

# **BIOPROTA**

**Key Issues in Biosphere Aspects of Assessment of the Long-term Impact of Contaminant Releases Associated with Radioactive Waste Management**

## **Report of Second Workshop**

**Switzerland, 6-7 May 2003**

**Hosted by NAGRA**

**Report of Second BIOPROTA Workshop  
6-7 May 2003  
Hosted by NAGRA, Switzerland**

**History**

Draft report Version 0.1 prepared by Enviros Consulting Ltd, distributed to those organisations which provided input.

Final Report Version 1.0 prepared by Enviros Consulting Ltd, distributed to those organisations which provided input.

**Preface**

The report is presented as working material for information. The content may not be taken to represent the official position of the organisations involved.

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## 1 Introduction

Key issues in biosphere aspects of assessment of the long term impact of contaminant releases associated with radioactive waste management were identified at a Preliminary BIOPROTA Workshop, hosted by Andra in June 2002 [BIOPROTA, 2002a]. Common issues and a way forward were set out in a BIOPROTA Concept and Definition Document [BIOPROTA, 2002b].

Following the Preliminary Workshop, and the first Workshop held in Oslo, October 2002, a Second Workshop was arranged for May 2003, at the invitation of Nagra. The aim of the Second Workshop was to discuss work progress to date, and the Work Plan to September 2003 and beyond. Each Task has its own agreed Work Plan, an example of which can be found in Appendix A. Participants are listed in Appendix B and the Agenda is reproduced as Appendix C.

### ***IUR Task Force on Waste Management and Radioecology***

The International Union of Radioecology (IUR) has set up a Task Force on waste management and radioecology, with an emphasis on long term radioactive releases and related issues. There are 4 objectives of this working group, to identify:

- gaps in knowledge associated with key radionuclides,
- strategies for assessments,
- geosphere – biosphere interface zone, and
- models for long term behaviour.

The working group will have close links with BIOPROTA, and several individuals are participating in both. The First Workshop of the Task Force was held at Merlewood, UK on 27/28 February 2003 to discuss the behaviour of Np-237, C-14 and Cl-36 in the environment. The minutes of the Workshop and the workshop presentations are available on the BIOPROTA workspace on Business Collaborator<sup>1</sup>. More information on the Task Force can be obtained from Brenda Howard ([b.howard@ite.ac.uk](mailto:b.howard@ite.ac.uk)) or Rodolfo Avila ([Rodolfo.avila@facilia.se](mailto:Rodolfo.avila@facilia.se)).

### ***EMRAS***

Some members of BIOPROTA will be present at the IAEA EMRAS workshop in early September to review TR364. In addition, EMRAS is due to have a task on C-14, focusing on relatively short term dose assessment issues compared with BIOPROTA. However it is anticipated that there will be technical overlaps. It has been suggested that someone represent BIOPROTA at the meeting work programme during the meeting to ensure we coordinate with EMRAS and not duplicate work.

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<sup>1</sup> All participants of BIOPROTA should by now have access to Business Collaborator [http://cobweb.businesscollaborator.com/bc/explogin\\_ie5.cgi/0/13590068](http://cobweb.businesscollaborator.com/bc/explogin_ie5.cgi/0/13590068) Should you have any difficulties accessing this website, please contact the Technical Secretariat at [emma.kerrigan@enviros.com](mailto:emma.kerrigan@enviros.com).

### ***International HLW Conference, Las Vegas March 2003***

A paper on BIOPROTA [Leclerc-Cessac and Smith, 2003] was presented, outlining the BIOPROTA programme. This prompted interest from the DOE Yucca Mountain Project assessment team and the Nuclear Waste Management Organisation (NWMO, Canada) among others. The paper has been loaded onto business Collaborator.

