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Mobile Measurement Systems

Final Report from NKS-B MOMS

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Abstract

Mobile car-borne measurement systems are an important asset in early phase emergency response in all Nordic countries. However, through the development of the systems in the different countries, there are considerable differences between the systems developed. This complicates Nordic cooperation and mutual assistance in emergency situations.

This project aimed to facilitate harmonization of mobile measurement systems between the Nordic countries. The project focused on harmonizing data formats, information exchange and measurement strategies. Although the work done was funded by each member, the project established a good platform for cooperation which will hopefully continue beyond the scope of the project.

A two-day seminar was held in May 2012, where all participants presented the current status (equipment, methods used etc.), in addition to invited speakers presenting development within the field of mobile detection and in situ measurements. Exchange of experiences and information on different measurement systems and practises in use was an important part of the seminar.

The seminar was followed up by a small workshop during the REFOX exercise in Lund, Sweden, September 2012. Exchange of measurement data from the exercise was facilitated through a workspace proveded by NRPA as part of the MOMS project.

The work done in this project will be presented at the NKS-B EmSem/NordEx12 seminar in summer 2013.

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Project partners

Partner organisations are:

- Norwegian Radiation Protection Authority (NRPA)
- Danish Emergency Management Agency (DEMA)
- Icelandic Radiation Safety Authority (IRSA)
- Swedish Radiation Safety Authority (SSM)
- Radiation and Nuclear Safety Authority (STUK)
- University of Lund
- Norwegian Geological Survey (NGU)
- Swedish Geological Survey (SGU)
- The Swedish Defence Research Agency (FOI)
- Institute For Energy research (IFE)

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Introduction

According to the Convention on Early Notification of a Nuclear Accident all IAEA member states are obliged to inform affected states of: "(…) any accident (…) from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State." (IAEA, 1987). However, there are few guidelines as to how this information should be given.

This project aims to map which resources are available in the Nordic countries, and improve the cross-border cooperation by implementing a common Nordic "language" with regards to data exchange and readability, but also by harmonizing how we perform our measurements to achieve comparable data.

Mobile detection systems

In this project we include several types of mobile detectors for different carriers, and to some extent hand-held detectors. We decided to include only detection systems designed primarily for gamma emitters.

The variety of detectors and detection systems available is reflected through the many detectors the partners in the project have. This should assure a representative selection of detection systems used in the Nordic countries.

Background

Different approaches to how to conduct radiological measurements and analysis are in use in the Nordic countries, and this can make it difficult to compare certain results across the borders. If not addressed, this could result in poorer emergency preparedness in the Nordic countries.

As all partners have different software for analysis of measurements, the data formats used are mostly incompatible. This could also hamper emergency preparedness, especially if a nuclear / radiological event results in releases of radioactivity across border regions, or if an affected nation needs assistance from others.

Objective of the project

By agreeing upon some few data formats, we can facilitate better information exchange between the partners in the project, and thereby improve emergency preparedness in case of a radiological or nuclear event.

Harmonising how we conduct measurements will improve the comparability of the results each partner obtains from measurements, i.e. we can trust each other's results as we would our own measurements.

The seminar

The MOMS seminar was held at Clarion Hotel Bastion in Oslo, May 22nd and 23rd of 2012. 23 participants from 11 institutions from all the Nordic countries took part in the seminar which also included guest speaker prof. Andrew Tyler from the University of Stirling.

The seminar was divided in 3 different sessions. Programme, abstracts and a list of participants for the seminar are given in appendixes 1-3 respectively.

Session 1

The first session was dedicated to presentations on the status of mobile measurement capacities in the Nordic countries. All countries gave a short presentation on available instrumentation and capabilities within the field of gamma spectrometry. Available radiation detection equipment is listed for the Nordic countries in table 1.

Country	*Handheld*	*Car borne*	*Airborne*	*In situ HPGe*
Denmark	Several	2	2	0 [1]
Finland	Several	1	2	1(3) [2]
Iceland	Several	3 [3]	3 [3]	1
Norway	Several	2 (3) [4]	3 (4) [4]	2
Sweden	Several	6	3	4(10) [5]

Table 1: overview of available detection systems in the Nordic countries

[1] DEMA has 0, there may be other in situ HPGe detectors available in other institutions

[2] STUK has one in situ HPGe plus two used in other measurement systems that can be used for in situ

[3] IRSA has three systems they use for both car and airborne measurements

[4] NGU has one system they use for both car and airborne measurements

[5] HPGe in the car borne systems can be used for in situ measurements as well

The University of Lund held two presentations, one on modular gamma radiation monitoring system (small gamma spectrometers, complete with hard- and software for remote areas), and the second on the development of a device for making homogeneous area sources. These area sources can be used for calibration purposes or exercising fallout scenarios (the same device was used in the REFOX exercise).

We invited several manufacturers of mobile detection systems to present their developments within this field, but only Radiation Solutions Incorporated (RSI) accepted. They presented the latest they had to offer. Among the more interesting points were directional detection by stacking four detectors together vertically, and calculate the position of the source by looking at the shielding effect the detectors had on each other.

