Notes on AMUG meeting

Tuesday 24 April

Update on the response of the Community Environmental Program to the nuclear accident at Fukushima (Ted Hartwell DRI)

The Community Environmental Program started in 1981 with funding from the US Department of Energy (National Nuclear Security Administration) to increase communication between the DOE and local people around the Nevada Test Site. The program now has 29 stations, which are run by the public and collect information on background radiation levels and weather conditions. This monitoring network detected elevated levels of particulate airborne radiation when the Fukushima dust cloud reached the US.

CEMP website (http://www.cemp.dri.edu/)

Nuclear situation in Japan and other relevant issues (Morgan Cox)

Yoshio Hino (JAIST) presentation from IEC meeting in Karlsruhe

The damage to the power plants at Fukushima after the tsunami made landfall is documented. There was no damage at the site caused by the earthquake. The on-going clean-up operation and the requirement for equipment to monitor radioactivity in an emergency situation were highlighted as areas for future efforts.

Fission product releases from Fukushima and Radiation exposure data from Fukushima (Morgan Cox)

Two presentations were given to inform the Air Monitoring User Group meeting on the details of the Fukushima incident.

The US nuclear program is to review safety procedures and ensure better seismic data collection. ANSI N42.58 portable contamination monitoring is to be revised to ensure instrument performance for nuclear and radiological emergencies in the light of the Fukushima incident.

European Detection of Fukushima (Alfred Klett Berthold)

Berthold's production facility had been closed down as a result of the Chernobyl reactor fire when the radioactive dust plume contaminated the site. In the light of this experience and problems at other manufacturing facilities, German industry is now much more aware of the dangers of radioactive contamination. The measurements of the Fukushima plume performed by various organisations (DWD – National Meteorological Service monitoring network (40 stations) in Germany, UK HPA and CTBTO) were summarised.

Phil's Annual Radon Hodgepodge (Phil Jenkins Bowser-Morner)

Phil gave information on the update of ANSI N42.51 – Performance Criteria for Devices, measuring radon in air and highlighted the problems with the 'national standard' for radon and the urgent need for comparative measurements. He also outlined some problems encountered when radon is measured, with in depth considerations of the following:

- The modelling of a large radon release in a uranium mine concluding that the monitoring for all the progeny was unnecessary and monitoring for radon was sufficient;
- The problems of performing mixed radon isotope monitoring using gross α counting which will give an erroneous result if thoron and/or actinium are present.

The Waste Isolation Pilot Plant - Update on Operational Performance (Rob Hayes WIPP)

The Waste Isolation pilot Plant (WIPP) is the first licensed geological repository for Transuranic (TRU) waste in the world. The waste will be entombed in salt deposits which are half a mile underground and ~ 1 mile thick. The underground workings cover ~550 acres. Mixed wastes are transported to the site in TRUPACT containers from the weapons complex and require extensive characterisation prior to consignment to the repository. The waste is placed in underground vaults which will overtime collapse on to the waste causing the drums to compress and ultimately the vault will self-fill the spaces between the individual packages and back fill the excavation unaided. Higher levels waste will be consigned to individual tunnels and the tunnel plugged after waste insertion.

TRUpack-III is a standard large box for consigning larger items (glove-boxes, lathes etc) which will reduce the waste generated by the sectioning of these items for consignment in 55 gallon drums, also glove-boxes may be pre-filled with waste and consigned full to better utilise the space.

Airborne Radioactivity Monitoring Users Group (Hilary Phillips NPL)

NPL's role and the ARMUG

Dynamic Radiation Sources for algorithm testing (Tom McLean LANL)

Proof of principle has been demonstrated for a mechanical device to enable the testing of transuranic aerosol collection on CAM filters without the need to generate the transuranic aerosol. The device also tests radon/thoron correction algorithms. Evaluation of this device is currently being performed.

Manufacturers Presentations:

Thermo Fisher Alpha 7A/L update (Scott Lamb Thermo)

Ungrounded Ethernet connectors on the Alpha 7 CAMs sometimes cause sparking and resetting of the CAMs computer. The ungrounded connections are being corrected in the field and in the current production Alpha 7 CAMs. LANL currently operates 280 Alpha 7L CAMs.

