Cefas

Cefas contract report RC103

RC103 project

FSA/CEFAS Mobile Monitoring Unit (MMU)

End of project report

Covering the period of 1st Jan 2004 to 31st Mar 2007

Science commissioned by the Food Standards Agency

Environment Report RL 17/08

RC103 project

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Paul Smedley
4th April 2007

(E&E Group)

CEFAS Lowestoft
Laboratory
Pakefield Road,
Lowestoft
Suffolk

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Introduction

The aim of the RC103 project was to maintain the Cefas MMU in a state of readiness for deployment anywhere within the UK mainland, within 24 hours, for monitoring radioactivity in the general area near to the scene of a radiological emergency. This was to enable the FSA to have available information on radioactivity in food (and other indicator samples) more quickly in an emergency and to optimise its decisions on food bans and further surveillance.

The RC103 project was a continuation of project RP258 'Development of a mobile facility for monitoring of radioactivity in food during an emergency' commissioned by FSA 1st Apr 99 and completed 31st Mar 2003. Details of RP258 can be found in Cefas Environment Report RL11/03.

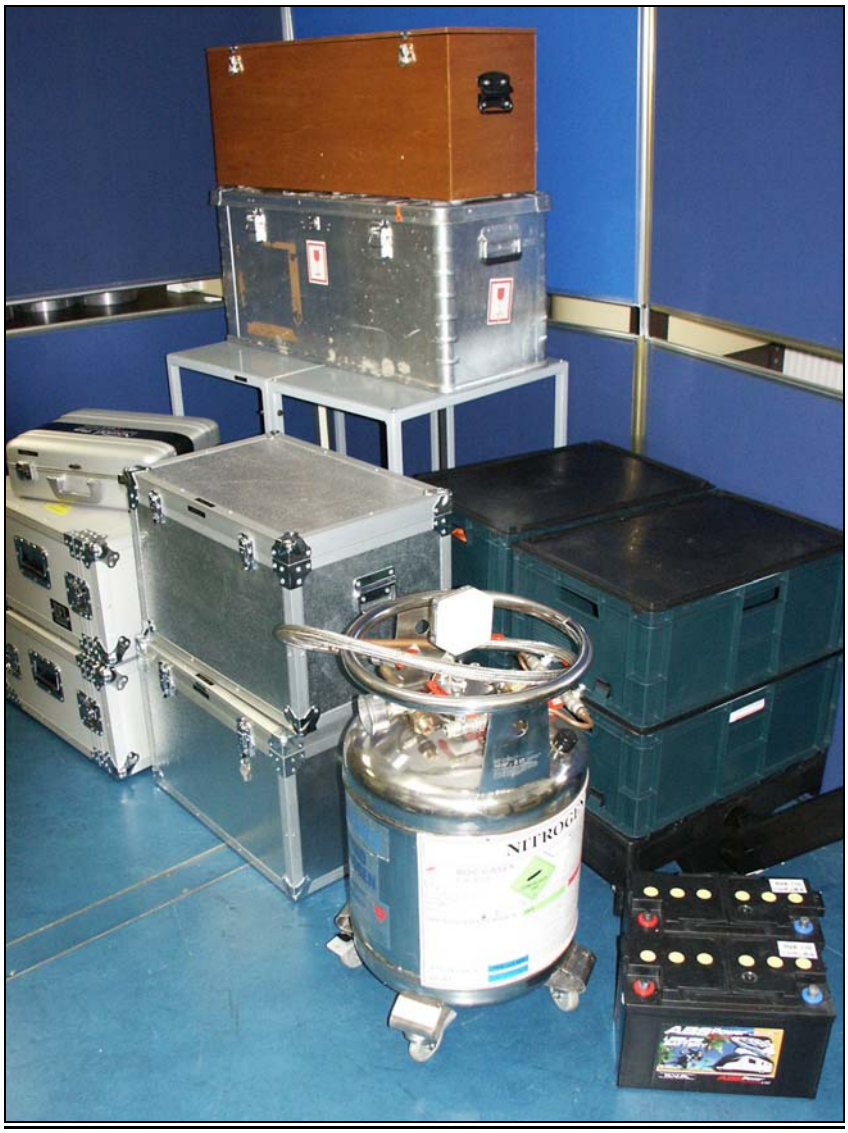
The project commenced in Jan 2004 and was added to the Food Standards Agency Service Level Agreement with CEFAS, for the Provision of Scientific Services: 2002-2007, in the same year. FSA project officer and point of contact has been Teresa Naylor, CEFAS project manager for the life of the contract has been myself Paul Smedley together with Dr John Hunt acting as technical advisor.

The period that this report covers is the 1st Jan 2004 to 31st March 2007 and describes the various works undertaken by Cefas on FSA's behalf.

Overview of service

Provision of service

The emergency mobile monitoring unit (MMU) is a dedicated self contained system designed for the fast analysis of a wide range of environmental samples under emergency conditions. The system is modular packing into secure boxes suitable for transport by road, rail or air (air transport is subject to certain restrictions).



The mobile equipment packed for shipping.

Cefas has in operation a 24/7 call-out system, ensuring an appropriate number of trained staff are available outside working hours for the deployment of the mobile monitoring unit. Unit and staff can be ready for dispatch in 2 to 4 hours, during normal

working hours. Cefas MMU maintains a list of suitable vehicle hire companies for this purpose. If no vehicles are available the MMU then uses Cefas pool vehicles.

If the request is received outside normal working hours deployment time increases to 6 hours. This is to allow staff to be contacted and mustered and the arrangement of hire vehicles (arrangements have been made with local hire companies who are willing to provide out of hours service).

