BIOPROTA: Seventh Workshop
Ottawa, 11-12 May 2005
Notes from Workshop

Wednesday 11 May

1) Introduction: Aims and Objectives of the Workshop

Paul Degnan reminded participants that BIOPROTA continues to act as a forum within the framework set out in a memorandum of understanding agreed among sponsoring organisations which make up the Steering Committee (SC). A list of SC organisations is included as Annex A. Participants introduced themselves and indicated their special interests and responsibilities. Participant names, organisations and email addresses are given below in Annex B.

The purpose of the Workshop was to discuss the output of the first two years of BIOPROTA and consider new work in future based on renewed priorities arising from recent developments. Day One discussed the current Themes and provided an opportunity for the presentation of national challenges faced by those attending the meeting. Day Two discussed the ideas put forward by various participants both prior to and during the workshop on future work programmes within BIOPROTA.

2) Review of Progress on Finalising the Output from 2003/2004

Graham Smith explained the background to and status of the Working Material reports. Draft documents have been reviewed by Ales Laciok plus one or more specific reviewers, independent from the main contributors. These reports are intended to be used as working material to inform about data, models and methods that support biosphere assessments. The reports provide advice and information most effectively as a set. However, it is intended to produce and publish each report as stand-alone document, see below. Each report will be prepared and produced by one of the sponsoring organisations and published in hard copy. The same reports, as formatted by the sponsoring organisation, will be made available as pdfs on the BIOPROTA website along with a brief description of each of the BIOPROTA Steering organisations. All the final versions are still subject to a final review by the SC.

Mike Thorne suggested that guidance on the referencing of reports should be provided on website. A draft citation has been written in discussion between the Technical Secretariat (TS) and Paul Degnan, the SC Chairman. This will be forwarded shortly to all SC members for comment/agreement.

2.1 Theme 1: Specialised DataBase (SDB) (Task Group Leader (TGL): Enviros)

Karen Smith reviewed the objectives and status of the task. The database tool and structure exists, but is thinly populated with data. Consultants are due to be appointed to provide the specific data and justification for application in particular situations. NB, ICRU Report 65[1] on definitions of radio-ecology terms is suggested for use by all BIOPROTA participants to ensure the consistent use of standard radio-ecological terms.

Additional complementary international activities were discussed that may provide useful input to the future task on population of the specialised database.

- Mike Thorne mentioned that a new resource, the “radflux database”, which was initially instigated some years ago by the European Commission (EC) and the International Union of Radioecologists (IUR), and is currently under review with the UK FSA (Food Standards Agency). This should be available to BIOPROTA by the end of July 2005. It has subsequently been agreed that Mike Thorne will review this database for the FSA by the end of July, which will ensure that it can be made available to BIOPROTA participants on that timescale.

[1] International Commission on Radiation Units and Measurements (2001). ICRU Report 65: Quantities, Units and Terms in Radioecology. Journal of the ICRU, volume 1(2).

- The IAEA's EMRAS programme includes updating of Tecdoc 364, due as draft in 2006. This complements the SDB work, since, instead of focussing on a few key radionuclides and processes, it covers the ground for all radionuclides and potentially relevant media. EMRAS also has a working group on C-14, but is focussing on short term assessment issues rather than the longer term interest of BIOPROTA.
- The IUR Waste task Force is due to produce a report on interaction matrices describing the behaviour of key radionuclides in terrestrial and aquatic systems. IUR also has a task group on radioecology data for food chains in Asia (uptake to rice) which may also have relevant data for some participants (www.iur-uir.org).

2.2 Theme 2 Task 1: Irrigation Modelling (TGL: Ulla Bergstrom, Studsvik)

One of the principal findings from the Irrigation task was that similar results were obtained from all of the varied models that were included in the assessment, suggesting that the different conceptual models did not lead to significantly different results provided that each model is applied consistently.

The report has been completed with the addition of conclusions and a common forward by the SC. Ulla Bergstrom is taking a final look at the report before end May, prior to circulation to the SC for a decision on publication. Mike Thorne suggested that the report material might be suitable for journal publication.