A New Approach To Acute Alarming in Continuous Air Monitors (Dave Baltz Bladewerx)

Use of Bayesian statistics for radon compensation and alpha spectrum activity determinations for a more rapid response to transuranic activity in CAMs.

SmartCAM Alpha Beta Plus Lab Impex (Jeff Sawyer Lab Impex)

Current status of Lab Impex effluent monitoring instrumentation.

eCAM (Arthur Desrosiers, SEC Perma-Fix Environmental Services, Inc.)

A new concept for radiation monitoring including air monitoring that uses centralized data analysis, data storage, and direct notification methods (e.g. email, text, or automated voice) to provide autonomous air monitoring.

The core of the eCAM is a radiation detector that has no local data display – the raw count rate from the detector is transmitted to a remote computer for analysis, data archive, and status/alerts/alarms.

Wednesday 25 April Visit to the Nevada Test Site

Thursday 26 April

HT/HTO Tritium in air monitor exposure project (Hilary Phillips NPL)

Tritium monitors exposed to HTO and HT in humid conditions

ANSI N323A and ANSI N323B Test and Calibration of Portable Survey Instruments (Ed Walker)

ANSI N323A 1997 Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments
ANSI N323B 2003 Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments for Near Background Operation

Standards now combined

Revisions include: - homeland security definitions

- Single nuclide performance checks if used with nuclide in question
- 3 point calibration preferred if beta curve used

- Recalibration frequency extended (necessity for annual recalibration removed provided; routine daily response recorded and does not deviate from expected value by more than 20%, use of control charts to demonstrate performance within bounds, may use total of all operational hours to define recalibration interval, other protocols may be acceptable if inline with standard
- Revised accuracy requirements calibration to reflect instrument use
- Records section expanded to give better information on record keeping
- Use of 2 source sizes for surface contamination measurements (10 x 10 or solid planchettes)

RadNet and Fukushima for AMUG (Ron Fraans EPA)

The EPA (US Environmental Protection Agency) routinely performs environmental monitoring for air, milk, rain and drinking water across the US at its 80 monitoring stations. These have a capability to track national airborne radiation levels and perform assessments of the data generated to inform authorities concerned with public wellbeing.
The network is built on the Environmental Radiation Ambient Monitoring System (ERAMS)and is operated by volunteers, who have received training and the necessary equipment (high volume air samplers 60m^3/day, minimally shielded 2" x2" NaI with partial thermal stability which uses a 4" polyester filter that runs for a week between filter changes). An encrypted telemetry system is used to relay data to central analysis station. If gross alpha/beta counts exceed a pre-set screening value additional lab observation is triggered. An annual calibration is performed using an Am-241 source, with additional auto calibration using a pulser.

DOE/NNSA Radiological Assistance Program (RAP) Capabilities Overview (Rob Hayes)

To give a radiological emergency response capability within US (or abroad e.g. Fukushima) teams of trained personnel have been formed from US DOE and its contractors. Each team consists of 8 members; one Team Leader, one Team Captain, one Senior Scientist, and five Health Physics Survey/Support personnel. The teams aim to be fully mobilized within 2 hours of notification, with on-scene arrival within 6 hours of notification. Team deployment is achieved by dedicated response vehicles, and charter or commercial air services. Each team is fully equipped to be capable of detection and identification of radioactive materials, performing environmental monitoring, evaluation of any hazards and/or risks that may be present and the dissemination of acquired information on the situation. Each team is provided with full PPE and α-, β-, γ-, and neutron monitoring instrumentation. Vehicle based systems (NaI and HPGe), and air samplers (high and low volume) are also supplied. Additional radiation mapping equipment is provided by helicopter or aircraft mounted systems to enable coverage of the extended area.

Simple Real-Time Measurements of WL and WLM with an Alpha CAM through the Utilization of Fundamental Concepts (LA-UR-12-20298) (Alan Justus, LANL)

Many working level (WL) measurements are based upon radon progeny activity concentration determinations using multiple timed counts or multiple detectors. An alternative approach is presented that makes use of the fundamental definition of WL, with an alpha CAM conceptually

replacing the role of a human lung. Simple algorithms are given for WL(Rn), WL(Tn), WL(total), as well as WLM(Rn) and WLM(Tn).