Twelve staff have been trained in sample collection and sample analysis using the portable counting equipment. Prior to each 8-hour shift a team and deputy team leader is appointed in the field with responsibility to co-ordinate the MMU, the field sampling teams and act as contact point for field communications.

After being mobilised the unit can be in the locality of the incident in 24 hours within mainland England (subject to time of notification, and location of the incident). On arrival the MMU staff can make the unit operational with the NaI detectors within 1 hour and fully operational with HpGe detectors within 2 hours (subject to the 6-hour cooling). The set-up time includes initial background and QC checks on all counting equipment at initialisation, which is repeated every two hours. Cooling time can be incorporated in to the travelling time so if the journey time is greater than 6 hours the HpGe detectors would be ready for deployment on arrival.

The Cefas laboratory at Whitehaven can also serve as a base for operations if required with staff trained in the use of MMU and sample collection procedures.

Once operational an estimated sample throughput of 15 to 20 samples per hour can be achieved (subject to sample collection times). This assumes a counting time of 10 minutes per sample plus QC checks. All counting systems have the capability to analyse any type of environmental material subject to that material being presented to the counters in the appropriate geometry.

The Cefas MMU staff can provide results verbally or electronically in the form of spreadsheets via email. Presently sample identification code, grid reference, sample description, time taken, nuclide, result, error and units are reported although this is adaptable to the customer's requirements.

Grass, soil and food collection

Cefas has also supplied trained staff to man emergency sampling teams to collect grass, soil and food samples from locations specified by the FSA (subject to safe working practices). Those involved in the MMU and sample collection have been trained in the relevant techniques and have completed refresher training on an annual basis. Training plans have been included in regular reports to the FSA, and summarised in the annual end of year reports.

Each sampling team is equipped with maps, GPS, Mobile phone, sampling equipment and radiological safety equipment including dosimeter with built level alarm. Mini 6/81s are also carried to measure dose rates in the sampling areas.

Sample details NGR, time collected and if applicable surface area are recorded. On return to the MMU each sample is issued with a unique identification number. The samples are then weighed and prepared for analysis in an appropriate counting geometry.

Sample containers are of a type appropriate to facilitate low counting time at an acceptable level of detection. The standard geometry for food and grass is a 287ml plastic tub with lid. Liquids are analysed in 1-litre poly bottles. The MMU also holds stores to enable continuous sampling for several days.

Counting geometries

Minimum sample weights required for analysis	
Sample Type	**Quantity**
Grass	100g
Food and herbage	250g
Soil	300g
Liquids	1 Litre

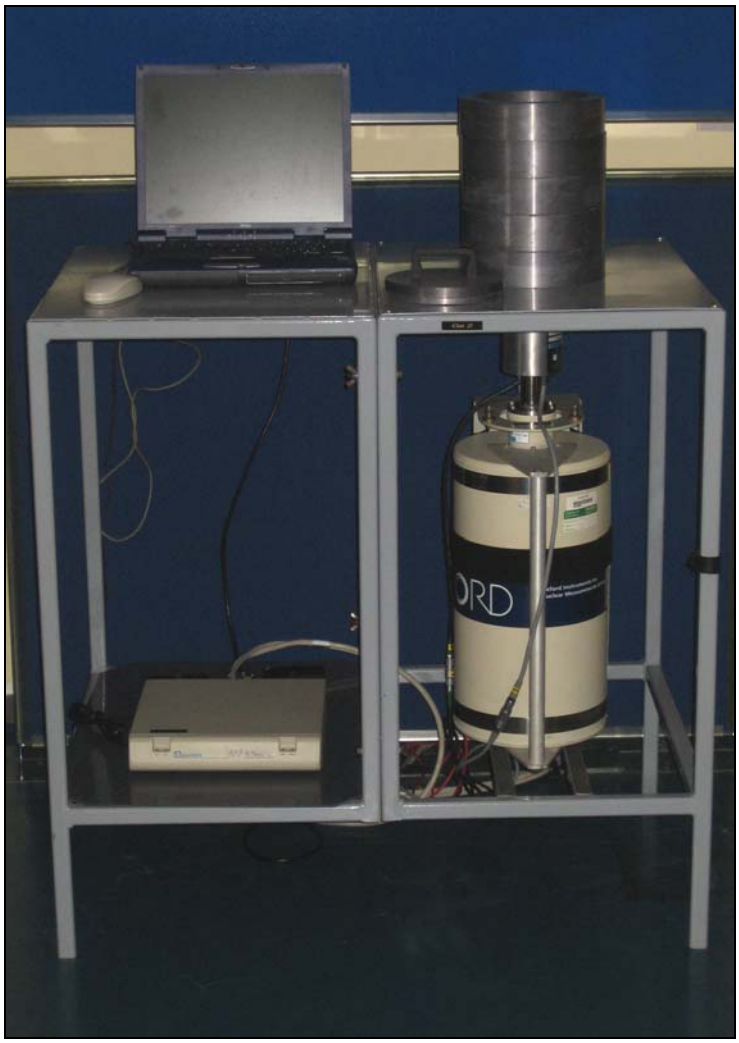
It should be noted that no sampling team would enter areas of contamination where dose rates exceed 7.5μ Sv/hr.

Dedicated mobile phones are issued to both the MMU staff and the sampling teams. For areas of poor reception, a satellite phone is also provided. Communications can be routed through the Lowestoft based emergency advice staff or the MMU staff directly.

Technical specifications of equipment.

