EMpower

Environmental Masters Programme Of Work Experience through Research

Supported by the Nuclear Decommissioning Authority, Health & Safety Executive – Nuclear Installations Inspectorate, Environment Agency, Cogent, British Energy and AWE, Aldermaston

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Project Descriptions

2009

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Outline Project Proposal No: AWE0901

Host Organisation	AWE Aldermaston
Host Organisation Supervisor	Phil Purdie & Paul Thompson
Project Location	Reading
Project Title	Collation and correlation of radionuclide data from two high volume air sampling units, RIMNET and Meteorology
Brief Project Description	The project will consist of assembling gamma spectrometry data from 2 HVS stations from previous years and investigating the relationships between the two stations. The data from the HVS stations will also be collated with data from RIMNET and the Metereological Office to investigate seasonal and weather related correlations.

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Outline Project Proposal No: AWE0902

Host Organisation	AWE Aldermaston
Host Organisation Supervisor	Phil Purdie & Duncan McCallum
Project Location	Reading
Project Title	Industry best practice for balancing implementation costs for renewables/sustainable aspects of construction, with long-term financial savings: Research on contemporary methodologies for valuing resources such as groundwater
Brief Project Description	The project should consider all sustainability aspects of a construction or refurbishment. This should include consideration of novel building materials, taking into account the economic, social and environmental impacts associated with their manufacture, transportation, maintenance and ultimate end-of-life fate. The viability of installing plants for harnessing locally-generated heat and power should be considered for development projects, balancing costs and risks of installation and maintenance of such equipment with more 'traditional' methods of power supply and climate control. The principle of 'pay-back' periods should be investigated with respect to renewables verses non-renewables - not only looking at economic factors but also considering social and environmental impacts of each technology and documenting the latest, respected, thinking on balancing the three considerations; there should be consideration of renewables reliability of supply and the degree to which each technology has been proven in the marketplace. Defensible data should be sought and presented with respect to energy price forecasting and availability, with sensitivity analysis undertaken. The study should also consider the impact of renewables implementation on security requirements for the site e.g. exposed-blade wind turbine failure on building structural integrity/ maintenance requirements for water harvesting/ green roof fire likelihood and mitigation measures. A secondary objective of the project is to look at how natural resources (e.g. the deep underlying groundwater major aquifer, clean air, precipitated water and surface water), ecology and heritage might be financially valued and how the Company can make better use of such resources/ install resource protection as deemed necessary.

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Outline Project Proposal No: EA0901

Host Organisation	Environment Agency
Host Organisation Supervisor	Alex Sutherland
Project Location	
Project Title	Review and update of historic radioactive discharge information for water reactors

Brief Project Description

Review the work done to date by the Environment Agency's contractor on assembling radioactive discharge information for gaseous and liquid effluent; identify areas of paucity of data. Examine and validate discharge data that have become available after the contractor's report was compiled and populate the databases associated with the project. Produce a simple protocol for maintaining this work in perpetuity.

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Outline Project Proposal No: EA0902

Host Organisation	Environment Agency
Host Organisation Supervisor	Ms Jane Rowe
Project Location	Preston, Lancashire
Project Title	Review baseline environmental monitoring data around 3 existing nuclear sites prior to potential construction of new nuclear power stations - Identify any gaps in baseline environmental monitoring data.

Brief Project Description

The Environment Agency is preparing for the Government's plans that a number of new nuclear power stations are constructed and operated. We will wish to understand the impact that any new nuclear power stations may have on the environment and members of the public. To help with this, we will wish to ensure that there is adequate baseline monitoring of radioactivity in the environment prior to the operation of new nuclear power stations. It is likely that the new nuclear power stations will be built at locations where there are existing nuclear power stations and the operators, the Environment Agency and the Food Standards Agency currently monitor the environment around these sites (e.g. surface water, groundwater, sediment, soil, grass, fish, shellfish, meat, vegetables, fruit). You will review the existing Environment Agency, Food Standards Agency and nuclear power station operator monitoring programmes around the sites where it is most likely that new nuclear power stations will be built to examine whether these programmes provide adequate baseline monitoring data. You will identify any gaps in the monitoring programme and provide recommendations to complete the necessary baseline monitoring data. You will need to work with the Food Standards Agency and nuclear power station operators to achieve this.

