



Martin Kelly

Qualifications
Year of birth
Nationality

BSc (1st class) Theoretical Physics, PhD Theoretical Physics
1968
British

Key Skills

- Radiological and chemotoxic assessments for deep and near-surface repositories, and contaminated land;
- Understanding and modelling of radionuclide transport processes in the geosphere and biosphere;
- Formal methods for eliciting FEPs and scenarios relevant to radioactive waste disposal system performance;
- Development and application of assessment software tools;
- Simplified mathematical analyses designed to promote understanding of disposal system behaviour;
- Interpretation and application of regulatory requirements, international recommendations and assessment methodologies;
- Development and application of decision-aiding methodologies.

Selection of Project Experience

- 2009** Consideration of improvements to the representation of the near field in radiological assessments of the LLWR. Improvements include the representation of time-dependent water flows and phased disposal of wastes.
- 2009** Lead author of a report to recommend an approach to the treatment of uncertainty in risk assessments undertaken for contaminated land at Sellafield.
- 2009** FEP analysis and illustrative calculations to investigate the potential benefits of vitrification of some components of the UK ILW inventory. Various backfill options were considered, including NRVB, crushed rock, and bentonite, for which radionuclide transport is diffusion-dominated.
- 2009** Development and documentation of an approach to the treatment of colloids and colloidal transport in performance assessments for the NDA. This included the development of a simple scoping model as well as a detailed assessment model.
- 2008** Review and recommendation of improvements to the approach to chemotoxic assessments adopted in assessments for the LLWR.

	The main improvements considered are the incorporation of controlled release of contaminants into solution and methods for making better use of available monitoring data.
2008	Direct support to LLWR, including re-examination of certain assessment results submitted under Requirement 9, and scoping calculations to determine if the submitted results are plausible.
2008	Member of the LLWR PAIS team, charged with identifying the potential risks and liabilities associated with current and future waste disposals at the LLWR.
2008	Production of a summary report for the upcoming NDA-RWMD Disposal System Safety Case. The objective is to produce a report that is accessible to a range of interested stakeholders.
2007 – present	Lead assessor for a series of risk assessments to assess the future impacts of contaminated land at Sellafield, including the potential mitigating effects of remediation. The project includes developing a method for interfacing the ConnectFlow and GoldSim computer codes. This project is the most significant contaminated land project currently being undertaken in the UK.
2007	Development of a future strategy for dealing with uncertainty in near field parameters for a HLW repository in the UK. The major focus of this project was parametric uncertainty.
2007 – 2008	Development of groundwater, human intrusion and chemo-toxic assessments to understand the potential impacts of a criticality event on a deep geological repository in the UK. In addition, calculations to estimate the probability of a criticality event in repositories in various geological environments
2007 – present	Development of assessment methodology and facilitation for ONDRAF. This work involves contributing to and co-ordinating a series of expert meetings on behalf of ONDRAF, to develop an approach to assessment and compliance modelling and to develop suitable near field data sets for use in those assessments.
2005 – present	Lead assessor for a series of GoldSim-based assessments to evaluate the radiological consequences of on-site disposal of decommissioning LLW at a number of nuclear power station sites in the UK. This work involves model development, data acquisition, scenario development and interpretation of the results in the context of the UK regulatory framework. Radiological assessments to inform a depth BPM study, assessment of detriments to non-human biota and from chemically toxic materials were also undertaken.
2004 – present	Review of the TSPA-SR GoldSim assessment codes for a disposal facility at Yucca Mountain, on behalf of State of Nevada. The work involves identifying potential weaknesses in the structure and implementation of the performance assessment models, such that contentions can be raised by State of Nevada with the US DoE.
2004 – 2005	Performance assessment expert for the research project to develop and implement a performance assessment methodology at multiple sites in France to support the assessment of their suitability as a host repository for long-lived radioactive wastes

("Projet HAVL Granite"). The work involved the development of a script-based approach for coupling radionuclide transport and groundwater flow codes, thus facilitating the evaluation of large numbers of variant cases.