Oxford/Canberra Hyper Pure Germanium (HpGe) gamma detector

- Oxford/Canberra Hyper Pure Germanium (HpGe) gamma detector ('P' type)
- Relative efficiency of 47.4% @1332.5 keV
- Aluminium end cap
- Canberra Inspector 1200 Multi-channel analyser
- Genie 2000 PC spectroscopy software
- Purpose built sectional support table
- 25mm lead shielding
- Portable power supplies
- 5L portable multi-orientation Liquid Nitrogen Dewar (48 hour running time)
- Cool down time of 6 hours



Oxford/Canberra HpGe detector assembled for use

Perkin Elmer Hyper Pure Germanium (HpGe) gamma detector

- Perkin Elmer portable Hyper Pure Germanium (HpGe) gamma detector ('N' type)
- Relative efficiency of 65.0% @1332.5 keV
- Carbon fibre end window
- Perkins Elmer Nomad Plus Multi-channel analyser
- Laptop
- Gamma Vision-32 PC spectroscopy software
- Purpose built sectional support table
- 25mm lead shielding
- Portable power supplies
- 3L portable multi-orientation Liquid Nitrogen Dewar (24 hour running time)
- Cool down time of 6 hours

Perkin-Elmer HpGe detector assembled for use.

Liquid Nitrogen storage Dewars

Two compact pressurised cryogenic Dewars ensure that sufficient liquid nitrogen is available for up to 7 days deployment based on a top every 24 hours. Safety procedures and equipment are also included.

Sodium Iodide (NaI) 3”x3” Low resolution gamma detectors

- Three lightweight portable Sodium Iodide (NaI) 3”x3” gamma detectors
- Custom-built stands
- 10mm lead shields
- 3 laptops
- Spectra analysed by LCG Spec low-resolution gamma spectroscopy software.
- Individual portable power supplies.
- Ready for use in less than 1 hour from assembly.
- Can be deployed individually from the back of a small car or van.

Sodium Iodide detector and operating laptop

General info on counting equipment

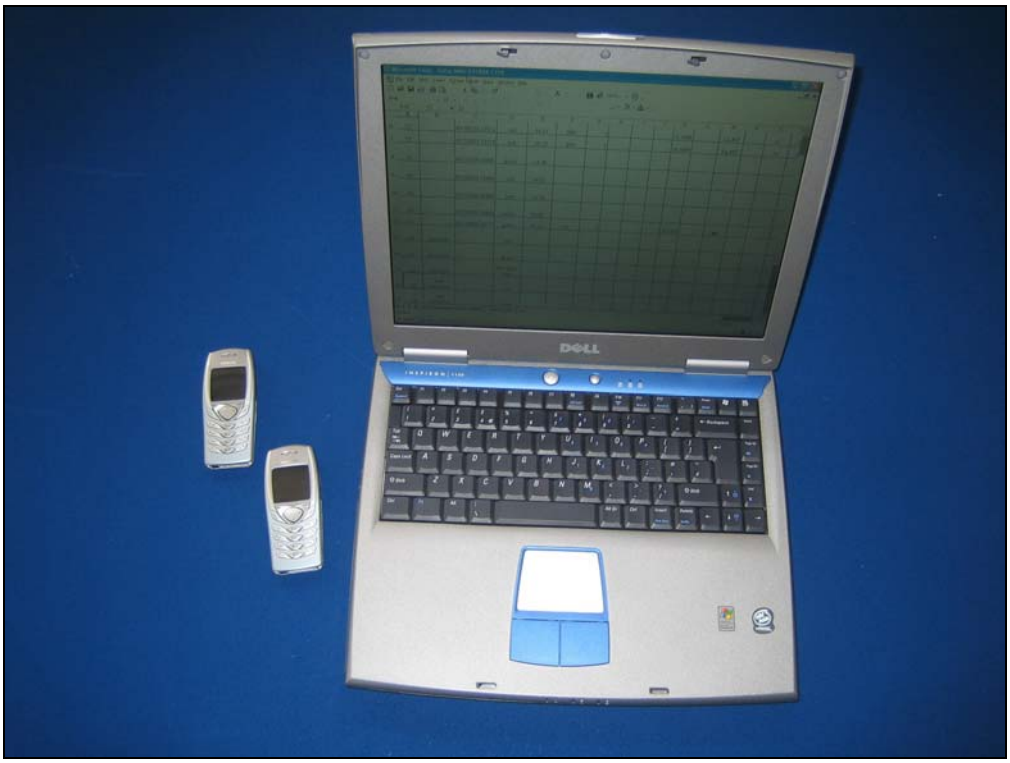
Each detector is specifically designed for the fast analysis of environmental samples for gamma emitting radionuclides within the range of 60keV and 2MeV. Each detector is a single standalone unit with its own portable rechargeable power supply giving a operational time of 24 hours between recharges, alternatively the units can be run from a generator or mains power supply. The size and configuration of the equipment allows it to be operated from a large van or in the case of the NaI equipment from small van or car. Alternatively all equipment can be deployed from a building including one of our other sites (Weymouth, Burnham or our out station at Whitehaven Cumbria). HpGe detectors have an advantage over traditional sodium iodide in that the higher resolution enables the counting system to analyse relatively complex spectra containing several radionuclides and peaks, which may be of a similar energy. The disadvantage is the lower measurement efficiency, need for liquid nitrogen and a cooling down time before use.

Cefas MMU team conducting analysis of samples from a Van

Operating the NaI detector from a car.