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Outline Project Proposal No: EA0903

Host Organisation	Environment Agency
Host Organisation Supervisor	Dr John Titley
Project Location	Preston, Lancashire
Project Title	Assess total impact to members of the public from multiple authorised discharges of radioactive substances in two Environment Agency regions.

Brief Project Description

The Environment Agency authorises discharges of radioactive substances to the environment from the nuclear industry (e.g. nuclear power stations, nuclear reprocessing sites) and non-nuclear industries (e.g. hospitals, universities, pharmaceutical industry). We assess the impact to members of the public of discharges from a particular premises. We assess the impact as dose. Defra require us to ensure that doses to members of the public from all discharges we authorise are less than a legal dose limit. We need to assess the dose to members of the public as a result of combined discharges to the environment in a particular place (e.g. multiple discharges to a sewer and hence a sewage treatment works). You will make this assessment for two Environment Agency regions (e.g. Thames and Midlands Regions).

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Outline Project Proposal No: EA0904

Host Organisation	Environment Agency
Host Organisation Supervisor	Mr N Leech / Mr Ray Pemberton
Project Location	Preston, Lancashire
Project Title	Review guidance and standards on monitoring of authorised radioactive substance emissions to air and water to enable the Environment Agency to update its guidance.

Brief Project Description

The Environment Agency is preparing for the Government's plans that a number of new nuclear power stations are constructed and operated. We will require operators to use good practice for monitoring their discharges to air and water. We have existing guidance on monitoring of emissions of radioactive substances to air and water, but it needs to be reviewed to take account of new monitoring developments (e.g. International Standards). You will research current good practice for monitoring emissions of radioactive substances to air and water and then review our existing guidance to provide a plan of what needs to be updated.

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Outline Project Proposal No: EA0905

Host Organisation	Environment Agency
Host Organisation Supervisor	Dr Rob Allott / Dr David Copplestone
Project Location	Preston, Lancashire
Project Title	Assess the impact of authorised emissions to air and water on wildlife in designated European protected sites (Natura 2000 sites) in England and Wales using the EU funded ERICA assessment tool.

Brief Project Description

The Environment Agency is responsible for ensuring that the discharges of radioactive substances to the environment, we authorise, do no adversely affect the integrity of European protected habitat (Natura 2000) sites. We have completed an assessment of the impact of all authorised discharges of radioactive substances using a methodology developed for the Environment Agency. A new assessment method has been developed under the EU funded ERICA project. This project produced an assessment tool. You will use this new tool to produce assessment data which you will use to revise our existing assessments. This will enable us to confirm whether the authorised discharges affect the integrity of Natura 2000 sites.

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Outline Project Proposal No: EA0906

Host Organisation	Environment Agency
Host Organisation Supervisor	Phil Heaton/David Griffiths
Project Location	?
Project Title	Nuclear hazard qualification methodologies
Brief Project Description	There are multiple benefits in making comparisons of nuclear hazard and costs of reduction of it across the nuclear industry: eg identifying priorities to decommission, identifying good practice in hazard reduction to share with others and identifying a proportionate amount of regulation. To date the Environment Agency have tried at least four different approaches (environmental indicators, nuclear Operator Performance Risk Assessment (OPRA), nuclear sector plan performance reports, inventories) with variable amounts of success. More recently the Nuclear Decommissioning Authority have suggested a new methodology called Safety and Environment Detriment (SED) for decommissioning sites. It is suggested that the focus of the project is that (a) hazard qualification methodologies are compared and (b) to see if a common approach can be taken across all sites. Hazard is seen as the combination of inventory, routine discharges and risk of accidental release. The study would not go into costs of reduction as this would involve commercial information but the EA would be able to subsequently access this data if the project was successful. An overview would clarify Environment Agency thinking on areas such as the Regulators Compliance Code and even prioritisation of decommissioning by rigorous analysis of SED data. The challenge in the study will be limiting the scope and this could be fitted to the background of the student.

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Outline Project Proposal No: EA0907

Host Organisation	Environment Agency
Host Organisation Supervisor	David Griffiths
Project Location	
Project Title	Investigate the approach taken to groundwater management on and around nuclear sites, with specific focus on Sellafield, for robustness to climate change impacts.
Brief Project Description	Groundwater conditions at many nuclear sites are being characterised and managed to reduce the impacts of radiological and other contaminants (primarily organics). Whilst the most significant effects may be seen at Sellafield it is likely that climate change will increase the risk of groundwater contamination both during sea level rise and as a result of increased precipitation. These effects may not at present be taken into account when groundwater is being characterised on nuclear sites. What opportunities should be taken to ensure that climate change risks are factored in to contaminated land and groundwater planning and management on nuclear sites? What approach should be taken to groundwater management in order to robustly mitigate and adapt to the impacts of climate change?