### ***Research Suggestions***

Practical suggestions for new experimental and monitoring research may arise at any time. Such suggestions could be taken up within BIOPROTA or by individual organisations, according to priorities and resources available. While a clear set of technical output is suggested above for the first year to September 2003, it is suggested that the BIOPROTA program could continue according to the activities outlined over a period of three years.

## **2. Discussion of the Themes and Tasks**

The workshop provided a setting for some lively debate for the Themes and Tasks within BIOPROTA. The following note does not document all arguments, rather the most important issues and the agreed decisions regarding how the Themes and Tasks should proceed.

Several of the Tasks were introduced with a presentation by the Task Group Leader (TGL) or the Technical Secretariat. (TS). Where available, these presentations have been filed on Business Collaborator.

### ***2.1: Theme 1: Specialised Database for Key Radionuclides and Process Data***

A presentation was made on the Nirex Database which raised questions regarding the data to include and how to structure the data. Due to the nature of the database, there is the ability to have several iterations of the data structure as new data becomes available and important processes are identified e.g from the model comparison exercises, to ensure the data is displayed in the most appropriate manner.

It should be noted that the Database is just a tool and there is some onus on the user when obtaining data for a performance assessment to justify the values chosen. In addition, Theme 2 will identify the important issues for each scenario and feed into later versions of the database.

Data considerations:

- Where possible, fundamental references should be used; this will include field measurements and experimental data, not assessment compilations.

- It may be appropriate to include a key process for a key radionuclide and acknowledge that the fundamental data does not exist. In absence of such data, analogue data could be used, perhaps provide through Theme 2 Task 5.
- If, from the above, we do not have adequate data, perhaps others e.g. IUR can come up with the data.
- There will be gaps in the database (first versions) because of knowledge gaps. The database will not solve the gap problem.
- Take multiple values and decide which are most appropriate, try to remove the assessment assumptions.
- Include dependencies. It will be useful to include the purpose of the experiments, measurements or the conditions of the experiment and the results, and to identify relevant dependencies.
- Data to include may be element dependent or independent, site dependent and/or radionuclide dependent. i.e. the Chapter for Cl-36 will include more information that Cl-36 specifics. i.e. include stable chlorine values, then add notes for when a site specific or generic value should be used.

SKB (report on biosphere data<sup>2</sup>) and ANDRA (report on Cl-36 not using a Kd approach comparison with classical approach) have both recently published reports that may be useful input material. The Swedish data is available in electronic form from Studsvik (and the report can be accessed via the SKB website).

Participants agree that the database should include the best available, primary, real, data. Where primary and real data is unavailable, use analogue or experimental data. This will reduce the number of reliable references considerably. In addition, there are few parameters that are really a cause for concern. It is proposed to structure the Database according to the references, however, this may change as information is received.

**Action:** To ensure the TS receive reliable data regarding the parameters of concern, the **TS** in consultation with interested experts (such as, Ulrik Kautsky, Gerhard Proehl, Ulla Bergstrom, Achim Albrecht, Maryla Wasiolek and Wesley Wu, and Mike Thorne) will develop specific questions with the objective of tailoring the responses to provide exactly the data required.

**Deadline:** 6 June 2003.

**Action: Participants** to consider the above request for information and send data to the TS in the required format.

**Deadline:** 14 July 2003.

**Action:** The **TS** will collate the data responses to the above request and agree the most appropriate structure for the database in consultation with Mike Thorne.

**Deadline:** 1 September 2003.

**Action:** To accompany the distribution of the Database to BIOPROTA participants, the **TS** in consultation with Mike Thorne, will develop a user guide.

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<sup>2</sup> Karlsson and Bergstrom (2002). SKB R-02-28 Nuclide documentation Element specific parameter values used in the biospheric models of the safety assessments SR 97 and SAFE

**Deadline** 1 September 2003, for distribution in advance of September workshop

## **2.2: Theme 2: Modelling**

### **2.2.1. Task 1: Develop guidance on irrigation modelling**

The objective of the Task is to improve confidence in irrigation modelling highlighting the important processes in different circumstances and the gaps within data.

