-238, Ra-226 and Pb-210 concentration (for a few years between 1991 and 1997) *(very few data above the detection limit)*
Soil	Average U-238, Ra-226 and Pb-210 concentration in dry matter (for each year within the period 1993–2005)
Vegetables	Average U-238, Ra-226 and Pb-210 concentration in dry and fresh matter (apple, beet and beet green, carrot and carrot top, leek, cabbage, turnip and turnip green) (for different years between 1993 and 2005)

No data were selected for animals because the few available measurement results in this area (for poultry and rabbit) were all below the detection limit.

Most data are from the period 1994–2006 (remediation finished in 1996). Many values on radionuclides in environmental samples, however, are below the detection limit (a limit which has lowered over time).

ROB: a FEPs analysis would be appropriate since this is a complex site.

Possible scenarios for the Bellezane modelling

SP presented an overview of the site, the activities, the source term, hydrogeology, etc. This description had been distributed to the group by email before the meeting. There are site specific data for climate, but not for K_d and transfer factors to plants and animals.

The two chosen exposure scenarios are:

1. Current situation

Impact for local residents living and working in the nearby village. Occupancy ½ hour/day and ¼ of the diet is locally grown products irrigated in summer with well water. Meat from animals fed from local contaminated pasture/grains, well water. Fish from local contaminated streams.

Questions to be answered:

Total dose? Dose per exposure pathway?

What is the concentration of radionuclides in groundwater and how does it compare to measurements?

2. Intrusion scenario

Due to budget restrictions, IRSN had to stop its monitoring programme in 2040. Consequently, in 2110, everybody has forgotten about the existence of the tailings.

A family builds a house on the site. They also work at home and they have a garden where they grow some vegetables which are irrigated in summer with water from a well pumping directly from the groundwater. These home-grown vegetables amount to a quarter of their vegetable diet.

Total dose? Dose per exposure pathway?

What is the concentration of radionuclides in the home-grown vegetables?

Discussions:

We assume that U-234 is in equilibrium with U-238.

Few data on Po-210 in fish, but we can assume that it will be higher than if calculated from Ra-226 assuming equilibrium.

Data on pH in the tailings are available, ***TD*** will provide them to the group.

The hydrological budget is important in prospective modelling. ***GL*** can help with the hydrological modeling.

Suggestion to first model activity concentrations in the environment from the source term, and then compare these with actual monitoring data. It would then be possible to adjust transfer factors between compartments so that the modelled results are consistent with the monitoring data. The adjusted transfer factors would then be the site specific transfer factors.

It might be wise to do modelling of each source term separately and then add the calculated results. This will simplify the complex system so that existing models can be used.

An agreement on standard scenario and input parameters will be discussed on Thursday.

Modelling Bellezane with ReCLAIM and RESRAD-OFFSITE

KI presented results calculated with ReCLAIM. The model has its own exposure pathways defined, i.e.:

— Ingestion of beef
— Ingestion of milk
— Ingestion of green vegetables
— Ingestion of root vegetation
— External dose buried

Open Pit Mine (OPM)-68:

The model cannot incorporate radionuclides in the 2 m covering layer. The layer has low level waste material.

Modelled dose 0.45 mSv/y from all exposure pathways when using ReCLAIM.