Additional equipment

Digital maps, Maps and Handheld GPS equipment



Communication equipment

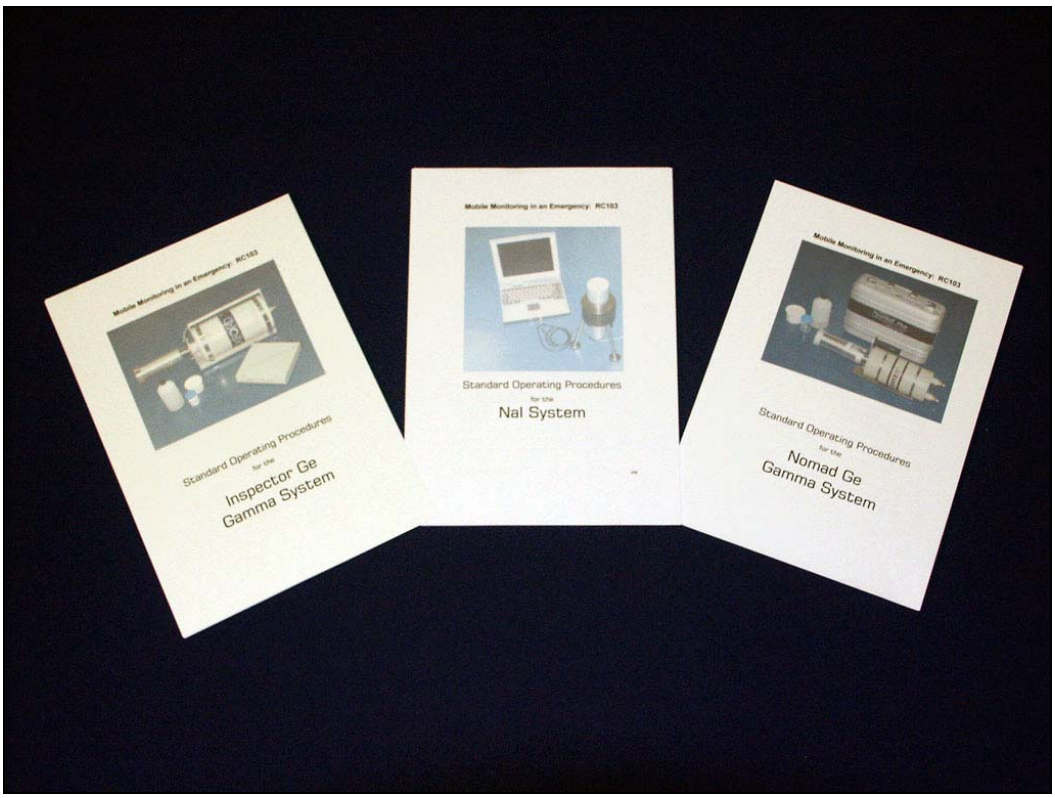
Dose/contamination equipment (LB122, mini 6/80, mini-instruments)

FSA Milk Monitors (Milk screening for Iodine-131)

Maintenance of systems and quality control.

The counting equipment is supported, calibrated and maintained by Cefas. Minor repairs have been completed on site by our own electronics staff. Major components are covered by an annual manufacturers support contract.

To maintain a consistent level of quality, Standard Operating Procedures have been developed over the three years covering both the counting equipment used in the MMU and sampling techniques, SOPs ARE reviewed annually and modified following feedback from the users and requirements of the customer.



Standard Operating Procedures for use of the mobile counting systems.

All counting equipment is calibrated at Cefas against traceable certified standard solutions. Different density materials in a range of geometries represent the different types of environmental samples analysed. All counting equipment is tested on a quarterly basis with performance and corrective action recorded. All dose equipment is tested and calibrated by an appropriate testing laboratory annually.

As part of the continued MMU Team training quality control samples are passed through the counting equipment on a regular basis. Each piece of detector has its own

quality control sample consisting of a sealed into 287ml Tub containing known amounts of Am-241, Cs-137 and Co-60, these have been chosen to give a test over the whole of the energy range (Low, medium and high energies). In their analysis they are treated as samples and the results reported are compared to the known activities, if the activities are within the upper and lower limits set for the equipment then it is passed ready for use. Peak positions are also checked and if necessary adjustments made. Other test samples can be used for general diagnostics or demonstrations.

Other equipment is tested and charged on a regular basis to maintain a state of readiness in case of an incident.

Feedback obtained from exercises and training sessions are reviewed and where practicable suggestions incorporated into the MMU systems and procedures thus maintaining a level of self-improvement and quality of service.

Report of activities – 1st Jan 2004 to 31st Mar 2004.

Targets for 2004 (Jan to Mar)

- Update SOP taking into account comments from FSA.
- Take out maintenance contract with supplier
- Equipment performance testing. Set up equipment, test normal function, check calibration against standards including nuclides in food sample geometries expected in emergency situations and produce test report. Testing to be undertaken for each detector at a rate of at least 4 times per year.
- Identify staff for initial training programme
- Consider training programme and compile training notes
- Carry out initial training sessions with feedback from trainees
- Agree with FSA a suitable exercise in 2004/05 for field deployment
- Write report of activities for year
- Produce calibration standards for nuclides in suitable sample geomteries

Summary of progress

This contract was signed up in January 2004 however it had been under discussion for most of the previous year and preparations had already been in hand. Thus whilst some of the purchasing had to be delayed, causing compressed activity from January to March 2004, much of the groundwork had been done, and the targets met.

The SOPs for the equipment were updated and updates sent to FSA during January/February 2004.

A maintenance contract was agreed with Canberra-Harwell Ltd and took effect from 1 March 2004. Contract covers the two Hyper Germanium counting systems.

Quarterly testing of counting systems commenced, each detector has its own quality control sample, which is counted as a sample, and the result compared to expected values and limits. The calibrations were done against quantifiable standards in appropriate geometries. The equipment performed as expected; the exercise revealed

the potential for effects due to some temperature drift with the NaI detectors and was addressed in the SOP calibration procedure.