A preliminary work plan was circulated in April and responses were received from Studsvik, YMP, EPRI, Andra, and JNC. There were many differences in the methods used to model irrigation, all with varying complexity. It was also apparent that the definitions of key processes are different, and the Task should address this inconsistency.

Due to the differences observed, the Task members need to agree what processes are involved in the irrigation pathway (model) e.g. should food preparation be included or should the pathway be more specific and only include interception and perhaps weathering. Therefore to complete the Task, the TGL need complementary descriptions of the calculations and conclusions in order to compare. To achieve some degree of similarity it has been proposed that the amount of irrigation and the concentration in irrigation water should be normalised to 150 mm per year and 1Bq m<sup>3</sup> respectively. In addition, the model should only consider 1 year of irrigation (therefore excludes accumulation) and all 5 key radionuclides should be considered.

**Action:** Ulla Bergstrom in consultation with the TS will request more specific data to identify parameters that lead to uncertainty, importance of irrigation comparison with drinking water, i.e. significance of irrigation as an exposure pathway. The request will include proposals for calculations and the complementary descriptions.

**Deadline:** 30 May 2003.

**Action:** Task Group Members to provide information regarding the above request to Ulla Bergstrom and the TS.

**Deadline:** 14 July 2003.

**Action:** Ulla Bergstrom again in consultation with the TS will compare the responses and draft a report discussing significant issues.

**Deadline:** 1 September 2003.

### **2.2.2. Task 2: Develop guidance on the inhalation pathway for actinides accumulating in soils/sediments**

The objective of the Task is to improve confidence in inhalation modelling post accumulation and reduce the uncertainty in the values, whilst highlighting the important processes in different circumstances and the gaps within data.

A preliminary work plan was circulated in April and responses were received from Studsvik, NUMO, UKAEA, YMP, EPRI, Andra, and Ciemat. Once again there were many differences in the methods used to model inhalation relating to occupancy, breathing rate, mass loading, enhancement factors, etc

Other comments relating to the comparison of inhalation modelling relate to the activities that result in the highest dust levels and the particle size. Also assumptions are made regarding chemical form, such assumptions should be used consistently.

There may be a relationship with Task 5 (Biosphere Analogues) as there are several examples that lead to inhalation exposure, for example the Donana accident, the Palomares accident and Karachai Lake.

**Action:** W Wu and M Wasiolek (joint TGLs) in consultation with the TS will request more specific data to identify parameters that lead to uncertainty. The request will include proposals for calculations and the complementary descriptions.

**Deadline:** 30 May 2003.

**Action:** **Task Group Members** to provide information regarding the above request to TGLs and the TS

**Deadline:** 14 July 2003.

**Action:** **YMP** again in consultation with the TS will compare the responses and draft a report discussing significant issues

**Deadline:** 1 September 2003.

### **2.2.3. Task 3: Model Review for C-14 Dose Assessment**

Despite the large amount of interest in C-14, a TGL had not been identified, and to date little progress has been made on a work plan, although information has been collated by the TS, including information from the IUR. Nagra is hosting a seminar on C-14 release and transport in repository environments in October 2003. This seminar will not focus on the biosphere. This Task will take account of the outputs from the seminar to determine source terms.

It has been suggested that the future work plan should add to the IUR matrices, and quantify or conceptually model the matrices (for both terrestrial and aquatic ecosystems). In addition it is hoped that several reports will be made available for review by experts. For example:

- QuantiSci report for ANDRA
- MTA report about C-14 in sewage sludge for FSA.
- SKB –brackish water system.
- EcoMatters review for Edf

It was proposed to ask Steve Sheppard of Ecomatters to be the TGL. Since the meeting, Steve has accepted this role. The way forward is:

**Action:** **TGL** in collaboration with TS to develop a Work plan to distribute to task group members.

**Deadline:** 30 May 2003.

**Action:** TGL and nominated **experts** (such as, Mike Thorne, Ulrick Kautsky, Achim Albrecht) to review existing reports and recent developments.

