

Radiological survey team
in line



The “m” in mSv Stands for Micro – Right?



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The Fukushima Nuclear reactor problems as a result of the Japanese earthquake and subsequent tsunami demonstrated only too well that just when you think matters cannot get worse – they most likely will, and even when 20 kilometres away, that does not mean your locality will not be affected. Unsurprisingly the incident has resulted in an increase in interest in nuclear emergency response exercises.

On a lovely warm sunny day in the southern USA the exercise coordinators prepare for the day’s nuclear exercise. Argon had been asked to assist with the provision of simulation equipment for the duration, as the exercise controllers were keen to see if they could enhance the overall quality for the exercise and in particular improve upon the use of the traditional inject whereby the student is shown a piece of card or the modern version, and electronic notepad to represent pretend instrument readings.

The response team to be evaluated was assembled and then briefed about a problem at a fictitious nuclear power station that was 20 kilometres away and just happened to be upwind of the team’s present location. The team then had to decide what action was required and what

equipment was necessary in order to assess the potential risk posed to the local population.

Once the potential risk had been determined, they were to brief the local authority and make recommendations regarding the protection of those who may, or may not be at risk. Sounds fairly straightforward, doesn’t it?

The exercise simulation requirement was discussed, which was as follows:

- A single plume to reach the training area 40 minutes after initiation of the exercise with deposition across the training area.
- The plume to comprise the following radionuclide’s:
 - 137C.
 - 131I.
 - 90SR.

NUCLEAR EMERGENCY RESPONSE

Radiological survey monitoring



- The following simulation instruments were required:
 - Survey simulator.
 - EPD-Mk2 Dosimeter simulator.
 - SAM 940 spectrometer simulator.
 - Alpha simulation for RADECO air sample filter contamination simulation.

The simulation control system comprised a laptop with the Argon Rad PlumeSIM software and live field base station, which provided effective real time exercise control throughout the exercise area.

A local map to assist in planning the simulated exercise and also to aid tracking the students was obtained using one of the many freely-available map resources to produce a .jpg image of the local terrain, which was then calibrated using a feature included within PlumeSIM.

Each survey team was to be equipped with a survey meter, personal dosimeters, and a spectrometer, with the remainder of the students responsible for communications (hand-held portable radios were provided for this purpose), logistics and the collation and management of the data received from the survey team, as well as the generation of the hazard prediction plots.

The exercise commenced with the team being briefed about the problem at the local nuclear power station. At this point they were advised that the extent of the problem at the power station was unknown, and that they would be provided with further information as the situation developed.

So, what do you think you would be doing having received such news?

- Consider deploying a means of monitoring in case the information provided was inaccurate or out of date (hence the plume was closer than anticipated)?
- Chat about last night's television sport?
- Call your mum?

It is fair to say initially the equipment remained where it was prior to the exercise brief. After a little prompting, a decision was made to deploy a

Radeco air sampling station. While the assembly of the sampler proved to be relatively easy, there was more than one view as to what airflow setting should be used initially during the warm-up period, and also the importance of keeping the exhaust of the generator used to power the Radeco a reasonable distance from the air sample intake. There was also some debate between students as to what was the ideal airflow rate to be set after the initial warm up phase.

The exercise coordinator then announced that a radioactive release had been confirmed, and that the estimated time of arrival of the release to the current location was 40 minutes. At this point the simulated plume release was initiated, the system configured to provide plume cover at the desired time over the exercise area. A preliminary trial run had been carried out to

ensure that the desired readings were obtained in the appropriate locations.

PlumeSIM has a very nice feature that enables you to fast forward or pause the exercise, thus enabling the exercise controller to manage the staging of the exercise to suit the precise progress and status of the exercise participants. While we all know that, in the real world, nature takes its course in its own time, an exercise may be to evaluate, test, validate or educate or a mixture and as such sometimes it can be useful to "pause the exercise" to perhaps provide some gentle guidance to ensure the students get the very best out of the day's experience.

A portable player device is worn by each survey team member. The exercise control system automatically transfers the exercise to the player unit, which then broadcasts the simulated radionuclide activity to the allocated simulators based upon the student's geographic location. The students' movements throughout the exercise are monitored in real time and recorded for after-action review later back in the classroom.