2.3 Theme 2 Task 2: Inhalation Modelling (TGL: Maryla Wasiolek, YMP)

Graham Smith explained why models that are not used in the assessment are included in the model description section, i.e., to provide interested parties information on alternative models. Enhancement factors have been included in assessments by a number of organisations to account for higher activity levels associated with smaller particles suspended in air compared with concentrations in bulk soil. Distribution of activity on different size particles and respirability of different size fractions were not considered in detail in the models, but are important factors which could affect estimates of dose.

The report has been reviewed and comments incorporated and checked by the TGL. Publication of the report is to be discussed within the SC.

Graham Smith described Safegrounds, a UK contaminated land collaboration project which aims to provide guidance on management of radioactively contaminated sites, some of which contain long-lived alpha activity. The assessment issues are similar and participants may more generally be interested in the contents of the website, (www.safegrounds.com).

2.4 Theme 2 Task 3: C-14 Modelling (TGL: Steve Sheppard, ECOMatters)

The report has been reviewed by Ales Laciok and Michael Balanov. We are awaiting specific comments from Mikhail (general positive comments have been received). Revisions to the report are to be made and, once completed, the report is to be supplied to Steve Sheppard to ensure he is happy with comments and amendments. The report is then to go to the SC for final review and decision on publication.

2.5 Theme 2 Task 4: Model Intercomparison for Accumulation in Soil (TGL: Achim Albrecht, ANDRA)

The model comparison task investigated the long-term accumulation of activity in soils following two scenarios – repeated flooding with contaminated river water and repeated irrigation with contaminated ground water. The report has been reviewed and comments incorporated and provided to ANDRA. Mike Thorne suggested that a paper on the report may be suitable for journal publication.

Mike Thorne made clear that the Theme 2 reports describe the models as they are, not how they were justified. They do not identify processes that may not be represented.

Graham Smith suggested that contamination from contaminated water rising from below could be the subject for consideration in the forthcoming work programme. He also suggested a possible future task to identify the dominant exposure pathways for each of the important radionuclides: direct foodchain contamination from irrigation, or foodchain contamination, inhalation or external irradiation after build-up in soil. Further discussion is provided under future tasks.

2.6 Theme 2 Task 5: Biotic Natural Analogues (TGL: Paul Degnan, Nirex)

Analogues can be used to support assessments, hence the inclusion of the biotic analogues task in the BIOPROTA activities. Detailed analogue information is not provided in the report, but guidance on the potential for use of analogue information and how to research information for specific assessments is provided.

Review comments have been received. Review comments are to be incorporated by 20/05 and the report subsequently distributed to all SC members. SC members are to respond with recommendation as to whether or not to publish.

2.7 Theme 2 Task 7: Environmental Change and the Geosphere-Biosphere Interface Zone (GBIZ) (TGL: Enviros/CIEMAT)

This Task report aims to provide the link between the geosphere and biosphere components of performance assessments. Examples of previous work suggest that dilution in the GBIZ has not been addressed directly, potentially resulting in over-estimation of doses, but also that some near-surface accumulation processes followed by environmental change could result in higher release rates of radionuclides to the biosphere, and hence higher dose estimates.

The report has been reviewed and is considered suitable as a stand-alone document to show the present state of play. Almudena Aguero at CIEMAT reviewed the updated version and kindly provided final comments from the contributors' perspective, bearing in mind that CIEMAT were originally the TGL for this task. All SC members are to receive a copy on which to comment, and confirm publication decision.

2.8 Theme 3 Task 1 & 2: Site Characterisation, and Research Protocols (TGL: Elisabeth Leclerc-Cessac, ANDRA and Mike Thorne)

Elisabeth Leclerc described progress on Task 1 (site characterisation). No further additional work has been conducted by Mike Thorne on Task 2 (protocols). There is a lot of information that could be included in the report, but this tends to be site specific. The document is due to be finalised by the end of 2005.