**Deadline:** 18 August 2003.

#### **2.2.4. Task 4: Updated Model-Model Comparison Exercise**

A preliminary work plan was circulated in April and responses were received from EDF, Nagra, BNFL, JGC, UKAEA, YMP and Andra. In addition, Nirex and GSF are considering responding. Each organisation uses different approaches (although JGC and UKAEA are comparable, both use Amber). In addition, both BIOMASS ERB2A and 2B system descriptions and the BIOMOVS II comparison can be considered.

To be able to compare the model results, several parameters need to be the same, therefore it was agreed that the activity concentration in groundwater compartments 1 and 2 will be equal. The proportion of groundwater to the well and to river, contamination of groundwater and turnover time will all be fixed. Seasonality will not be considered. The flora and fauna included will be suggested and the endpoint will be the dose to humans. However, for other processes it will be sufficient to acknowledge that different organisations will choose to model how they want. For example, sedimentation rate, inclusion of bioturbation.

Participants are requested to consider whether the Task should include:

- Chlorine,
- Depth dependent distribution coefficient for  $K_d$
- Redox

The above data will be applied to the suggested scenarios below:

- Irrigation scenario
- Natural scenario, no anthropogenic activity
- Mixture scenario of both.

**Action:** Achim Albrecht to specify those values that should be used, then circulate a new work plan to request data, modelling using the same parameters.

**Deadline:** 30 May 2003.

**Action:** Task Group Members to calculate doses using the values and scenarios specified in the work plan, and provide corresponding model and data descriptions.

**Deadline:** 1 August.

**Action:** Achim Albrecht with support of TS and participants to compare the results from the task group members and draft working material.

**Deadline:** 1 September 2003

#### **2.2.5. Task 5: Update and review use of analogue data to resolve the key issues identified**

Analogue studies are useful to provide evidence of processes on timescales that are difficult to replicate experimentally. In addition they provided quantitative information, include real world complexity that is too difficult for models to replicate, are usually free

of sampling bias, and can be used to support scenarios and conceptual models and to calibrate and validate models.

Analogue studies are useful in the context of performance assessments as confidence building tools, allowing scenario generation, applying in numerical models and questioning assumptions. They can provide some information to fill the knowledge gaps that policy makers and the public are concerned about.

The EC are funding a project (NANet) to investigate non-biotic pathways, including natural fluxes, climatic analogues and environmental change. BIOPROTA aims to investigate analogues of biotic pathways. This will include natural and anthropogenic analogues involving the key radionuclides of interest (at a later date the list can be extended). The initial emphasis is to be on terrestrial ecosystems and relevant to a deep repository. The areas of interest are:

- Soil- plant- animal pathways
- Human potential exposure groups (PEGs), lifestyles and habits
- Industrial influences (mines, mill tailings, power stations etc.)

To date, a preliminary literature review has been completed using the INIS database. There has also been discussion and integration with the NANet project team and some national information has been provided from Finland and Japan. Participant interest includes: Posiva, NUMO, Studsvik, Andra, Mike Thorne Associates, SKB, EDF, UKAEA,

It is recognised that NANet and BIOPROTA Task 5 should have a consistent reporting format, like that suggested below (taking the form of an encyclopaedia):

1. Analogue description
  - key features
  - illustrations
2. Relevance of limitations
  - degree of relevance
  - summary of limitations
3. Quantitative information
  - relevant for PA studies
4. Quality
  - assessment of both quantitative and qualitative data
5. Previous use in PA or other purposes
6. Timescale of application
7. Reference
8. Added value
  - Could the analogue be better exploited e.g. conceptual model development, data population, validation.
9. Additional work required
  - Experimental studies
  - Further field work
  - Additional analyses

**Action:** TS to extend the literature review, with inputs from participants.

**Deadline:** 28 June 2003.

**Action:** **Paul Degnan** to compile and analyse national information provided by task group members, documenting summaries in a consistent format.