The team decided to check the Radeco filter to see if any reading could be obtained. A simulation source had been installed on the inside of the filter paper holder, and when the simulation Alpha probe was offered up to the filter paper a reading noticeable above background was obtained. The reading was reported to the control cell together with the flow rate and the duration of the sample period, thus enabling the airborne activity level to be determined.

A survey of the local area was requested. A survey team of four comprising two team members each carrying survey simulators, (both generic survey simulators) and one team member with a SAM940 spectrometer simulator, with the fourth team member being responsible for radio communications. Two of the team were also wearing simulation dosimeters based upon the EPD-Mk2.

The areas in which the survey team would receive simulated radiation readings and to what

level had been pre-determined by the exercise controller such that initial readings would be obtained typically 150 meters away from the command station, the requirement being to simulate readings as a result of uneven deposition. The survey team spread with a distance of ten meters between each of the three instrument-carrying members, the communications operative following a little behind the line.

As the survey team approached the "hot zone" readings started to climb above background level and were called in. This is where, from an observer point of view, the exercise started to get interesting. Remember it was a very sunny day. The team members were suitably dressed in protective ensemble and wearing respirators, and this combined with the bright sunlight made the displays rather more difficult to read than when in the nice comfortable classroom and not wearing a respirator.

The team member carrying the instrument would call out a reading. The communications operative would then contact the control centre and repeat the reading, quickly followed by the originator calling out "no, that's not what I said" and repeat the reading again. The respirators were not fitted with voice modules and so inevitably verbal communication was not straightforward. That was between two humans. When the message is then relayed across a hand portable radio by the communications operative also wearing a respirator the whole event turned into something reminiscent of a child's game of Chinese whispers!

Another interesting observation was confusion over units of measurement. It so happened that some instruments we set to indicate in Rem, while others were set to indicate in Sv/hr. The simulation survey meter reading rose to 10mSv/hr and the call went out "now reading 10mS/v", each letter m, s and v being stated phonetically, (Mike, Sierra, Victor), which was duly acknowledged by the communications team member with the response "m – Mike stands for micro, right?"

The fact that some instruments were indicating different units of measurement also generated some interesting discussion regarding the relationship between Sv/hr, Rem etc. While it is fair to say that there would most likely be consistency within particular groups as to the units of measurement used, serious incidents such as in Japan often result in multinational involvement with the inevitable preference for different units of measurement among different well-meaning groups.

The message to take home here is clear – those expected to use instruments of any type must be well practiced in being able to read and correctly interpret the actual display. Furthermore, they need to absolutely understand the significance of any readings they observe, and ensure these readings are communicated to any third-party accurately.

The display on the SAM 940 simulator (in fact a simulation probe attached to a real SAM940 detector) started to flash red, advising of a dangerous radiation level being present. Upon selecting "identify" the spectra was displayed together with the radionuclide list, which was correctly read out and reported. While the survey team stood discussing the readings suddenly a beeping was heard – one of the dosimeters has exceeded the pre-set dose alarm.

Like most dosimeters, the EPD-Mk2 is rather small and therefore has a small display, and in



Radeco Set-up

particular the unit of measurement indicator is very small and care is required when reading the display if wearing a respirator or level A suit (although in some instances such devices are worn inside the level A suit). While the dosimeter alarm was being reported to the control station a second simulation dosimeter also started to alarm.

The survey team completed its mission and returned to base for a full debrief. The group being evaluated then had to provide (and justify) their recommendations with regards to the evacuation or otherwise of the local population.

A number of visiting teams were to be put through the same exercise scenario, some of which comprised members who had not worked together before. This in itself highlighted some interesting problems, not least of which was differing levels of proficiency within the team, whereas if a team had trained and worked together previously, there was a stronger sense of organisation and competency.

Summary

The simulation system enabled a sophisticated scenario involving multiple radionuclides to be implemented with ease and repeated as and when required. Perhaps the greatest value was the ability to generate relatively high instrument readings such that most operators had never had to experience before. This in itself exposed the problems that can occur if these readings are not fully understood or incorrectly communicated.

The importance of training regularly as a team was evident, however as was noted when teams were made up from people who had not worked together before, there is great merit in replicating this situation in training, since you never know when you might be asked at a major incident to either join or command a team that until that point you had never worked with previously.

The exercise coordinators found it refreshing not to have to calculate the dose alarms and simulated dosimeter readings for the inject cards, as this was taken care of automatically by the simulation system.