Paul Degnan suggested that new and current tasks be integrated to provide support to Elisabeth whilst enabling future tasks to move forward. Paul will contact Elisabeth to discuss how best to support and therefore move forward.

2.9 Summary of actions on the 2003/2004 Output

The TS is to supply SC members with all version 2 reports for comment by the end of May. Comments from SC members are to be returned by 17th June. Comments will be incorporated by the TS and reports forwarded to the publishing organisation by the end of June for incorporation into their standard publication format. Publishing organisations are required to supply the TechSec with a pdf of the formatted report for publication on the BIOPROTA web-site by mid July. Additional report-specific actions are detailed below.

REPORT	ACTIONS
Specialised Database	Appointment of consultants to provide input data
Irrigation Modelling	Ulla Bergstrom to review alterations made to report and indicate by 31st May if happy to go ahead with publication.
Inhalation Modelling	SC to receive reviewed report and decide whether to publish in peer reviewed journal.
Carbon-14	Review comments to be incorporated following response from M. Balanov. Once completed, Steve Sheppard to ensure satisfied with alterations made prior to publication.
Intercomparison Exercise	SC to receive reviewed report and decide whether to prepare peer-reviewed journal publication.

Biotic Analogues	Review comments to be incorporated by 31st May to Paul Degnan and SC to be provided with copy for consideration as to whether suitable for publication.
GBIZ	-
Site Characterisation and Research Protocols	Completion of report is to be considered under additional tasks for 2005-06.

3. National Challenges

Presentations were given by a national representative of each country involved in BIOPROTA.

3.1 Canada

Steve Sheppard presented. The Canadian biosphere programme is particularly interested in landscape-based models. The assessment of parameter values is complete so the current focus is on model development. Models under development take into account element-specific parameters including de-gassing from water and soil (rate constant), soil-to-plant transfer, sorption onto soil, water-to-sediment transfer, water-to-aquatic life transfer, feed-to-meat/milk transfer and stable element concentrations. Reports are available on a number of elements including Iodine, Chlorine, Neptunium, Uranium and Radium/Radon. Interesting results were presented to indicate that the soil transport of elements may not follow leaching processes as expected from the Kd. A large amount of data (around 240 entries) is available in a database on uranium uptake factors from soils.

3.2 France

Elisabeth Leclerc presented. ANDRA are due to release a report on HLW disposal shortly (within 2005). The radionuclides of primary interest to the biosphere programme are I-129, Cl-36, Se-79, Tc-99, Cs-135 and Nb-94. Many research studies currently underway on the main radionuclides of interest, for example a recent study looking at the role of micro-organisms has been published (Ed. Lavoisier book). ANDRA are also looking at Se in collaboration with Nirex. Data on the various radionuclides are available in scientific papers that can be accessed through the ANDRA website, www.andra.fr. In addition, a literature review has been conducted that can be made available to BIOPROTA and an analogues report (written by ANDRA and Enviros) that was produced for EMRAS is also available.

In addition to radionuclides, there has been consideration given to the need to include impact assessment on non-radioactive contaminants, for example, B, Sb, Ni, Se & U. Work to date has focused on local (site-specific) data.

The proposed Iodine in bogs project (see below) is of interest for future. The proposal for this work has been changed to include *in situ* experiments. Bibliographic reviews on specific chemicals and radionuclides is also of interest – ANDRA would be interested in sharing costs with other BIOPROTA participants.

3.4 United Kingdom

Mike Thorne presented. CoRWM (Committee on Radioactive Waste Management) is currently funding technical reviews on the various radioactive waste management options. Recommendations on radioactive waste management options are due in 2006. No new climate modelling effort has been made since BIOCLIM reported in late 2003.

Nirex have been developing assessment models and have funded research on soil-plant transfers of key radionuclides (Tc-99, I-129 and more latterly in collaboration with ANDRA on Se-79). This work will be presented in a book that is currently being written by Imperial College in association with Nirex. The book is due to be published towards the end of 2005. Additional work by Mike Thorne & Associates has focused on the transfer of H-3 and C-14 in gaseous form in transport, operational and post-closure assessment contexts. This work is presented in Quintessa Report QRS-1248A-1 that is available from Nirex.