**Deadline:** 31 July 2003.

**Action:** **Paul Degnan** to draft report introduction with support from TS and participants providing the scope, objectives and aims of the Task and the link with Nanet. Circulate to task group members for comment.

**Deadline:** 18 August 2003.

**Action:** **Paul Degnan** to consider the generalities and commonalities, information deficiencies for discussion in September.

**Deadline:** 1 September 2003.

#### **2.2.6. Task 6: Environmental Change**

It is recognised that it is difficult to model human influenced environmental change. It is proposed to use ERB2B as a basis for this Task, but with the inclusion of human influences in the constant biosphere. This will allow task group members to identify how human influenced environmental change affects exposure and over what timescales. However, BIOMASS assumptions were conservative. It is proposed that the scenarios considered during this Task reflect extreme scenarios, therefore if the results suggest the scenario has no impact then it can be excluded from future model consideration.

It is acknowledged that a draft report will be produced for review in September, however, there will be input from the BIOCLIM programme to further advance this Task in 2003.

The TS will contact potential contributors in consultation with the TGL.

**Deadline:** 15 June 2003

A discussion document will then be prepared for distribution.

**Deadline:** 1 September 2003

#### **2.2.7. Task 7: Geosphere Biosphere Interface Zone**

In the past the geosphere biosphere interface zone has not been considered in detail, and traditionally both zones have been considered separately, without consistent treatment of boundary conditions. In addition, very variable assumptions have been made in assessments without a clear understanding of why. It is acknowledged that the geosphere biosphere interface is an artificial, conceptual interface to support modelling and safety assessment scenarios.

A preliminary work plan was circulated in April. Each organisation uses different approaches. In addition, both BIOMASS system description and the BIOMOVs comparison can be considered.

Attention was drawn to the BIOMOSA approach to consideration of the GBIZ, as a copy of understanding the impact of unit release rate from the geosphere. This involves

understanding the impact of unit activity concentration in surface water bodies and the effective diluting volumetric flow (m<sup>3</sup>/y), necessary (at specific site and for an assumed generic site) to convert a release rate Bq/y to a unit concentration, 1Bq/M<sup>3</sup> {m<sup>3</sup>/y}. Clearly such a dilution will depend on the flow in local surface water bodies as well as processes in the GBIZ.

**Action: Task Group Members** to provide information on source terms from the geosphere, the transport processes and boundary conditions and the hypothesis for biosphere analysis such as source terms, biosphere media, and transport processes

**Deadline:** 28 June 2003.

**Action: TGL, Paloma Pinedo** to draft a report based on the information from the task group members and the reports mentioned above,

**Deadline:** 1 September 2003.

### ***2.3 Theme 3: Site Investigation, Experiments and Monitoring***

#### ***2.3.1. Task 1: Develop guidance on biosphere site specific characterisation***

For this Task, site specific characterisation is limited to human exposure, key radionuclides, performance assessment, biosphere characteristics and the GBIZ. This is because it is important to describe geology, hydrogeology, climate, water, soils, plants, animals and human behaviour. The Task should be based on the parameter descriptions as used in BIOMASS.

The Task will involve determining parameters, methods for measuring, spatial average and correlation between site specific and other parameters. The parameters considered will be used for environmental assessment, not focusing on long term radiological assessment, although this will need to be taken into account.

**Action: Task Group Participants** to send information to Elisabeth Leclerc-Cessac (TGL) detailing key parameters, those that change with climate and those that are constant for different biospheres and identify how to measure them.

**Deadline:** 30 May 2003

**Action: Elisabeth Leclerc-Cessac** to draft a report with TS and participant support based on the information from participants.