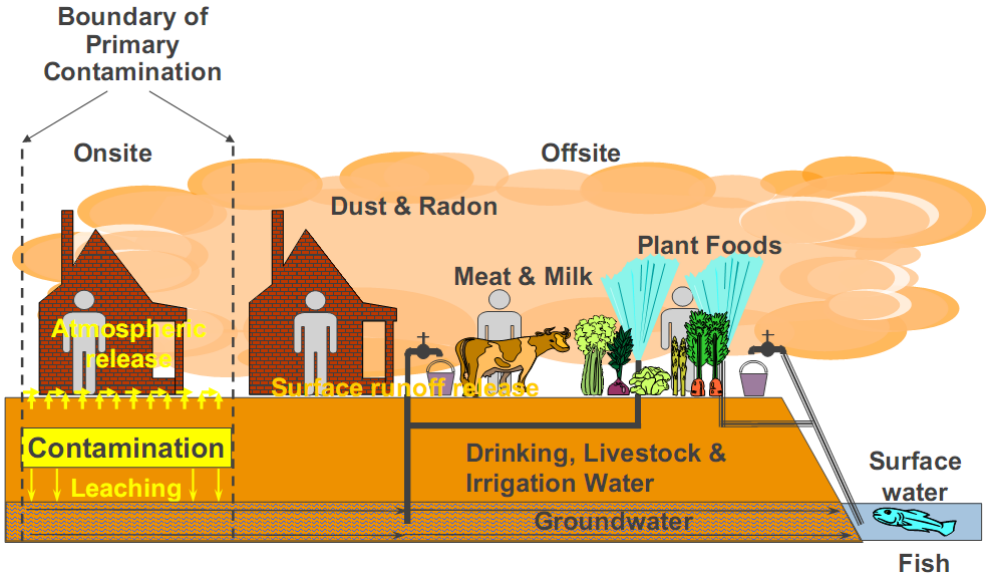
Did the same with RESRAD-OFFSITE for various pathways with and without radon. The modelled results showed very low doses for pathways without radon. ***SK*** explained that this is due to the 2 m cover being defined as clean so transfer to plants will only happen a long time in the future (after ~900 years). It is necessary to define where the receptor is to get reasonable results.

RESRAD-ONSITE gave more reasonable results.

SK came with some good advice on how to best use RESRAD codes for this site.

Added features of the RESRAD-OFFSITE code—the expanded source term models

SK first presented the major features of RESRAD-OFFSITE. Different exposure pathways possible:



Three release scenarios:

(1) To the atmosphere;
(2) To the groundwater;
(3) To the surface water due to soil erosion.

A detailed description of the modelled processes was given.

Extension of RESRAD-OFFSITE capabilities to be usable for modeling waste facilities:

The code is being modified to model transport (by water) within the contaminated zone and to provide 3 additional release options:

— "Solubility rate-controlled" release
— "Solubility equilibrium" release
— "Adsorption-desorption equilibrium" release

SK also explained the NRC's use of probabilistic analysis in DCGL derivation for decommissioning projects.

Probabilistic analysis can be used to define sensitive parameters. Parameter types:

Metabolic, behavioral or physical

→ Parameters that have insignificant influence on the variability of dose – standard values can be used.

→ Parameters that have significant influence on the variability of dose – site specific data necessary, more monitoring or data gathering might be necessary to reduce the variability.

Then confirm that the selected parameters account for all the variability in the dose.

Please consult the presentation by ***SK*** for a more detailed understanding of RESRAD-OFFSITE features. The RESRAD home page can be consulted for more descriptions and for down-loading the various modeling codes: http://web.ead.anl.gov/resrad/home2/

Biota assessment approach to a past uranium mining site in Slovenia

BS gave a presentation detailing the situation in Slovenia. Mine operations during 1985–1990, 600 000 tons of uranium ore processed. Two disposal sites:

— Borst with U-mill tailings deposited, the highest concentrations are for Ra-226 (8.6 Bq/g).
— Jazbec site with waste rock piles, the highest concentrations are for Th-230 (62 Bq/g).

Frequent emission of radionuclides to nearby habitats due to flow of tailings and mine waters to local streams. Monitoring ongoing since the start of the remediation process.

Used the ERICA tool Tier 2 to assess impact on the environment. Aquatic (freshwater) and terrestrial biota assessed. The model showed significantly higher doses to crayfish than to trout, up to 10–12 microGy/h around 1990. The doses have in general declined steadily since the remediation.

Dose rates to plants lower, up to 3.5 microGy/h.