Calibration standards were produced in 287ml tub, 150ml pot and 300ml (litre bottle) geometries. The solution used was a certificated multi-nuclide Amersham standard covering the full operational range of equipment. The calibration for the standard tub geometry had been completed and fully tested on all 5 detectors. The other two geometries will be completed in May 04.

The additional staff for the initial programme of training were identified. Training notes were compiled and sent to FSA. Initial training was carried out in three 1½ day sessions with two trainees each session. Feedback was appreciative, there were no major problems, and some minor changes were made to SOPs as a result. Trainees underlined the need for annual refresher training, which we have already identified. Consideration is also needed of ways to assist troubleshooting when operating in the field.

Report of activities – 1st Apr 2004 to 31st Mar 2005.

Targets for 2004/2005

- Carry out necessary briefings and deploy/use equipment during an emergency exercise; conduct debrief.
- Revise SOP with lessons learned
- Revise training with lessons learned
- Carry out second training campaign
- Equipment performance testing over year.
- Liase with FSA to plan 2005/06 programme

Summary of progress

Emergency Exercise Deployment

The deployment of the equipment and trained staff during an exercise was brought forward to March 2004, as the exercise and locality seemed appropriate. The exercise 'NEMESIS' was based around the Sizewell site, a summary of CEFAS involvement was issued as part of the 2004 end of year report. A debrief was held after the event and discussed with FSA. I have included a brief list of key issues raised and comments as they have an effect on the work carried out during this reporting period.

Main debrief points and comments

- Vehicles, communications, electronics etc. generally worked well. NaI equipment suffered from peak drift due to change in temperature that needed adjustment in the field.

  Comment – Mobile power supplies were modified to improve stability, drift due to temperature changes are still evident but staff are now trained in how to make adjustments to the NaI systems.

- The trained staff quickly found their roles though further training would be required in sampling techniques especially dealing with soil and grass sampling for Bq/m^2 analysis.

  Comment – Annual refresher training required to 'keep the trainees hand in'

- Staff safety during an incident

  Comment - It has been agreed that the MMU team will be deployed in the event of a radiological incident but safety measures but must be in place to minimise the potential radiation exposure of the team and the equipment.

- Long list of nuclide results to transmit, all needed eg Rb-88?

  Comment – List was not supplied as definitive but as a guide and has now been edited to include only essential nuclides (Iodine, Caesium, Americium, Cobalt etc.) Nuclides with only second or minute half-lives were removed. Only positive results will be recorded/transmitted and no MDAs unless requested to do so.

- Sampling takes time (15 min per location)

  Comment – Consideration has been made to where samples are taken, with better grouping and or chosen location to minimise travelling and maximise sampling time. Grass and soil sampling for Bq/m^2 will still take longer than standard sampling methods and this is unavoidable.

- Exercise too short to get much field test data, exercise started 09:00, CEFAS MMU Team deployed from Lowestoft at 10:35, MMU set-up for first sample arrival by 13:15, and exercise finished at 15:00.

  Comment – Consideration will be made to whether it will be more useful to deploy the MMU Team to the area ahead of the start of the exercise to maximise sampling and analysis time as travelling time is irrelevant during this type of exercise.

- The Bq/m^2 philosophy needs consideration.

Comment – It has been agreed that Initial concentrations in grass/soil may be needed in areas that have been traversed by the plume in order to refine source terms and modelling parameters. It should be noted this would slow up sampling and analysis due to the extra steps involved in establishing Bq/m^2.

- When to move to food monitoring?

Comment – Though food was not sampled during the exercise the point was raised for discussion in case of a 'real' event. It was agreed that the first sampling would probably be of indicators as in soils and grass followed by milk and other foodstuffs. FSA would advise when the changeover would start but it would probably be some time after the initial event.

SOP Revisions

Lessons learnt from the 'NEMESIS' exercise and from the training sessions with the MMU staff have resulted in numerous minor changes to the NaI and HpGe SOPs. The changes are mainly connected with clarification of operational procedures and the implementation of additional calibration curves for liquid and grass sample geometries. New copies of the amended SOPs have been issued to both the CEFAS staff and to FSA.

Additional SOPs were also compiled on sampling of indicator samples (Soil and Grass) for Bq/m^2 analysis. Also a simple guide was written on the operation of the NaI Milk Screening Equipment (new addition to the MMU).

Training revision

A new training plan was drafted taking in to account observations and comments made during the emergency exercise and from the first session of training. The main changes were the inclusion of training on 'Equipment fault finding and adjustment' this was to aid the MMU team to identify potential faults with equipment and how to take appropriate action. Also included was training on the use of the NaI Milk screening equipment (new for 2004/05). A copy of the new training plan was forwarded to FSA in Jan 2005.

Second training campaign

It was identified from the emergency exercise 'NEMISIS' that further training sessions were required for the 6 MMU Team members as well as training of additional staff. Throughout the year the MMU team members were encouraged to get more hands on experience with the equipment. The one NaI permanently located to our Whitehaven Laboratory (since Nov 2004) was used and tested on a monthly basis, the two staff there are where very competent users sending regular test reports on QCs to Lowestoft.

The Lowestoft based team also completed several tests and quality control tasks with both the Germanium and NaI detectors. There was also additional training in equipment fault diagnostics and adjustment that should enable the team to correctly identify a fault and take appropriate action to overcome the problem. This is especially important with the NaI equipment, which can require manual gain/peak adjustment due to temperature differences from being set-up in the laboratory, when used in the back of a vehicle.