Use of Canberra iCAMs at Argonne National Lab (Charlotte Sholeen ANL)

A description of the use of the Canberra iCAMs in a facility with engineered air flows used for waste handling over four floors, three of which are underground was given. Thoron levels within the building are less than those for radon; however the compensation applied for radon gives a satisfactory compensation for thoron. The monitor placement was determined using smoke flows and with consideration for work patterns within the limited room space of the building.

A new statistical analysis technique for air monitoring (Rob Hayes, URS Washington TRU Solutions LLC)

WIPP effluent air monitoring has indicated increasing Pu content over time in the mine, observation of the colour of the dust at the base of the shaft has also changed from nearly white to a colour closer to that on the surface. Air entering the mine is not filtered and the contamination has potentially migrated from the surrounding land at the test site. Evaluation of historical data accumulated over 10+ years indicates an unexpected increase in Pu levels above that anticipated from the work performed in the mine. Re-examination of the data is in progress and various statistical uncertainty techniques are being employed – advice was sort on the method used.

Dust Loading Studies at the Savannah River Site (Dennis Hadlock Savannah River Nuclear Solutions, LLC)

Dust loading on filters may prevent the detection of a critical airborne alpha release or invalidate the use of the routinely applied 20% correction factor for self-absorption and dust loading on the filter. Increasing dust loading attenuates the alpha spectra to lower energy values and may lead to false analysis.

1998 study data has been rechecked and some of the work repeated to give greater confidence in the earlier findings. This was reported at the 2007 annual Health Physics Society meeting. As previously studies were performed using mylar as a dust substitute and the attenuation related to that from dust. The dust loading was achieved by exposure of the filter to the environment (3 day intervals at a location) which proved to be problematic.

Manufacturers presentations:

Physical Separation Of Materials As A Means To Achieve Multi-Channel Air Monitors With Near Zero Cross-Talk (Robert Goldstein, Overhoff Technologies/Technical Associates)

At many nuclear facilities, air and stack monitors have the responsibility to measure multiple radio-active materials, separately and simultaneously with great accuracy and high sensitivity even when high concentrations of one nuclide are likely to mask the signals from low concentration of other

nuclides being measured. Most ionising radiation detector types exhibit significant cross talk when presented with multiple sources of ionizing radiation.

Overhoff Technology sees a need for a new family of air and stack monitors to simultaneously measure Tritium, Organic C-14, Inorganic C-14 (14CO2) and Noble Gases. Overhoff has designed a new monitor which incorporates a Nafion membrane to separate HTO from other radioactive gases that are present in the air to be monitored.

Canberra Tritium Monitoring (James Forde-Johnston, Canberra)

Tritium monitors from Canberra

CAMs and High Level 220Rn Releases (James Forde-Johnston Canberra)

The Areva Uranium reprocessing and enrichment of facility in Central France (George Besse II) has a requirement to monitor for thoron (^{220}Rn) gas leaks from equipment. ^{222}Rn and ^{220}Rn interfere with U, Pu measurement in Alpha CAMs. Compensation is necessary for radon events in the long-lived region of the alpha spectrum. Normal compensation methods assume only ^{218}Po, ^{214}Po ^{212}Bi and ^{212}Po peaks are present in the spectrum. An assumption that 'aged' ^{220}Rn is of geological origin. When 'fresh' ^{220}Rn is present at high levels a peak from ^{216}Po at 6.78 MeV could be seen on CAMs and may compromise the compensation. if the air contains 'aged' thoron the compensation works well, however if the air contains 'fresh' thoron peaks from Po-216 a revised compensation algorithm is required which has been based on Bayesian statistics.

AMUG 2012 EMD Millipore Product Overview (Celia Landers Millipore)

Millipore was founded in 1954 and has been manufacturing filters ever since. It is now part of Merck KGaA.

Millipore produces three types of filters; Depth Filters (a matrix of randomly oriented glass or polypropylene fibres pressed together to form flow channels with no exact pore size), with a large particle loading capacity and excellent flow rates; Screen Filters of PTFE, PVDF, MCE for dusts and aerosols which have 'absolute' uniform pore sizes; Track Etched Filters, rigid filters of a uniform mesh material with a smooth surface and uniform diameter pores generated by exposure of the film to a beam of accelerated Cr^{6+} ions, and submersion in a bath of NaOH to selectively generate the pores.