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Outline Project Proposal No: EA0908

Host Organisation	Environment Agency
Host Organisation Supervisor	David Griffiths
Project Location	?
Project Title	Determine the main factors affecting the long term (100+ year) viability of locating new nuclear facilities on coastal sites
Brief Project Description	The aim of the project is to determine the main factors affecting the long term (100+ year) viability of locating new nuclear facilities on coastal sites. This will involve identifying the construction and operating risks whilst developing an outline programme to enable operators and regulators to identify and mitigate against environmental damage. This damage will largely arise from the effects of flooding from coastal erosion, sea level rise and from abnormally high seasonal rainfall. The project is highly relevant to the work of the Nuclear Installations Inspectorate.

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Outline Project Proposal No: EA0909

Host Organisation	Environment Agency
Host Organisation Supervisor	Alex Sutherland
Project Location	
Project Title	Assess the types and quantities of solid radioactive waste arising from the operation of discharge abatement plant on water reactors.

Brief Project Description

Examine the publicly-available submissions made to the Generic Design Assessment (GDA) office by reactor vendors to identify types and quantities of solid radioactive waste arising from the abatement plant used to clean up gaseous and liquid effluent streams. Produce a report enabling comparisons of performance to be made between reactor types. Find any available published studies on the performance of individual abatement plant and reference these in the report.

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Outline Project Proposal No: MN0901

Host Organisation	Magnox North
Host Organisation Supervisor	Janet Young & Ian Warner
Project Location	?
Project Title	Review industry best practice to evaluate established waste management practices within Magnox North, against the Best Available Techniques (formerly called the Best Practicable Environmental Option)
Brief Project Description	The focus of the project is to be some or all of the waste streams authorised under the Radioactive Substances Act. In-line with BPEO methodology the project will need to consider implications such as cost, and ease of implementation as well as the technical environmental considerations.

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Outline Project Proposal No: MN0902

Host Organisation	Magnox North
Host Organisation Supervisor	Janet Young & Ian Warner
Project Location	?
Project Title	Establish a process based methodology for undertaking preliminary flood risk assessments at Magnox North sites.
Brief Project Description	A simple methodology is to be established which could be applied by a non-specialist environmental professional making use of easily available data (such as drainage information, topography, meteorological data etc). Output is to to work on two levels. On a portfolio level, the output should enable inter site comparison on the vulnerability of the site to flooding thus enabling prioritisation of the need for further work. On a single site level, the output should aide the identification of 'pinch points' on a site drainage system given a rainfall event of a certain magnitude (likelihood).

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Outline Project Proposal No: MN0903

Host Organisation	Magnox North
Host Organisation Supervisor	Janet Young & Ian Warner
Project Location	?
Project Title	Evaluate the USEPA 7 step DQO methodology as a means for determining clearance of an area in preparation for 'de-licensing'.
Brief Project Description	Consider this methodology against other methodologies, against the current thinking of the HSE and in the context of waste minimisation and ALARP principles.

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Outline Project Proposal No: NNL0901

Host Organisation	NNL
Host Organisation Supervisor	Divyesh Trivedi
Project Location	Warrington
Project Title	Improving GIS based estimates of the volume of contaminated land
Brief Project Description	It is important to know the volume and mass of potentially contaminated land on UK nuclear licensed sites in order to calculate the cost of cleanup, estimated at hundreds on £m on NDA sites based upon calculated volumes. Several methods exist of calculating volumes and mass, all of which involve calculating volume and mass of soil, or more correctly, geological units. Modern methods involve creating 3D bounding surfaces for each representative unit using techniques such as kriging or interpolation etc. Each method produces broadly similar results, but detail present in some methods may be lost in others. A short, but useful project would be to, using a representative dataset (or datasets) from UK nuclear sites would be to examine each the techniques in detail in order to ascertain firstly which technique produces the best results for representing the geology and secondly which of the best techniques produces the best results that are appropriate for the calculation of volumes and masses. Although various modelling packages (such as Rockworks2006, EVSPro etc) can be used, the project should have some basis in GIS documentation, databasing and visualisation. In terms of the latter point, it should be possible to save both new data and created files in a GIS geodatabase, and be able to visualise the calculations both in map form and in 3D using GIS techniques.