Session 2

Presentation by prof. Tyler from the University of Stirling on developments in gamma ray spectrometry, with main focus on In-situ measurements, made up the second session. He addressed the problems with defining the heterogeneity and spatial distribution of activity (especially valid for ^{137}Cs) in soil by in-situ gamma ray detection, and gave some examples of how to solve these problems (mainly forward scattering). He also included a comparison of soil sample analysis, in-situ and airborne gamma spectrometry performed in Scotland.

Prof. Tyler also included experiences from source search in the vicinity of Dounreay (a nuclear facility in Scotland), both on a nearby beach and under water, which gave some important head ups with regards to planning and equipment.

Session 3

In the third session the participants were divided in two groups, data exchange and measurement strategies, to try to establish some common ground for data exchange and to see if we could harmonize our measurement strategies (e.g. environmental sampling methods) within the Nordic countries.

The data exchange group landed on a three-step procedure for data exchange between the countries. The first step falls in under the Convention on Early Notification of a Nuclear Accident, and will be vie e-mail and / or fax and be written text. The second and third steps will be exchange of measurement data and / or analysis. It was decided that for preliminary information exchange shapefiles were to be used. This is a wide-spread standard for GIS software, and is also small enough to be shared even with low bandwidth. As a last step (if desired) we decided to land on the xml-standard N42.42 developed by ANSI / IEEE (American National Standards Institute / Institute of Electrical and Electronics Engineers).

Due to the vast differences in detection systems in the Nordic countries, it was decided that each partner would look at their strategies / procedures and see if they deviated from IAEA's Tecdoc-1092's recommendations. Any uncovered deviations were to be sent to NRPA with a short description on why a different approach had been chosen. It seems all partners follow IAEA's recommendations, and where deviations occur they use guidelines developed by ICRU (International Commission on Radiation Units and measurements).

The workshop

The MOMS workshop was concluded in connection with the REFOX exercise that took place in Lund, Sweden, September 22nd – 28th during the first two days (22nd – 23rd) of the exercise. Due to late arrivals and a big workload connected to the REFOX exercise, only a short meeting and half-a-day of measurements were performed.

The meeting was held on Sunday 22nd in Revingehed, with participants from NRPA, DEMA and IRSA. Due to the scale of work needed for the REFOX exercise it was decided to keep the NKS MOMS activity to a minimum, and only a short intercomparison exercise with one fallout spot (provided by Karl Östlunds "contamination device") and three sources (one mixed gamma-, one beta- and one neutron-source) were to be held the following day at the site of the REFOX exercise.

Out of the project partners, DEMA, STUK and NRPA had cars available for the exercise, and thus only these participated in the fallout spot exercise. Only two partners, the NRPA and STUK, participated in the three source measurements. This was due to conflicting exercises in REFOX and availability for cars only at the measurement sites.

Results from all NKS MOMS partners that participated at the intercomparison exercise and the REFOX exercises where more than one partner participated will be presented at the NKS-B EmSem/NordEx12 seminar in summer 2013. The results will also be presented in the report from that project.

Conclusions

Data exchange

There is still work to be done when it comes to exchange of data between the Nordic countries. One of the biggest challenges is that in most of the organizations there's only a handful of persons that have the required competence / access to operate and make changes in the software. This also applies to importing and converting data formats that are not in daily use. This makes information exchange in case of an emergency very vulnerable.

To help this we propose using the following formats (until something better is available) for exchanging measurement data:

- **Shapefiles** – for exchanging files on general situation overview, and for decision support tools in a radiological / nuclear emergency
- **N42.42** – for exchange of raw- and metadata

Harmonization of strategies

As all partners follow the guidelines in IAEA's TecDoc-1092 and / or ICRU report 75 for environmental monitoring and sampling, the Nordic countries are quite well harmonized in that respect, and through intercomparisons such as NPL's (National Physical Laboratory) we test the reliability and accuracy of our laboratories.

The partners have different systems for mobile detection of radioactivity, but there are some common features:

- Large NaI-detectors for aerial surveys
- (relatively) large NaI-detectors for car-borne systems, mainly planned for source search and urban fallout measurements
- Small hand-held detectors for verification / identification purposes

In general it was concluded that although car-borne detectors can be used for mapping of fallout, it has a very limited field of view due to short distance from the ground. In addition cars rely on roads (at least in most cases) which limit the potential for using them in mapping larger areas. Also, in case of rainfall a lot of the fallout will wash into ditches on the sides of the roads, this could lead to an overestimation of activity due to higher levels close to the detector, but will also reduce the detector's ability to "see" beyond the activity in the ditch. Car-borne systems can nevertheless have their uses, especially if the limitations and pitfalls are understood and this is what the MOMS activity has aimed to do.

Car-borne detection systems are vital for mapping fallout in urban areas and other areas where helicopters and airplanes don't have access. They are also well suited for orphan source search.