Additionally, the FSA has recently taken delivery of a new soil-plant-animal model (PRISM 2.0). This was developed by Quintessa and Mike Thorne and Associates Limited. Although primarily directed to the assessment of routine and accidental atmospheric releases, it is readily adapted to groundwater

releases and is likely to be of some interest to BIOPROTA participants. Details of the model and underlying databases have been made available to EMRAS.

3.5 Japan

Shigeru Okuyama presented. The Japanese disposal site is due to be developed by around 2025 and operational by 2035. Research and development areas focus on both geo- and bio-databases, radionuclide transport, and processes (perturbations) all of which will be site specific. They are currently in a 'pre-literary survey', which is site generic, but takes account of possible design and site type combinations. Further work will begin once a candidate site(s) has been identified.

3.6 Finland

Ari Ikonen presented. A vegetation inventory within forest plots has been undertaken and sampling is underway. The focus of the programme is on terrestrial monitoring since marine surveys are routinely conducted by a nuclear plant. The biosphere assessment, which is focused on the current ecosystem, but taking account of land up-lift, is due to be completed by 2012, with interim and final reports being produced at intervals up until then. A landscape model is under development and could be reported by the end of 2006. This is looking at shoreline forecasting with respect to sea-level change. A report on doses to non-human biota is due to be completed by the end of 2006. The biosphere process reports will inform model development. Challenges being faced include identification/prediction of future human actions such as location of wells and agricultural practises, GBIZ, non-human biota assessment methods and ecosystem specific dose conversion factors.

3.7 Sweden

Tobias Lindborg and Ulrik Kautsky presented. Site characterisation reports are available from SKB. Sweden has decided on a deep repository for disposal of spent fuel and other radioactive wastes for which two potential sites have been identified. SKB are currently in the middle of the site characterisation phase, which is due to be finalised by 2008. Safety assessments are being conducted throughout the process. Site dependent models for both geology and ecosystems have been developed.

3.8 Switzerland

Frits van Dorp presented. The report on the safety assessment of a HLW-, ILW- and Spent Fuel-repository in Opalinus clay published in 2002 is currently being reviewed by the authorities. The review will be published soon. Decisions on biosphere modelling/assessments will be taken when the review by the authorities is available. No surface or near surface storage is envisaged in Switzerland, it will be deep geological disposal for all the radioactive wastes. No biosphere-specific criteria on site selection have been provided.

Improvements are particularly envisaged in modelling landscape evolution processes (e.g. sedimentation/erosion/uplift). The landscape in northern Switzerland is determined largely by abrupt events (land slides, flooding) and climate changes (glaciation).

3.9 Discussion

Carine Damois mentioned that EDF have worked a lot on uncertainties and on analogues. It was suggested that BIOPROTA look at uncertainty to determine the differences resulting from the use of various models. It was noted that some differences in results arise from the different conceptual approaches in the various models, and this has been addressed in the previous BIOPROTA tasks. The statistical determination of contributions to uncertainties associated with specific assumptions has not been considered in BIOPROTA. For example, the use of current distributions for human health habits for informing future assessments was raised – should such data distributions be used in this way? It was noted that different regulatory approaches to these issues apply in different countries, even though the problem is the same[2].

[2] It may also be noted that Task 6 of the 2004 programme was originally intended to examine human aspects of system change, in terms of affect on the system and how that affected exposure, taking account of the behaviour of the people in that system. This was not anticipated to be an endless discussion of possible human technical and

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4 Future Work Programme

4.1 Continued Development of the Specialised Database

There is a small delay on allocation of contract for this work, to allow new SC members to review proposals and submit recommendations to the SC. All work carried out will be subject to independent review.

Mike Thorne offered to help the contractor in the restructuring of the database, as an identically structured system is used by Nirex. Any user difficulties noted by SC members should be identified to ensure these are addressed during the restructuring process.