- 2005** Provision of expert consultancy and two training courses to Ukrainian experts on techniques for developing and undertaking a performance assessment for a near-surface repository in the Ukraine. The course was in two parts: a two-week course on theory and a week-long course on application of principles.
- 2005** Provision of consultancy to train experts from the EU body (JRC) on performance assessment modelling.
- 2005** Software manager for PROPER, SKB's performance assessment software. This included undertaking verification testing of PROPER with other codes to ensure that the novel features of PROPER are correctly implemented.
- 2005** Lead consultant to define a new risk assessment approach to evaluate the impact of Depleted Uranium on the Environment. Customer DSTL
- 2003** Review of the capabilities and suitability of the GoldSim suite to assess its suitability as an assessment-modelling tool.
- 2003 – 2004** Development of regulatory criteria for a proposed deep geological repository in the Ukraine. This involves reviewing existing regulations applicable in the Ukraine, identifying inconsistencies and proposing revised criteria.
- 2003** Development of a methodology and associated spreadsheet to undertake a suite of human intrusion calculations for UK Nirex Ltd. Provision has been made for consideration of a variety of disposal concepts (including deep disposal, shallow disposal and surface storage) and intrusion scenarios (including drilling, excavation and longer term exposures).
- 2001 – 2004** Lead assessor for the main post-closure assessment of the Australian National Repository, including the use of GoldSim to evaluate the groundwater pathway. This assessment will form part of the license application for this facility, and is currently being reviewed by the IAEA.
- 2003 – 2004** Development of waste acceptance criteria for the Australian National Repository. Criteria were developed for the complete inventory of radionuclides, for individual waste drums and for sealed sources.
- 2002 – 2003** Review of the UK Nirex Ltd approach to human intrusion assessments. This includes a comparison with the approaches adopted by other groups, recommendations for improvements to the Nirex approach and a review of suitable software to implement the revised approach.
- 2002 – 2003** Development of a handbook of radionuclide properties for the Environment Agency. The aim was to produce a reference work suitable for non-experts to understand the key issues in radiation protection of wildlife.

- 1999 – 2003** Project manager of two projects for Food Standards Agency. These are the development of biokinetic models for carbon, sulphur and tritium transport in farm animals, and expert elicitation of transfer parameters for the compartment biosphere model SPADE. Team member for a project to review and recommend optimum strategies for ground-based and aerial monitoring of contaminated land following a nuclear accident.
- 2002** Project manager for a project to develop state-of-the-art probabilistic biokinetic models suitable for implementation in the AMBER and PRISM codes, for Food Standards Agency. The project included a series of sensitivity analyses, to verify the implementation of the new models and to identify parameter correlations.
- 2001 – 2002** Assessment of contaminated ground at Dounreay, including the detriments arising from operational health physics activities and programmes of sampling and monitoring the contaminated land.
- 2001 – 2002** Literature review of biosphere parameters for ANDRA, for U, PA, Tc, Se and I. All aspects of biosphere transport were considered, including sorption, plant uptake and translocation, animal transfer factors and fish concentration ratios.
- 2001 – 2002** Examination of the impact of radionuclide contamination on natural species (i.e. plants and animals). The work involved the construction of dosimetric models appropriate to plants and animals, and the estimation of absorbed doses and the resulting health detriments to these species. This work was timely, in view of current international interest in radiation hazards to non-human species.
- 1999 – 2002** Participation in a project for the Food Standards Agency to determine the optimum combinations of aerial and ground-based monitoring in the aftermath of a nuclear emergency. This involves consideration of plausible options, evaluation of their performance in terms of resolving photon spectra, and the use of decision aiding techniques to choose the optimum option.
- 2001** Lead assessor for an assessment of hazards presented by the burial of plutonium and other radionuclides in trenches at Maralinga, Australia. The project also included biokinetic modelling within the ModelMaker compartment model code to assess the chemical toxicity of disposed uranium and lead at Maralinga.
- 2001** Assorted reviews of information and assumptions used in Drigg post-closure safety assessments, including external dose factors adopted, treatment of radionuclide decay chains, and the treatment of human intrusion.
- 2000 – 2001** Biosphere assessments for the shallow waste disposal facility in Puspokszilagy, Hungary. This work included calculation of dose-per-unit-flux factors for use in assessment calculations, effects of human intrusion and various other events including earthquakes, slope collapse and cap degradation.
- 2000 – 2001** Assessments of the likelihood and consequence of various low-

probability / high consequence events at the shallow disposal facility at Drigg. These events include meteorite impacts, aircraft crashes, explosions and tsunamis.

1999 – 2001

Radiological and toxicological assessments of the consequences of glacial and other erosional processes on the wastes stored at the shallow disposal facility at Drigg, in the United Kingdom. Consequences of human intrusion, including individual and collective doses, were also considered.

1998 – 2001

Environmental impact assessment of former uranium mining liabilities in Bulgaria, Slovakia and Albania. This includes radiological and toxicological impact assessments and the application of multi-attribute decision analysis techniques for selection of optimal remediation options. The Project in Albania included extensive liaison with Albanian experts, and the organisation of an international workshop in Albania to present the results of the study to other international experts and member of the Albanian government.