The IAEA dose level of 400 microGy/h not exceeded, the ERICA screening value of 10 microGy/h was slightly exceeded for stone crayfish only.

They also measure U and Ra in air to assess the contributed Rn to air from the mining site. Highest on top of the two waste piles, from above 100 to about 20 Bq/m3 from 2004 to 2008.

Monitoring data in various compartments and for various radionuclides generally show a decline in levels after remediation was performed.

The dose to the population from Rn was assessed to around 0.3 mSv/y. Background values were derived from an uncontaminated control area in the same area.

Presentations of possible venues for the next interim meeting

Belgium – presented by SP

Meeting at FANC offices in Brussels. Three possible sites:

— Olen – former radium extraction facility (radium sources produced 1922–1969), two dumpsites to be remediated + remediation of river banks almost finished.
— Tessenderlo – Ca_2F landfill + phosphate industry (still in activity).
— Ghent – Former Fe-Nb extraction facility, former dumpsite around the facility (facility now extracting molybdenium, expanding on the contaminated site)

Short distance from airport to both FANC offices and the sites.

Bulgaria – presented by KI

Buhovo uranium mining and milling site, with tailing pond. Situated 15 km north-east of Sofia.

900 acres, 8320 tons of waste deposited.

Water treatment plant at Iskra. Waste piles and water contamination at two locations (Seslavtsi + Kremikovts). Flood and village Iana.

All situated in the same region. Monitoring data available for water, sediments, soil, plants. Remediation done, but is it satisfactory?

The Ministry of Health and the waste company will participate in a field visit.

Short distance from airport to sites, cheap city compared to other countries in Europe.

More details are given in the presentation (see the attached Agenda).

China – presented by QW

Inner Mongolia BaoTou Iron and Steel Plant (BTISP). Open pit mine, iron and rare earth metal processing, slag dumps, tailing ponds, waste facility.

Some of the ferrous slag has been used to produce cement and bricks for houses.

Monitoring data required by the regional authority.

Possible scenarios for modelling:

- Stack release source
- Surface area source
- Indoor radon concentrations

150 km away: Bayan Obu mines, tailing ponds, waste dumps.

QW has contacted the authorities and discussed the possibility. The meeting could be held in Baotou or in Beijing.

2 day field visit to Baoutou and Bayan Obu, 2–3 day meeting. Distance from Beijing to Baotou is 500 km, but it is possible to fly to Baotou city from Beijing.

More details are given in the presentation.

USA – presented by MS on behalf of Stuart Walker, EPA

Navajo Abandoned Uranium Mines – on the border between New Mexico and Arizona. The mining was very close to where native Americans are living (in reserves).

Northeast Church Rock Mine – largest underground U mine in the country and highest priority mine for Navajo Nation. Some remediation has been done. Goal to select a cleanup alternative for this site in 2010.

Huge site, lots of monitoring data available. Settlements very close by, people have grazing animals there.

A film was shown from the site: http://www.epa.gov/region9/superfund/navajo-nation/contaminated-structures.html

The closest airport is Albuquerque. The distance to the site is about 2 hours bus drive. Stuart Walker/EPA will act as a host.

More details are given in the presentation.

Argentina – presented by AL on behalf of Daniel Cicerone

The Los Gigantes uranium mining facility was in operation until 1990 and is situated 30 km for the city Villa Carlos Paz, in the Sierra Grande.

Quarry, waste rock sector, tailings and leaching ponds. High mountain plane with a dry season (May–September) and a rainy season (October–April).

Monitoring data available for radionuclides in surface water, subsurface water, Rn-222 in air, equivalent dose rates, surface contamination of materials, tools etc. Data on meteorology, hydrogeology, etc., also available.

More details are given in the presentation.

It was decided that the proposers could send a short summary of site, monitoring data, travel logistics, etc. to all members of the group and there will then be a vote via email in order to choose which site for the venue for the next interim WG2 meeting (see also Action Plan 2011 below).