Material used in filter production are; MF – mixed cellulose membranes used in environmental monitoring; Glass fibres – borosilicate microfiber for large sized particulate with variable pore sizes; polycarbonate with the smallest pore size of all the filters generated by track etching; PVC – medical grade filters for the collection of silica, carbon black, quartz, lead etc.; PTFE – brands Fluoropore and Mitex (unsupported). Hydrophobic inert membranes used for alpha particulate collection.

WirelessWall Inside (Ed Smith Wireless Wall)

VPN provides encrypted network access via client servers; however security is often on the laptop / PC and also on the server to which these are connected but not on the wired connections between these which offers the potential for illicit signal high-jacking. Wireless Wall has installed a totally secure system at the Savannah River Site using wireless connections to give a completely secure and encrypted system, a first within the industry.

Question: Why is wireless use not acceptable in the nuclear industry?

Friday 27 April

Looking for life in the wrong places (Duane Moser DRI)

Possible link between radiation and life?

The limits of biosphere may be extended to include the bacteria found in deep geological formations (~99% of these bacteria cannot be cultured in the lab), desulforudis audaxviator (sulphur eating bacterium) are the dominant species in water samples from very deep mines/boreholes which contain water from 100 million years ago.

Studies of deep mining excavations including the mine on the Nevada Test site have found bacteria (desulforudis audaxviator). This bacteria exists in geologically deep mines (studied using deep bore holes into the Amargosa dessert Ash Meadows gravity fault, Black Hills Gold Mine - Homestake Mine South Dakota to be used for neutrino studies, Sudbury in Ontario in Canada (deepest mine in western hemisphere), Driefontein Mine, South Africa (second deepest mine in World). The bacteria is thought to grow in radiation driven ecosystems (Driefontein Mine was previously mined for Uranium and is now a gold mine) which contain water from 100 million years ago. The bacterias presence in the Nevada Test Site mine is unexpected. Has it been formed as a result of the nuclear testing on the site and entered the mine in deep water flows? Subject for further investigation.

High specific activity TRU waste project (Martin Brennan Sandia NL)

The TRU waste concerned is a small amount of Pu-239 waste (different to weapons grade waste) accumulated on site and requiring disposal. Some re-packing of the 20 year old waste drums prior to consignment will be required. The waste contains an engineered metal oxide with an AMAD (Activity Median Aerodynamic Diameter) of ~1 micron; inhalation, ingestion or injection of a single particle will result in a high internal dose-rate. Other waste drums contain liquids which will require solidification prior to disposal.

To treat the particulate a glove box system is being commissioned with additional controls (glove bags, area ventilation, hepa filtration etc.). The glove box pipework will be upgraded to stainless steel and bends removed to reduce the locations for particulate accumulation. The heap filter will be positioned inside the glove box to reduce the likelihood of contamination escape on filter change. The room ventilation has had valves installed to enable an airflow to be re-directed towards the

glove box to ensure removal of any external contamination. The glove box will operate at a negative pressure to that in the room to further minimise potential contamination. The waste handling system to be used will initially be tested on the bench were access is easier for modifications / servicing before installation inside the glove box. A large opening has been installed on one end of the glove box to enable the passage of larger items into the box via an air lock.

Consideration has been given to the type and positioning of air monitoring instrumentation (smoke testing) and the potential use of personal air samplers. Background studies over several weeks will be performed to accurately establish background levels before the glove-box is brought into service. The number of false alarm responses is being minimised and the generation of indicators of potential containment failure based on CAM responses has been evaluated. NUREG 1400 criteria have been used to assess the likely dose from the operation of the glove box.

Effects of barometric pressure on the measurement of radon and its progeny and the effects of measuring this in gases other than air (methane and carbon dioxide) (Phil Jenkins Bowser-Morner)

The potential effects of humidity on CAM measurement may be a consideration at some locations and should be established if %RH may fluctuate during CAM operation.

Variations in atmospheric pressure may also effect these measurements as well as the instrumentation response to radon in gases other than air e.g. methane burnt in homes / power generation or carbon dioxide (used in soft drinks industry).