**Deadline:** 1 September 2003

In addition Tobias Lindborg presented details of the SKB site investigation programme<sup>3</sup>. The present site is the best analogue for the future and so is worth characterising in detail. SKB have measured as much as possible in the field, other parameters are estimated using knowledge of historic climates, topography, ecosystems, and practices. The characterisation allows us to exclude features, events and processes that we know will not happen in the future. Throughout the characterisation it is important to state what and why you include or exclude details in the assessment and how decisions are justified.

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<sup>3</sup> Site characterisation strategy report in progress: R-03-06

### **2.3.2. Task 2: Research Protocols**

This Task was not discussed in detail. Mike Thorne agreed at the Oslo Workshop to provide a paper for the September Workshop.

**Action:** Mike Thorne to write a paper with input from interested participants (Tobias Lindborg) as appropriate.

**Deadline:** 1 September 2003

## **3 Work Programme and Schedule**

The work plans for each Task will be revised to take account of the actions and deadlines outlined above. However, in addition to ensure that there is a consistent approach used for documentation the TS will propose a report format for TGL to use. The TGL should submit a table of contents and/or a summary for each TGL to review by 16 June 2003.

Many tasks will continue beyond Sept 2003. The work programme for 2003- 2004 will be provisionally agreed by the Steering Committee by 1 September 2003 and discussed at the September Workshop.

### **3.1 September Workshop**

It was agreed that a meeting would be held in Paris, hosted by Andra, on 22-24 September 2003. The meeting will allow presentation and discussion on draft working material and the work programme beyond September 2003.

## **4 Acknowledgement**

All participants expressed their thanks to Nagra for hosting the Workshop and providing excellent facilities and hospitality.

## **5 References**

BIOPROTA (2002a). BIOPROTA Key Issues in Biosphere Aspects of Assessment of the Long-Term Impact of Contaminant Releases Associated with Radioactive Waste Management, Report of Workshop 12-14 June 2002, hosted by Andra, Chateney-Malabry.

BIOPROTA (2002b). BIOPROTA Key Issues in Biosphere Aspects of Assessment of the Long-Term Impact of Contaminant Releases Associated with Radioactive Waste Management, Project Concept and Definition Version 2, September 2002.

## **APPENDIX A: Theme 2 Task 1 Work Plan**

### **Model Review and Comparison for Spray Irrigation Pathway**

#### **Introduction, Objectives and Scope**

Previous discussions have identified common interest in investigating further the calculation of doses arising from interception by growing crops of contaminated irrigation water and the consequent contamination of the food consumed by humans.

The intention is that the comparison of assessment models for this important exposure pathway will:

- improve confidence in the treatment of the relevant processes and data assumptions,
- identify the circumstances in which different processes are important, hence requiring different modelling treatment, and
- identify where important data may be lacking.

The scope of this task includes only the contamination of foodstuffs arising only by the direct interception and uptake onto and into the crop, and any relevant transfer to edible parts. It does not cover contamination which falls to soil, and is then subsequently taken up by the crop. That is the basic processes of interest include interception, weathering, transfer to the inside of the crop, transfer to edible parts and losses during food preparation (these processes were identified in the BIOMASS Example Reference Biosphere 2A and some modelling alternatives were briefly considered). In describing processes, please take account of the definitions given in ICRU 65<sup>4</sup>.

#### **Work Plan**

Participants are asked to provide input in two stages.

#### **Stage 1: Identify Conceptual and Mathematical Models, and the Data Employed**

Participants are asked provide information about their current assessment models as follows. Please provide the information to the Technical Secretariat, if possible before 30 April. Please note the detail in the questions and the format requested.

Assuming irrigation of a leafy green vegetable crop and separately of a root vegetable crop:-

- what processes are assumed by which the contamination is transferred to the food as consumed?
- what further processes are taken into account by which doses are estimated?

For each process, what mathematical equation is used to represent it? Please make clear, any distinction you make between leafy green vegetables and root vegetables.