Environmental remediation project on the nuclear legacy sites in Ukraine – challenge and implementation

GL explained that Ukraine was among the leaders of the U mining and milling industry as part of USSR – 36 mines, 2 large milling and extraction facilities. Now, a renaissance for the industry, but at the same time challenges with remediation of old sites. Serious problems in Dnieprodzerzhinsk town (legacy) (home town of Bresjnev).

State programme for remediation since 2009, but challenges due to little knowledge in project planning and financing of operations. Also lacks in regulatory framework.

Dnieprodzerzhinsk milling facility from 1948 to 1991, 9 tailing dumps on the site today. The town has 280 000 citizens. 42 million tons of U production residues on site, total activity uncertain.

Monitoring only started in 2005. Surface water and discharges, groundwater regime, meteorological regime, Rn-222 emanation rates, aerosols (both radionuclides and heavy metals), soils. Analyses performed by the Ukrainian Hydrometeorological Institute.

Very close to the Dnieper River and run-off from the site goes to Dnieper. The facilities are still in place and need demolition. 2 km of highly contaminated pipelines and tubes were cut, removed from the territory, packed in special containers and temporarily stored in a fenced storage place.

Doses to workers could exceed 20 mSv/y, while the doses to the public are assessed to be lower than 1 mSv/y at the present time. However, accidents/incidents could lead to the movement of tailings and contamination of the river and nearby areas, so remediation is necessary.

GL can provide participants with more detailed descriptions and data if required.

SATURN (Support System for Assessment of Risks to the public and the environment from Uranium mining activities)

RA presented SATURN to the group. ***HMF*** notified the group about an exercise with SATURN to take place in Vienna 27 June – 1 July 2011. He will send information to the group.

Objective to develop a web based support system for risk analysis: www.saturn.facilia.se

Uploading and downloading models, documentation and training material. Adding and extracting data from databases. User forum, useful links.

SATURN components:

— Web site
— A set of methodologies (in Wiki style) – GAMP could go in here?
— An internationally agreed list of FEPs for uranium
— Set of modules (from MATHREM)
— Databases
— Training material

Types of assessments:

— Current situation – risk assessment
— Future situations – safety assessment

Supposed to be a clickable system for expanded information and include a Toolbox of ready-made sub-models (based on Ecolego). Sub-models:

— Exposure assessment
— Surface runoff
— Surface water
— Land
— Agriculture
— Etc.

Probabilistic analysis included (Monte Carlo based).

It is hoped that the system will be ready in the summer and a Training Course will be held in Vienna in November 2011.

The group pointed to the planned follow-up programme to EMRAS II and that SATURN should be a part of that instead of having parallel work.

Discussions on GAMP

Lots of useful comments were provided to ***ROB*** by participants after the Limoges meeting. ***ROB*** went through the changes made since then.

The group should use the term “remedial action” instead of ”remediation”, in line with the IAEA’s terminology.

Discussions took place regarding on future scenarios and time spans for the group’s assessments. There is a need to think about this and perhaps have a link to WG3 on disposal. Climate change issues are difficult to predict and could be very costly. Some guidance needs to be given on when it would be necessary to use forecast predictions on climate. The group are generally assessing in the time frame of hundreds of years, and not tens of thousands of years.

It might also be that standards will change with time and the group cannot foresee how this will develop. The group needs to give the best advice it can at the present time with some reasonable view on future site use scenarios. It might also give some advice on the monitoring time necessary after a decision has been taken or a remedial action has been carried out.

The group must bear in mind that the decisions are not taken by the assessors, but by the decision makers. There will be an optimization process by the decision maker as well, who will then decide what is good enough based on the scientific advice on hazards, the available financial means and societal issues.

All participants were asked to think about this and provide text to ***ROB***.

Generally, participants were content with the GAMP now and think it will be a useful guidance for assessors and good information for regulators as well.