2000

Expert elicitation of unusual exposure pathways for the Environment Agency. The work involved participation in and recording of brainstorming sessions to identify exposure pathways to radioactive contamination arising from routine discharges and radioactive waste repositories. Use was made of the FANFARE software in the course of this work.

1999

Development of an air and water flow model for shelters located in Chernobyl. This will ultimately be used to investigate the environmental impact of radioactively contaminated waters leaking to neighbouring structures, or back to the groundwater system. Software was developed in C++ to implement the model.

1993 – 1998

Involvement in the development and application of new systematic approaches to FEP analysis and scenario development for radioactive waste disposal facilities. Chief designer and programmer for the FANFARE computer programme. Wide experience of the application of this software in expert elicitation sessions. This experience includes application to deep disposal facilities in Russia, Norway, Korea and the United Kingdom.

1997

Production of technical specifications and test plans for the biosphere assessment code TDDBM, which is designed to calculate contaminant transport in the biosphere, taking account of the time-dependent evolution of the system over the assessment timescale.

1993 – 1997

Development of simplified models of contaminant transport through the near field and geosphere. The aim of these models is to explain in simple terms the broad features of assessment PSA calculations. They were implemented within the MASCOT assessment code and applied during the Nirex 95 and Nirex 97 assessments.

1994 – 1996

Participation in an NEA Working Group to develop an International database of FEPs. The database is used as an aid to audit existing FEP lists, and as a starting point for more detailed project-specific FEP analyses.

Career History

2001 – present

Serco Assurance

Senior Consultant specialising in repository post-closure performance safety assessments, contaminated land assessments and radiological and biosphere dose assessments.

1993 – 2001

AEA Technology

Environmental Assessment Modeller. With experience of systematic methods for FEP and scenario analysis, mathematical modelling of radionuclide transport in near field, geosphere and biosphere, software development and application and environmental impact assessments for contaminated land and structures.

References

- Two reports for SKB relating to the user guide and verification tests for the PROPER code (expected date for publication – end of October).
- M Kelly and C.P. Jackson, User Guide for the New Human Intrusion Spreadsheet, Serco Assurance Report SA/ENV-0557, 2003.
- M Kelly, A.J. Baker and D. Charles, The Treatment of Human Intrusion in Post-closure Performance Assessment, Serco Assurance report SA/ENV-0495, 2003.
- A V Chambers, W R Rodwell, M Kelly, A R Hoch and A J Baker, Assessment of Package Performance during Long-term Storage of Intermediate-level Radioactive Waste, oral presentation at the ICEM'03 Conference, September 2003.
- M Kelly, D Holton and M.C. Thorne, Impact Assessment of Uranium Exploration Liabilities in Albania, accepted for oral presentation at ICEM '03.
- D Holton, M Kelly and A Baker, Paradise Lost? Assessment of Liabilities at a Uranium Mine in the Slovak Republic, Mine Water Hydrogeology and Geochemistry 198, pp 365-377, 2002.
- M C Thorne, M Kelly J H Rees, P Sánchez-Friera and M Calvez, A Model for Evaluating Radiological Impacts on Organisms other than Man for use in Post-closure Assessments of Geological Repositories for Radioactive Wastes, Journal of Radiation Protection Volume 22 Number 3, pp 249-279, 2002.
- M. Kelly and M.C. Thorne, An Approach to Multi-attribute Utility Analysis Under Parametric Uncertainty, Annals of Nuclear Energy 28 (2001), 875-893.
- M. Kelly and D.E. Billington, Scenario Analysis and Conceptual Model Development, Using FANFARE, Scientific Basis for Nuclear Waste Management XXi, Volume 506, pp 702-708, 1997.
- M. Kelly and D.E. Billington, Conceptual Basis of the Master Directed Diagram, Nirex Science Report S/98/010, 1998.
- Contributed to J. Locke et al, Overview Description of the Base Scenario Derived from FEP Analysis, Nirex Science Report S/98/011, 1998
- Contributed to L.E.F. Bailey et al, Overview of the FEP Analysis Approach to Model Development, Nirex Science Report S/98/009, 1998
- Contributed to A.J. Baker et al, Nirex 97: An Assessment of the Post-closure Performance of a Deep Waste Repository at Sellafield, Volume 3 - The Groundwater Pathway, Nirex Science Report S/97/012, 1997.
- Four papers in the course of PhD studies, three on crystal field splittings in the rare earths and one on solutions of Emden's equation.