Training in the basic operations of the newly acquired NaI Milk Screening equipment was also started using the Lowestoft based staff. More training would be required when a suitable procedure for sampling is agreed.

Equipment maintenance and testing

Three FSA milk screening monitors added to the MMU at the FSA's request. Monitors to be maintained in a state of readiness and to be used for rapid screening for I-131 in Milk.

As part of the continued MMU Team training frequent quality control samples were passed through the counting equipment on a quarterly basis and in the case of the Whitehaven unit on a monthly one.

Both the NaI and Ge detectors have functioned well and only needed minor adjustments to compensate for peak drift, there was some user errors (entering wrong sample dates for one) but this was more or less eradicated through retraining. The Ge detectors were particularly stable which is to be expected due to the superior electronics and complexity of the equipment. However Ge no 2 (Oxford/Canberra) developed a fault in that it warmed up during use (bias shuts down after 2 hours during use), this equipment was covered by an annual repair contract and was repaired.

As part of the continued upgrading and development of the systems it was felt that one of the laptop PCs required replacing (the first one which was purchased back in 1999). The screen was of an older type and was difficult to see in bright light and the general performance of the PC was slower than that of the rest of the systems. A suitable replacement was purchased. The older model retained as a spare.

Additional Comments

In addition to the normal course of work Dr John Hunt and Paul Smedley of Cefas were requested to give a talk and demonstration on the MMU equipment to selected FSA staff connected to the work at AVH London. The talk took place on the 30th Nov 04 and was well attended and received. It quickly became clear that there are two demands on the system one to provide (Bq/m^2) data on non-foodstuffs at 'precise' locations to refine modelling parameters in the early stages of an incident. The other to provide a quick analysis of foodstuffs (Bq/kg or L) to lift imposed food bans in areas of possible contamination, post event.

There were some points raised on homogeneity, hotspots and cross contamination. It was pointed out that though basic sample preparation and cross contam prevention can be dealt with by the MMU team the system is not a mobile laboratory and so has limitations. If a greater accuracy or additional analytical techniques are required (hotspot removal and analysis for instance) then it is advisable to send samples to the main laboratory, which have the extra facilities to deal with the issues raised.

Report of activities – 1st Apr 2005 to 31st Mar 2006.

Targets for 2005/2006

- Carry out necessary briefings and deploy/use equipment during an emergency exercise; conduct debrief and report to FSA.
- Revise SOP with lessons learned
- Revise training with lessons learned
- Carry out third training campaign
- Equipment performance testing over year
- Equipment testing performance for milk monitors
- Liase with FSA to plan 2006/07 programme

Summary of progress

Emergency Exercise Deployment

- As agreed with FSA the CEFAS Mobile Monitoring equipment and 9 trained staff were deployed during an emergency exercise. The exercise 'DANUBE' took place on the 28th Sep 2005 and was based around the Sizewell area. The following day a full debrief was held with the participating staff and discussed with FSA.

Main debrief points and comments

- The general consensus was that the early deployment of the MMU worked very well for CEFAS as that gave us more time to test the system in the field compared to the previous year. The two field teams collected over 40 samples and 30 were analysed in a total of 5 hours. This was compared to only 9 samples analysed during the 2004 exercise.

- The area chosen as a base for the MMU was satisfactory with amenities close by and close enough to the incident for the field teams to be able to keep the detectors supplied with samples.

- The communications using mobile phones mainly worked well but a few locations in the area had poor coverage. Cefas Laboratory looked at acquiring satellite phones that could be used in poor areas. There was some concerns expressed that mobile phone communication may be down during a real emergency. It was discussed with FSA about the availability and use of ACCOLC phones numbers (emergency network) but it was felt that this was not appropriate for the MMU and is more for emergency services use. FSA has stated that an ACCOLC phone may be made available from them at the LEC. Again the satellite phones should alleviate this potential problem.

- Sampling of grass and soil was completed efficiently and was enhanced buy the incorporation of ready-made sampling quadrants. Two comments made that require further work are the inclusion of equipment lists in the crates to be checked off before leaving the lab and the use of GPS units. Though copies of maps were given to the two sampling teams a borrowed GPS unit provided reassurance that the correct location had been found.

- There was a change to the type of vehicle used this year, due to one HpGe detector being out of service a high top LWB Transit was acquired rather than the larger Luton van used previously. The LWB Transit is more readily available than the Luton so it provided useful information on its suitability. Space was tight but fairly comfortable. Storage of empty cases and the receipt/preparation area had to be outside so CEFAS is considering the procurement of an incident tent to add more space. It may also be advisable to use two of these vans then space would not be a problem even with the addition of the other detector. Working from any vehicle is ok for a short period but if working for more than a day or two more suitable accommodations should be found ideally with power, water and toilets.

- The nine members of the MMU quickly found their roles and worked very well as a team. Each member had a chance to conduct sampling and counting throughout the day and remained enthusiastic and well motivated. One area that does need development is the training of a Field Monitoring Co-ordinator whose role in a real emergency will be to liase with CEFAS, organise the team also to trouble shoot the equipment, and deal with any public and press enquiries. Two of the existing team members where identified and trained in the duties during the 2006/07 round of training.

- One HpGe, two NaI's and two milk monitors were deployed, the second HpGe was away for repair. The counting equipment generally worked as expected with

sufficient power being supplied by the three large 12-volt leisure batteries and inverters. The NaI detectors again suffered from peak drift and were unstable for the first hour of use then stabilised. This will now be included in the NaI SOPs to instruct the user to turn on the equipment as soon as possible and allow to stabilise for an hour before checking with a QC sample. This should reduce the amount of staff time wasted adjusting and readjusting the equipment until it becomes stable. The HpGe had no problems and functioned faultlessly throughout the exercise.