Progress so far and input on the next EMRAS programme (2012 onwards)

MS: Not so much progress in the nuclear legacy issues since participants with this as their main interest have been unable to attend on a regular basis. Furthermore, participants from, e.g. Estonia, were unable to find financial support for their attendance. Nuclear legacy should be more predominant in the next programme period and a stronger link between the international working forum on Regulatory Supervision of Legacy Sites (RSLS) and EMRAS II WG2, where uranium legacy will be natural link between NORM and other Nuclear Legacy sites.

Many nuclear legacy sites were connected to military activities and are still sensitive with regard to obtaining necessary information for modelling. Uranium mining and reprocessing were used for both civilian and military purposes and are the first step in the fuel cycle activities and could be a natural starting point to focus on in the next project period. Furthermore, ***MS*** was elected chair of the RSLS and then had little time to lead the process in WG2 on nuclear legacy.

PMc: It seems the visit at Bellezane was very successful, and also the follow up work on scenario and monitoring data. Satisfied with the GAMP now.

ROB: In the NORM Working Group of EMRAS PHASE I there was very little data and real scenarios available. During the 4 years that EMRAS Phase I ran, more data for real sites became available. The idea of visiting real sites was also started during that period. The participants of EMRAS II WG2 are from a wider range of countries than those of the NORM Working Group of EMRAS Phase I and many new sites and challenges have been presented. There are still very few models available for natural radionuclides decay chains. It could be beneficial to have models that incorporate this better and could be used for more than a couple of hundred years in the future.

Participation from many countries is stimulating to the group and gives many examples of sites and both modelling and regulatory challenges. How to develop training in this aspect? Not covered so far. Financial support for training and attending EMRAS II meetings is necessary for certain countries.

MS: People dealing with NORM and nuclear legacy, respectively, can learn from each other. The GAMP document is applicable for all kinds of sites and is now very good. Models can also be used for all sites. Therefore both types should be kept in one group, especially since U mining and reprocessing is part of both.

TD: More time is needed for this work, both a longer programme and more time in his own institution for carrying out the work.

LM: Thought that this type of assessment would be more straight forward. The variability in assessment results are also much larger, even for a well defined site, than was thought. U mining and milling sites, e.g., can be very complex and even advanced codes like RESRAD cannot fully encompass this (cannot have several sources on one site).

VK: The group needs to produce modelling data for its final report. The group has modellers, regulators, advisors… which is good, but it si perhaps a bit weak in modellers. Even if the group will not be able to show so much in the way of results, it needs to have a good collection of all the scenarios that could be used during the next period, i.e. during the follow-up programme to EMRAS II.

AL: Reminded participants that the group will carry out Gela model-model intercomparison and also for Bellezane. For the other scenarios presented, the group will ask people to prepare a description for the final report, so that it could be used for the future.

VK: No financing for the follow-up programme to EMRAS II itself, but might obtain support from a given country through the national liaison officer if the participation can be linked to an ongoing Technical Cooperation Project.

"IAEA's International Working Forum for Regulatory Supervision of Legacy Sites (RSLS)"

MS presented the objectives of the new forum which was established last year. The group seek to share experience in handling legacy sites, develop new regulations where necessary, support development of guidance and recommendations regarding the application of optimization, supporting the development of environmental impact assessment methods and more.

During the first meeting, the link between legacy management and the national strategy for radioactive waste management was recognized. There is a need to address legacies even while new nuclear activities are being promoted (solve the issues of the past and make sure that there will not be new legacies in the future). There needs to be cooperation between authorities for health, safety and environment. Some sites might need special regulatory arrangements because the site falls outside the standard regulations.

U legacy sites have large amounts of low-level waste while nuclear technology legacy sites have small volumes of high activity waste and large volumes of low-level waste.

There needs to be a balance between physical, chemical and radiological risks, and balancing security and safety issues. There is often a lack of trained experts to deal with the situation, e.g. monitoring.