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Outline Project Proposal No: NNL0902

Host Organisation	NNL
Host Organisation Supervisor	Divyesh Trivedi
Project Location	Warrington
Project Title	Modelling of flows through a near-surface repository in response to varying boundary conditions and barrier degradation
Brief Project Description	Safety cases for near surface radioactive waste disposal sites undertake calculations to demonstrate risks associated with plausible scenarios over thousands of years in a quantitative manner and hundreds of thousands of years with indicative calculations. The flow of water through near field engineered barriers such as caps, walls, backfill and grouted waste packages will conceptually vary with time. The challenge is to model the flow of water through such materials as they degrade. This project will utilise simple spreadsheet calculations to look at water flows and water balances and how they change with time as near field engineering features change with time. An opportunity will be given for the student to learn to utilise more sophisticated modelling tools, for instance using GOLDSIM, at the NNL offices in Warrington.

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Outline Project Proposal No: NNL0903

Host Organisation	NNL
Host Organisation Supervisor	Divyesh Trivedi
Project Location	Warrington
Project Title	Use of WEPP (Water Erosion Predictions Project) model to investigate potential impact of future climate scenarios on cap performance
Brief Project Description	Near surface radioactive waste disposal sites require safety cases that undertake quantitative and qualitative calculations extending hundreds of thousands of years. Over such timescales it is important to assess if climate change can affect the way that features of the site, such as a cap over the disposal facility, will degrade. This project will utilise a freely available US developed tool (see http://topsoil.nserl.purdue.edu/nserlweb/weppmain/) to undertake calculations on the rate of degradation of an engineered cap at a "model" waste disposal facility, to understand if climate change effects can significantly change the current assumptions concerning cap performance. It is envisaged that some time will be required at the NNL offices in Warrington in order to understand the context and scope of the calculations.

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Outline Project Proposal No: NNL0904

Host Organisation	NNL
Host Organisation Supervisor	Divyesh Trivedi
Project Location	Warrington
Project Title	Under which conditions are colloids transported in groundwater?
Brief Project Description	Colloids have the potential to transport radionuclides in groundwaters from contaminated land and both near surface and geological radwaste disposal sites. Version 2.13 of the freely available PHREEQC speciation calculator tool (see http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/PHREEQC) has the capability to model contaminant sorption onto colloids and subsequent radionuclide mobility. Utilising a platform of work already begun by the NNL, this study will undertake modelling calculations of how radioelements such as Cs, Sr and U will be affected by colloid in groundwater. Model colloids could be iron hyr(oxides) and organics.

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Outline Project Proposal No: NNL0905

Host Organisation	NNL
Host Organisation Supervisor	Divyesh Trivedi
Project Location	Warrington
Project Title	Bitumen as an alternative to cement in encapsulating waste for geological disposal
Brief Project Description	One proposed material for the encapsulation of radioactive waste for long term storage is bitumen, however it is known that bitumen decomposes to form oxalates which strongly complex a number of radionuclides and therefore mediate their transport within the water surrounding the waste store. This study will investigate the complexation of radionuclides under the redox conditions of deep repositories and the subsequent mobility through the repository store water and eventually their movement in to ground waters.

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Outline Project Proposal No: SEL0901

Host Organisation	SELLAFIELD LTD
Host Organisation Supervisor	Dr Rex Strong
Project Location	Sellafield, Cumbria
Project Title	The application of the Waste Management Hierarchy within the nuclear industry.

Brief Project Description

The Waste Management Hierarchy is a common regulatory requirement relating to nuclear sites, which generate aerial, liquid, radioactive and non-radioactive wastes, along with various solid wastes with different categorisations according to their different concentrations. Inherent conflicts are introduced when the concept is applied in such situations, e.g. for a project which generates all these different types of wastes, how can the concept be applied to them all, when decreases in generation of one metric will inevitably lead to increases in another.

It is envisaged that the MSc will involve;

- a review of the origins of the concept and the initial thinking regarding its application
- a review of current regulatory expectations relating to the nuclear industry
- a review of application and limitations in practice within the nuclear industry
- recommendations as to a preferred method of application in future (addressing its internal conflicts) or an argument against its future use in such situations.

Case studies from Sellafield Ltd could be used to illustrate the project.

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