- The three Delta 5 Milk Monitors were also tested in the field and were easy to use and could be used to produce results for I-131 in milk quickly and simply.

SOP Revisions

The main change to the standard operating procedures has been the production of short versions of the SOPs for the use in the field by trained staff. These were used for the first time during the September exercise and were found to be much more user friendly for quick reference than the full versions, though these are still required for training purposes.

Training revision

A new training plan was drafted taking in to account observations and comments made during the emergency exercise and from the second session of training. The main change was the inclusion of training on radiological safety in the field during an emergency. A copy of the revised training plan used for 2005/06 is included in Appendix 2 of this document.

Third training campaign

It was identified from the emergency exercise that further training sessions were required for the existing MMU Team members as well as training of additional staff. Throughout the year the MMU team members have been encouraged to get more hands on experience with the equipment. The one NaI permanently located to our Whitehaven Laboratory (since Nov 2004) has been used and tested on a monthly basis, the two staff there are now very competent users sending regular test reports on QCs to Lowestoft.

The Lowestoft based team has also completed several tests and quality control tasks with the one HpGe and two NaI detectors. There has also been additional training in equipment fault diagnostics and adjustment that should enable the team to correctly

identify a fault and take appropriate action to overcome the problem. This is especially important with the NaI equipment, which can require manual gain/peak adjustment due to temperature differences from being set-up in the laboratory to be used in the back of a vehicle.

Refresher training in the basic operations of the NaI Milk screening equipment was also completed using the Lowestoft based staff. More training may be required when a suitable procedure for sampling is agreed.

Three more CEFAS staff were identified for training in the use of the MMU equipment, sampling and safety, this time two from the non-analytical groups. The three successfully completed the training and even though they had little or no experience in sampling and radiological measuring equipment they quickly took on board what was required and were included in the September exercise.

Unfortunately one member of the team left CEFAS, his replacement has now been recruited and will be included in the 2006/07 training campaign along with two additional volunteers. This will bring the final number of trained personnel to twelve.

As mentioned under 'training revision' one area that has been brought in to the training is personal safety during emergencies especially radiological protection. It has been understood that members of the MMU may be required to enter areas where radioactive contamination may be present. To minimise any potential risk a few simple guidelines have been drawn up.

Radiological Safety Guidelines while in the field.

1. Field sampling teams and the monitoring unit must not be sent into high-risk areas.
2. A risk assessment must have been made before entering any potentially contaminated area. This must include an estimate of the nuclides that may be present.
3. Dose meters will be supplied to all sampling teams and must be worn at all times.
4. If the dose measurement reaches 7.5 □Sv/h the team will immediately withdraw to a safe distance and contact the base for further instruction.
5. Any MMU or sampling team member who may be pregnant should not go out into the field in an emergency to limit their chance of exposure. Dose limits to pregnant team members should revert back to the public's level of 1mSv/y.
6. Safety clothing, disposable gloves and facemasks will be made available to the team members to minimise the risks from inhalation and ingestion.

Equipment maintenance and testing

As part of the continued MMU Team training frequent quality control samples have been passed through the counting equipment on a regular basis.

The remaining HpGe detector and three NaI's have functioned well and have only needed minor adjustments to compensate for peak drift. The Ortec HpGe detector (Ge 1) has been particularly stable which is to be expected due to the superior electronics and complexity of the equipment.

One of the three 12 volt leisure batteries has been replaced, as it was not holding charge. There has been a failure of one inverter used to change the 12-Volt DC to 240-Volt AC and this will also be replaced with a more substantial unit in April. The charger for the battery has also been upgraded to a heavier duty model.

Equipment testing performance for milk monitors

The milk monitors have still not been tested against an Iodine-131 source, this is due to the limited availability of a source solution though one may be available through locally (Hospital). It has been suggested that in a real emergency with a release of Iodine that a calibration could be done using a sample and a comparison with a calibrated HpGe gamma detector, this is certainly a possibility. In the mean time tests are limited to regular background and battery checks. Some shield modifications are also planned to improve the safety when assembling the units.

Additional Comments

On the 29th November 2005 Dr John Hunt and Paul Smedley attended a progress meeting with Teresa Naylor (FSA) at Aviation House London. The CEFAS debrief notes from the Exercise Danube were discussed. Also discussed was the forward year plan, which is also the final year of this particular contract.

Report of activities – 1st Apr 2006 to 31st Mar 2007.

Targets for 2006/2007

- Equipment testing performance for milk monitors.
- Carry out necessary briefings and deploy/use equipment during an emergency exercise. conduct debrief and report to FSA.
- Revise SOP with lessons learned.
- Revise training with lessons learned.
- Carry out forth training campaign.
- Equipment performance testing over year.
- Equipment testing performance for milk monitors.
- Produce draft final report for 4y programme.
- Finalise report of 4y programme taking into account FSA comments.

Summary of progress

Emergency Exercise Deployment

As agreed with FSA the CEFAS Mobile Monitoring equipment and 6 trained staff were deployed during an emergency exercise. This time the exercise was to be in the Sellafield area as a distance test. The exercise 'OSCAR 8' took place on the 3rd Oct 06 and was based North of the Sellafield area. A full debrief of events was sent to FSA in October 06.

Main debrief items and comments

- Field team phones worked fine but coverage limited in some areas. Due to being stationed on a busy car park the MMU phone was very difficult to hear may need earpiece or a better phone. Or avoid busy car parks to minimise disturbance (see use of MMU equipment below). Ideally need a separate person dedicated to handling communications. Could also do with a second phone for email as it ties up

calls. Laptop email went down for 20 minutes but problem was identified as a problem with the laptop settings, laptop defaulted to landline when mobile was not attached.