The forum decided on three working groups:

— Enhancing the regulatory infrastructure (Leader: FMBA, Russian Federation)
— Professional development for regulators (Leader: DSEWPC, Australia)
— Safety assessment methods and Environmental impact assessment (Leader: NRC, USA)

These 3 groups could easily link to EMRAS II WG2 results. Both GAMP and different models could be tested at different nuclear legacy sites.

The activities in the last group (led by NRC and EPA, USA) are more directly connected to EMRAS II WG2 and are to:

— develop a questionnaire for collection of the information on existing requirements/guidance from various countries on what has to be in environmental assessments, safety assessments, and optimization procedures;

— compare and contrast results from the completed questionnaire;
— develop criteria for information from operator;
— develop criteria for information on safety, environmental and optimization assessments by regulator; and
— specify review methodology (i.e., roles and responsibilities of various parties in the assessment and optimization processes).

The outputs from EMRAS II nWG2 will be of value to RSLS. The forum is open for all regulators, who would like to discuss supervision of nuclear legacy issues at the international level, so participants of EMRAS II WG2 are welcome to inform regulators in their respective countries and encourage them to participate.

The responsible IAEA Scientific Secretary for RSLS is Russel Edge (R.Edge@iaea.org) while ***MS*** (malgorzata.sneve@nrpa.no) is the chair of the forum.

GSL asked if the forum was focussing on specific countries or if it would discuss the problem in a more generic way? ***MS*** explained that the forum is not pointing to a specific country or specific sites, it is supposed to be a forum for sharing experience and assist in development of regulations and guidelines that could be used by all countries in the end.

"Links between Regulatory Objectives, Assessment Methods and Scientific Support"

MS gave a presentation on how RSLS and EMRAS II WG2 could interact (please see the Word document distributed to all by ***MS*** before the meeting). Will our assessments give results that answer the regulators questions related to justification, optimisation and individual dose limits?

Justification:

— Do our radiological assessments present the harm avoided (or not) by alternative remediation options?

ROB: If we include the "do nothing" option in addition to remedial actions, then it is covered.

PMc: Are we talking about the averted doses concept? ***MS***: Not only, because there could be other factors like geological / seismic activity that poses an extra harm.

Optimisation:

— Do our assessments present the likelihood of exposure, the number exposed and the individual dose distribution in the exposed population?

Participants are generally confident that our models address this more or less.

Individual dose limits and constraints:

— Is legacy management a planned or existing exposure situation? Does that affect how we assess the dose?

Legacy sites are existing exposure situations according to ICRP 103, but there was discussion about whether the remedial actions will be classified as planned or existing exposure situations. For planned situations, there are dose ***limits*** while for existing situations there are only ***reference levels***.

Both GAMP, the new IAEA guides on waste management and national waste strategies will be important parts of this. When planning remedial actions, one should take into account the possible change of the use of the site over time (hundreds of years).

From the regulatory point of view, assessments should be able to:

— Demonstrate that a proposed remediation plan will do more good than harm;
— Address a wide range of exposure situations, addressing initial assessment of a newly identified legacy, operation period and the period after work is complete;

— Address radiological impacts for the more likely exposure situations, but also to consider accidents during operations, and unlikely, but potentially significant disturbance of a site after work is complete; and
— Provide results for radiological impacts which can be used coherently alongside other safety and environmental assessments relevant to NORM and nuclear legacy site management.

It seems that WG2's work is very much in line with this.

"Role of guideline levels"

BV gave a short overview about the limits and levels used in radioprotection. A guideline level is a specified quantity above which appropriate actions should be considered. There are isotope specific guidance levels available for liquids, namely for drinking water recommended by WHO (2008). According to ICRP 103 there are lower levels to act for Rn-222 concentration in dwellings and workplaces. The goal of the safe-value (S-value) concept developed is to establish guideline levels for safe concentrations of radionuclides in solid material not excluding any kind of possible pathways. The reference dose level is 0.1 mSv/y corresponding to so called trivial risk according to the recommendation of ICRP. The method of the derivation is overly conservative, consequently the values are very low. The list of radionuclides includes the important fission products, possible fissionable materials, artificial radionuclides, as well as natural isotopes. If the S-values are exceeded, then ***BV*** suggests that regulators should:

— make a risk assessment (either a very simple calculation of dose with a real circumstances or conduct further investigation);
— run a sufficient model;
— designate or recall a decision-support system according to the need of the actual problem;
— analyze cost and benefit; and
— make a decision about the any kind of action taken or not.