An important part of the database population task will be the critical evaluation of the data, e.g. in terms of the experimental conditions and the context within which the information was collected. There is therefore an important onus on the contractor to thoroughly examine the data and record important ancillary information associated with them. It is important to also note that the use that is made of the data incorporated into the database will be the responsibility of the various radioactive waste management agencies and subject to their own regulatory frameworks. Consequently, recommendations concerning the actual use to be made of the data are outside the scope of the currently planned task.

4.2 GBIZ

Graham Smith presented the proposed future task for GBIZ. It was proposed that work focus on sites where assessment work has been undertaken, but not necessarily published as this may help gain support for the task. More than one site would be considered to identify common features for assessments and specific features for individual sites. The work would not aim to conduct site characterisation, but would focus on the improvement of models to ensure consistency, which could then be used to focus site characterisation. The work should focus on current rates of change rather than characterisation of the current static system. The output should identify inadequacies in current approaches and how they might be addressed. These could then be used to identify future proposals (e.g. EC 6th Framework).

Several issues arose from discussion.

Should the task be taken forwards as a 6th Framework proposal it was recommended that a technical secretariat be appointed to take administration pressure away from the lead organisation.

There was discussion on the environmental transport of radionuclides from repositories. It was suggested that chemical (whole system) processes should be taken into account rather than just transport alone.

It was agreed that lakes and rivers should be focused upon since these are the most common important biosphere receptors. It was also suggested that just one site would be focused upon to inform model development that could subsequently be applied to other sites.

FEPs were discussed, in particular the need to identify critical FEPs, as all FEPs may not yet have been identified, and subsequently assess how these should be modelled. However, it was agreed that this is probably outside of the scope of a GBIZ task.

Graham Smith was asked to draw up proposal objectives and circulate to SC members.

4.3 Iodine in Bogs

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social changes, but a consideration of how humans might behave within systems affected by climate and other changes, which are already included elsewhere in the PA. This is a difficult issue which remains to be considered. G Smith post hoc comment.

Elisabeth Leclerc presented the proposal and several agencies agreed to contribute financially to the project as a collaborative effort within BIOPROTA (Nirex, Posiva, SKB). Paul Degnan suggested that the Imperial College 3D model soil-plant transfer model could be used at a late stage, after data collection and analysis (allowing the model to be tested and possibly providing insight into the physical processes involved). It was suggested that it may be possible to extrapolate the results from the Iodine in bogs study to freshwater sediments.

4.4 Software tools

Graham Smith presented on behalf of Achim Albrecht. Information on the proposed working group was circulated at the meeting. It is proposed to have an initial workshop in September; this is being hosted by ANDRA in Paris. Anyone requiring additional information should contact Achim directly. It was agreed that the task should be included within BIOPROTA as one of the 2005-06 themes.

4.5 Site Characterisation

The continuation of the site characterisation task was discussed generally by the group. There is a need to consider how to make the link between site characterisation and safety assessments. Nirex has conducted top down analysis of this issue. Tobias Lindborg gave a brief presentation on perceived difficulties with adopting a top-down approach to identifying parameters required for site characterisation. Particular concerns were that such an approach could lead to a lack of understanding of the site, that site characterisation should stand alone from performance assessments and that a site characterisation is a description of a site, not a list of parameters. It was suggested that both approaches are needed and are complementary. Without a top-down view, one might explore site characteristics without end or with misallocation of resources; without a bottom up perspective, one may miss crucial understanding of the system.

Future site characterisation proposal is to be drawn up in association with Elisabeth Leclerc to take into account work currently underway in Theme 3 and the other continuing tasks.