Each equation will have parameters in it. So that the meaning of the equation is clear, it will be necessary to describe each parameter

Lastly, what values of parameters are used. For element dependent parameters, please assume we are evaluating I-129. Please also provide the references used to obtain the values.

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<sup>4</sup> Quantities, Units and Terms in Radioecology. Journal of the International Commission on Radiation Units and Measurements. Volume 1 No 2, 2001

At this stage we do not look for the justification of the assumptions, only a clear specification of what they are. The participant contributions will be combined and tabulated by the Technical Secretariat, in a format such as follows:

Process	Model 1	Model 2	Model 3	etc
1. Interception	Y	Y	Y	Y
2. Irrigation rate	N	Y	Y	Y
3. Weathering	N	N	N	Y
4. etc				

Equations used to represent processes:

1.  $y = mx$

where:

y is the concentration of I-129 in the foodstuffs, Bq/kg fresh wt,  
m is a very well justified universally relevant empirical factor, m<sup>3</sup>/kg, value  
x is the concentration of I-129 in the irrigation water, Bq/m<sup>3</sup>,

Please, if possible supply your model description in this format to facilitate compilation.

### **Stage 2: Identify the Significance of the Differences in Approaches Used**

The compilation of models and data will be discussed at the Workshop at Nagra, 6-7th May and the key model and data differences identified.

The importance of the differences will then be determined through a series of calculations relevant to actual assessments. The purpose is to determine whether any such differences are of material significance and, if so, in what circumstances.

These calculations will be specified in light of Workshop discussions and participants asked to complete them and submit results during May/June/July, for compilation during August. A draft working material report can then be prepared setting out the common form of the model for assessing the dose and the circumstances when it may be appropriate to vary from that form. Any significant weaknesses in data will also be identified, in so far as values for sensitive model parameters are not able to be identified and justified.

The draft Working Material report will be discussed at the Workshop in September.

## APPENDIX B: Workshop Participation List

<b>May Workshop Participation</b>					
<b>Name</b>	<b>Company</b>	<b>Address</b>	<b>e-mail</b>	<b>Phone</b>	<b>Fax</b>
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## **APPENDIX C: Workshop AGENDA, Nagra, May 2003.**

The meeting will focus on progress to date and implementation of a future work plan to enable participants to develop Working Material for September 2003. Presentations will be made by Task Group Leaders and/or the TechSec on achievements to date and proposals for the future.

### ***Tuesday 6 May***

**9.00AM**

**Day One**

Introduction

Aims and Objectives of the Meeting, TechSec  
Review of agenda  
Update of interface with IUR and other external bodies  
Theme 1: The specialised database: populated with C1-36 data, TechSec

**10.30AM**

**Coffee**

Theme 2:

Task 1: Spray irrigation modelling. U Bergstrom & TechSec

**12.30PM**

**Lunch**

Theme 2:

Task 2: Inhalation Exposure Modelling, TechSec (on behalf of YMP)

Theme 2:

Task 3: Discussion of C-14 Modelling, TechSec

**3.00PM**

**Coffee**

Theme 2:

Task 4: Discussion of Model Inter-comparison Exercise, A Albrecht

**5.30PM**

**Close (for participants)**

Steering Committee Meeting

**6.30PM**

**Close (for Steering Committee)**

### ***Wednesday 7 May***

**9.00AM**

**Day Two**

Theme 2:

Task 5-7: Natural Analogues, Environmental Change and the Geosphere Biosphere Interface zone, P Degnan, P Pinedo & TechSec

Theme 3:

Task 1: Site Characterisation, E Leclerc-Cessac & TechSec  
Task 2: Research Protocols, TechSec and input from T Lindborg

**10.30AM**

**Coffee**

Future Work Programme:

Discussion of proposals for work to end September 2003, E Leclerc & TechSec  
Continuing Programme from October 2003

**12.30PM**

**Lunch**

**2.00PM**

**Close**