Lots of discussion took place within the group as to what this actually means. The S-values are very low, so to initiate a full investigation if the value is exceeded seems excessive. ***BV*** believes that giving the lower concentration associated with trivial risk is important for the public accepting the use of radionuclides and peaceful use of nuclear energy.

Plans for a final report

Suggestion of report content presented by ***ROB***. Discussions within the group. A few points:

— Divide between nuclear legacy sites, NORM sites and U mining and milling sites, since the latter could be defined as both according to national legislation.
— Should use chapter heading "Sites" for site description and characterisation text, while chapter heading "Scenarios" would be restricted to the two (three?) scenarios we will model together, i.e., Gela, Bellezane (next field visit site?) which includes the site description, defined scenario and input parameters.
— There will be a standard format for describing the sites. An example will be distributed to all in due course.
— A section on the model-model intercomparison is needed.
— Examples on how to apply the GAMP to real sites should be included in the Appendix. Suggestion to use defined scenarios also from NORM in EMRAS (Phase I) and apply GAMP to them. Also do some simple modelling for remedial actions in order to illustrate this part of GAMP.

Action Plan 2011

— Interim meeting proposals must be distributed to all by 21 February 2011 (***AL***, with input from Daniel Cicerone, Stuart Walker, ***SP***, ***KI*** and ***QW***)

— -mail voting for venue to be done first week of March (by 4 March 2011) (all)

— Any comments on the GAMP must be sent by 28 February 2011 to ***ROB*** (all)

— Final minutes produced by ***AL*** by 28 February 2011

— Data for Gela sent to all by 15 February 2011 (***ROB*** with others)

— Data for Bellezane sent to all by 15 March 2011 (***TD*** with others)

— Modelling results for Gela sent to ***ROB*** by 30 April 2011 (all)

— Modelling results for Bellezane sent to ***TD*** by 31 May 2011 (all)

— Draft Hamilton paper to all by 15 March 2011 (***AL***)

— Comments on paper to ***AL*** by 1 April 2011(all)

— Input to continuation of WG2 and the follow-up programme to EMRAS II, ideas to ***AL*** by 15 April 2011 (all)

— Final report:

- Final GAMP description 31 March 2011 (***ROB***)
- Description of sites by 1 May 2011 to ***SP*** (all)
- Description of models by 15 April 2011 to ***PMc*** (all)
- Examples of the use of GAMP to real sites by 1 September 2011 to ***JCM*** (all)
- Model-model intercomparison including scenario description by 1 September 2011 (***TD*** and ***ROB***)
- All chapter leaders to send draft to ***AL*** by 1 September 2011
- Full draft report to all before interim meeting (***AL***)
- Comments by 30 October 2011 (all)
- New draft by 1 December 2011 (***AL***)
- Comments by 31 December 2011 (all)
- Final version by 15 January 2011 (AL)

The question of writing two articles on the model-model intercomparisons of Gela and Bellezane was left for the interim meeting since the group already has a lot of work to do this spring.