- The hired LWB transit was adequate, used two NaIs and Two Ge detectors, useable table space limited. New preparation tent worked fine as an extra space with enough storage for empty boxes and room for the folding table for samples. Additional table needed for maps for communications person. May need something to tie the tent down if windy. Two hire cars were fine for roadside sampling.

- Detectors performed generally well. NaI showed drift but corrected after being left for an hour. There was minor drift with the Ge detectors and was easily corrected for in the field. The power supplies worked well with enough power for the exercise.

- The milk monitors were not used (no milk sampled).

- A pair of insulated gloves for liquid nitrogen fills were forgotten but we were able to use others in the spare kit. Crates still need equipment lists so that field teams can check contents before leaving.

- Staff training generally worked very well, equipment set-up quickly some minor mistakes but corrected at the time. Being stationed in a busy car park has its drawbacks one being people wanting to know what we were doing (ranged from are you camping here to are we spooks/surveillance people). At one stage we had over 20 college students on a day trip gathered round the van. Also the noise from buses and cars caused some problems mentioned under the communications sections.

- Staff will still need annual refresher training to improve efficiency though they soon picked it up, Whitehaven staff will need a training session on the Ge either at Lowestoft or at Whitehaven.

- Cefas still have a need for an expert in the field for troubleshooting in the likely absence of Paul Smedley.

- The sample data sheets need some modifications to stop users from reading total weights as count weights.

- An absolute minimum number of staff required at the MMU is three (what we had on the day) but would be better with four as result transfers and call logging takes time (communications officer required).

- Field sampling team specified a need for sample spatulas for sample prep, shears still a problem for some. Actual communication on the day was good but some info confusing on locations. These need to be clearly spelt out and given standard 6-figure grid refs. Also needed is clear guidance on what areas can be accessed (road block at Frizington but ok to go round? and pickup crab sample from Whitehaven when Plume over area?)

- Some locations had no exposed soil at this time of year. Can grass and soil be used interchangeably, e.g. if we have one must we have the other, if all you want is Bq/m^2? This would improve speed of sampling a lot.

- Maps used need to be standard OS maps (landranger or larger scale eg 1:25000) capable of plotting standard 6-fig grid refs. If unable to take with the MMU, buy locally at e.g. garage shop. GPS can be used near or at a sample location to provide more accuracy for FSA modelling purposes.

- FSA arranged for RPA staff to take part for the first time and the staff were excellent (as was ours). Their local knowledge was very useful and they were prepared to get stuck in helping were they could. Only negative point to make is that they had to accompany our staff, as they do not have any equipment of their own (including personal dose monitors and sampling gear) and lack training.

SOP Revisions

Only minimal revisions to SOPs have been required this period to improve procedure layout based on feedback from users.

Training revisions

Additional training identified and added to the plan to include the two recently purchased Global Positioning Systems (GPS). The GPS handheld units have the ability to store digital maps and guide the user to a specified grid reference.

Forth training campaign

Two additional staff were trained in the use of the counting equipment and sampling techniques. Further refresher training sessions were required for the existing MMU Team members. Throughout the year the MMU team members have gained more hands on experience with the equipment completing the necessary equipment checks using QC samples. The one NaI permanently located to our Whitehaven Laboratory

(since Nov 2004) has continued to be tested on a monthly basis, the two staff there are now very competent users sending regular test reports on QCs to Lowestoft.

The Lowestoft based staff has also completed refresher training in the basic operations of the three NaI Milk screening detectors. Feed back from the users is that the equipment is basic and easy to use, the staff remain competent in its operation though no training in sampling of milk has been completed at this time.

Equipment maintenance and testing

Two Garmin eTrex Legend Cx personal navigators (GPS's) were purchased along with Memory Map 1:50 000 scale digital maps covering all of the United Kingdom. This is to improve accuracy of sampling and the recording of grid references previously taken directly from paper maps.

One satellite mobile phone has also been purchased to improve emergency communications when phone network coverage is poor or when networks are down due to the emergency. The phone is also capable of transmitting data via email when connected to a PC.

As part of the continued MMU Team training frequent quality control samples have been passed through the counting equipment on a regular basis.

The two HpGe detectors and three NaI's have functioned well and have only needed minor adjustments to compensate for peak drift and the occasional pole-zero (HpGe only) to maintain a stable peak resolution (FWHM). The only repair required over the year has been to a high-voltage inhibit connector on the Ortec HpGe that was accidentally twisted from the cable preventing the detector from powering up. This was repaired in-house, the replacement is of a more robust design so should last longer, the detector was back up and running within a week.

The 12-volt leisure batteries have been checked regularly and hold charge well. All other equipment is maintained in a state of readiness.

Equipment testing performance for milk monitors

The three milk monitors have still not been tested against an Iodine-131 source. As previously stated this is due to the limited availability of a source because of its short half-life (8.04 days). It has been suggested that in a real emergency with a release of Iodine that a calibration could be done using a sample and a comparison with a

calibrated HpGe gamma detector, this is certainly a possibility. In the meantime tests are limited to regular background and battery checks. The equipment has functioned reliably over the last 12 months.

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Head office
Centre for Environment,
Fisheries & Aquaculture Science
Pakefield Road, Lowestoft,
Suffolk NR33 0HT UK

Tel +44 (0) 1502 56 2244
Fax +44 (0) 1502 51 3865
Web www.cefas.co.uk

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