4.6 Critical pathways

Graham Smith presented ideas for a task looking at critical pathways for the key radionuclides. We currently have useful output in Working Material which provides information and data on models for exposure via irrigation, foodchain uptake, accumulation in soil and inhalation, but there is no examination of which exposure routes are likely to be the most important from among these alternatives. It is therefore difficult to focus further research for each radionuclide. The objective is therefore to use existing output to: identify the dominant exposure pathways for each of the important radionuclides: direct foodchain contamination from irrigation, or foodchain contamination, inhalation or external irradiation after build-up in soil. Output from the BIOMOSA project could also be useful. The work would require normalising the source term applied in each case and also inclusion of more radionuclides for some of the exposure scenarios. Such normalising would in part depend on assumptions for the GBIZ, so the considerations in the GBIZ continuing task could be useful

It was suggested that this task begin by conducting a sensitivity analysis for each radionuclide and pathway to ensure that the ranking of pathways by different models is accurate. This should include freshwater pathways (e.g. for C-14). Concern was raised that the models may identify relative importance of pathways incorrectly due to uncertainties in the factors applied within models. However, as the models were all in close agreement during the modelling exercises conducted under Theme 2 this is unlikely to be the case. There was general consensus that more information is required on how important the task would be for reducing the work required in biosphere assessments by focusing efforts on key pathways and radionuclides.

It was suggested that the approach should be applied to one radionuclide in the first instance to determine how useful the approach is.

Graham Smith and Mike Thorne were asked to develop a proposal for circulation to all the SC.

4.7 Uranium chain

Mike Thorne presented an idea on how to model the uranium decay chain. Disequilibrium of uranium and the evolution of ecosystems should be taken into account. It was noted that this is of importance for

non-human biota due to the accumulation of the uranium-decay series in biota. It was suggested that this should form a separate task to GBIZ. Mike Thorne was tasked with drawing together a proposal for consideration by the SC. A draft proposal has subsequently been circulated to Paul Degnan, Fritz van Dorp and Graham Smith for comment.

5 Next BIOPROTA Meeting

It was agreed by the Steering Committee that the next BIOPROTA meeting will be held in Oxford in May 2006. Working meetings of Task groups are also anticipated.

Karen Smith and Graham Smith
BIOPROTA Technical Secretariat

Annex A: Steering Committee Organisations

Organisation	2003 – 2004 programme	2005 programme	SC representative
ANDRA	X	X	Elisabeth Leclerc-Cessac
BNFL/Nexia	X	X	Mark Willans
EDF		X	Carine Damois
ENRESA	X		Antonio Cortes
KAERI		X	Yong Soo Hwang
Nagra		X	Frits van Dorp
Nirex	X	X	Paul Degnan
NRI		X	Ales Laciok
NUMO	X	X	Shigeru Okuyama
Posiva	X	X	Ari Ikonen
SKB	X	X	Ulrik Kautsky
UKAEA	X	X	Mike Pearl

Annex B: BIOPROTA Seventh Workshop Participation List

Name	Organisation	Email
Elisabeth Leclerc-Cessac	Andra	Elisabeth.leclerc@andra.fr
Steve Sheppard	Ecomatters	sheppards@ecomatters.com
Carine Damois	EDF	Carine.damois@edf.fr
Graham Smith	Enviros	Graham.smith@enviros.com
Karen Smith	Enviros	Karen.smith@enviros.com
Hideji Yoshida	JGC Corporation	Yoshida.hideji@jgc.co.jp
Morimasa Naito	JNC	naitom@hq.jnc.go.jp
Mike Thorne	MTA	MikeThorneLtd@aol.com
Frits van Dorp	NAGRA	vandorp@nagra.ch
Mark Willans	Nexia Solutions	Mark.willans@nexiasolutions.com
Paul Degnan	Nirex	Paul.degnan@nirex.co.uk
Shigeru Okuyama	NUMO	sokuyama@numo.or.jp
Paul Gierszewski	OPG	Paul.gierszewski@opg.com
Helen Leung	OPG	Helen.leung@opg.com
Ari Ikonen	Posiva	Ari.ikonen@posiva.fr
Ulrik Kautsky	SKB	Ulrik.kautsky@skb.se
Tobias Lindborg	SKB	Tobias.lindborg@skb.se
Ulla Bergstrom	Studsvik	Ulla.bergstrom@studsvik.se
Marilyn Stuart	AECL	stuartm@aecl.ca
Tamara Yankovich	AECL	yankovicht@aecl.ca