WG2 MEETING AGENDA		
Monday, 24 January 2011		
09:30–13:00	Opening Plenary Session	
13:00–14:00	***LUNCH BREAK***	
14:00–14:30	Welcome and introduction	Astrid Liland, WGL, NRPA (Norway)
14:30–15:00	Modelling of the ♣Gela site, using RESRAD-OFFSITE	Richard O'Brien, ARPANSA (Australia)
15:00–15:30	Modelling experience with the Gela site	All participants
15:30–16:00	***COFFEE BREAK***	
16:00–17:00	Preliminary Test of ♣GAMP on Gela Site	Juan Carlos Mora, CIEMAT (Spain)
	Area of former uranium milling plant "♣Zvezda" Eleshniva – before and now	Kremena Ivanova, NCRRP (Bulgaria)
	Discussions on Gela	All participants
Tuesday, 25 January 2011		
09:00–09:30	Overview of the ♣monitoring data around the Bellezane site potentially usable for modelling	Thierry Doursout, IRSN (France)
09:30–10:00	♣Possible scenarios for the Bellezane modelling	Stéphane Pepin, FANC (Belgium)
10:00–10:30	Scenario discussions	All particiapnts
10:30–11:00	***COFFEE BREAK***	
11:00–11:30	Modelling experience with ♣Bellezane Site	Kremena Ivanova
11:40–13:00	Added features of the ♣RESRAD-OFFSITE code—the expanded source term models	Sunita Kamboj, ANL (USA)
13:00–14:30	***LUNCH BREAK***	
14:30–15:10	♣Biota assessment approach to a past uranium mining site in Slovenia	Borut Smodis, JSI (Slovenia)
15:10–15:30	Presentations of ♣possible venues for the next interim meeting – Belgium	Stéphane Pepin
15:30–16:00	***COFFEE BREAK***	
16:00–16:15I	Presentations of ♣possible venues (continued): Bulgaria – Sofia, Buhovo uranium mining and milling site	Kremena Ivanova
16:15–16:45	Overview of Legacy/NORM sites in ♣Bayan Obo & Baotou, Inner Mongolia, China	Qifan Wu, TU (China)
16:45–17:00	♣Navajo Abandoned Uranium Mines, USA	Stuart Walker, EPA (USA)♦
17:00–17:15	♣Uranium Mining Activities in Los Gigantes, Argentina: Possible Case Study Site	Daniel Cicerone (Argentina)♠
Wednesday, 26 January 2011		
09:00–10:30	Plenary Session presentations	
10:30–11:00	***COFFEE BREAK***	
11:30–12:15	♣Environmental remediation project on the nuclear legacy sites in Ukraine	Gennady Laptyev, (Ukraine)
12:00–13:00	♣SATURN	Rodolfo Avila, Facilia (Sweden)
13:00–14:30	***LUNCH BREAK***	
14:30–15:30	GAMP – final round of commenting and improving	All participants
15:30–16:00	***COFFEE BREAK***	
16:00–16:45	Progress so far and input on the next EMRAS programme (2012 onwards)	All participants
Thursday, 27 January 2011		
09:00–10:00	IAEA's International Working Forum for Regulatory Supervision of Legacy Sites (♣RSLS)	Malgorzata Sneve, NRPA (Norway)
09:30–10:45	♣Links between Regulatory Objectives, Assessment Methods and Scientific Support	
10:45–11:05	***COFFEE BREAK***	
11:00–11:30	♣Role of guideline levels	Beata Varga, CAO (Hungary)
10:30–12:30	♣Plans for a final report	Introduction by Richard O'Brien All participants
12:30–13:30	***LUNCH BREAK***	
13:30–14:00	Gela standard scenario and parameters	All participants
14:30–15:45	Bellezane scenario and parameters discussion	All participants
15:45–16:15	***COFFEE BREAK***	
16:15–17:00	Action plan for 2011	All participants
17:00–17:15	Working group progress report for Friday, any other business, closure of meeting	All participants
Friday, 28 January 2011		
09:00–13:00	Closing Plenary Session	

♣ Indicates the name of the presentation given on the WG7 web page (http://www-ns.iaea.org/projects/emras/emras2/working-groups/working-group-seven.asp?s=8&l=63).

♦ Participant unable to attend, presentation was given by Malgorzata Sneve.

♠ Participant unable to attend, presentation was given by Astrid Liland.