For larger areas, mapping of fallout is best performed by airborne detection systems, either mounted on rotary- or fixed wing aircrafts.

The way forward

We will present the work we've done in this project at the NKS-B EmSem/NordEx12 seminar in 2013, and discuss the possibility of writing a paper where we sum up the results from the REFOX exercise. We will also include the results from the intercomparison and data exchange following the practical part of the project in the NKS-B EmSem/NordEx12 seminar and report.

This project formed a good platform from which development of similar procedures and harmonization of data formats can continue and ensure better crisis management in the Nordic countries in case of a nuclear or radiologic event. There is still a lot of work to be done on sharing data regardless of format, this should be addressed in future projects.

Appendix 1: Seminar program

Tuesday 22nd of May

Time	Title of presentation, Presenter
09:00 – 09:30	Registration and coffee
09:30 – 09:45	Opening of the seminar, Johannes Nilssen
09:45 – 10:30	Norwegian systems for field gamma measurements, Morten Sickel, Paula Nunez, Robin Watson
10:30 – 10:45	Coffee break
10:45 – 11:30	Danish Mobile Measurement Systems: Strategy, Calibration and Data Transfer, Per Reppenhagen Grim, Helle Karina Aage
11:30 – 12:15	Finnish mobile measurement systems and strategy, Petri Smolander
12:15 – 13:00	Lunch
13:00 – 13:45	Mobile gamma spectrometry for emergency preparedness in Sweden Celina Jelinek, Simon Karlsson
13:45 – 14:30	Mobile measurements in Iceland - equipment and strategySigurður Emil Pálsson
14:30 – 14:45	Coffee break
14:45 – 15:15	Modular gamma radiation monitoring system, Homogeneous area sources Jonas Nilsson, Karl Östlund
15:15 – 15:45	RSI's latest development on mobile measurement systems, Stephen Monkhouse
15:45 – 16:45	Discussion

Wednesday 23rd of May

Time	Title of presentation, presenter
09:00 – 10:00	Some developments in environmental gamma ray spectrometry, Andrew Tyler
10:00 – 10:15	Coffee break
10:15 – 10:45	Some developments in environmental gamma ray spectrometry continues, Andrew Tyler
10:45 – 11:15	Presentation on data handling / formats
11:15 – 12:00	Work group meetings (two groups: software and strategy / equipment)
12:00 – 13:00	Lunch
13:00 – 14:30	Work group meetings continues
14:30 – 15:00	Coffee break
15:00 – 15:30	Presentation of work group efforts and conclusions
15:30 – 16:00	Establishment of harmonization efforts
16:00	End of seminar

Appendix 2: Abstracts from the seminar

Norwegian mobile measurement systems

Morten Sickel[1], Paula Nunez[2], Robin Watson[3]
[1]NRPA, Norway
[2]IFE, Norway
[3]NGU, Norway

Norwegian measurement capabilities (not including hand-held systems) are divided between four organizations, namely NRPA, NGU, IFE and the Norwegian Defence. NRPA, IFE and NGU have car-borne detectors. The Norwegian Defence and NGU have airborne systems, both for rotary-wing and fixed wing aircrafts.

The four organizations have the same or similar equipment, but use different software for data handling and analysis of the measurement data. The geometry is also somewhat different due to placement of the detectors in different carriers. There has not been performed any intercomparison of the detection systems in use in Norway to date.

Exchange of data between the organizations has been performed mainly by exchanging analysed data, not raw data. Where raw data has been exchanged, it has been done in the form of xml-files.

Danish mobile measurement systems

Helle Karina Aage, Per Reppenhagen Grim
DEMA, Denmark

The DEMA headquarter is situated in Birkerød, North of Copenhagen. Here the nuclear division has offices where measurement evaluations and decisions about deployment of measurement teams are made. The measurement teams are based on measurement operators from the six DEMA emergency centres in Denmark. All measurement equipment except for the carborne systems are placed at the DEMA emergency centres ready at hand for the operators.

DEMAs measurement strategy makes use of early warnings from measurement stations and/or European and bilateral warning agreements combined with ARGOS falloutprognoses.
The outcome is a tactical deployment of mobile measurement teams with handheld instruments later followed by use of carborne spectrometry, and tactical use of airborne spectrometry based on the results from the first two categories of measurements and updated fallout prognoses.

The DEMA carborne systems implemented in 2010 are calibrated for natural radionuclides on the pads in Borlänge Airport in Sweden. It is planned to check the sensitivities from measurements of soil samples or in areas where the content of natural radionuclides are known. This has yet to be done. Due to the detector position on top of the car there are unsolved issues for corrections of field of view. Calibration for fallout, e.g. Cs-137 area

sources has yet to be done. The DEMA airborne systems implemented in 2011 are undergoing calibration for natural radionuclides. Also calibration for fallout has yet to be done.

DEMA has improvement plans considering tactical use of sampling and in-situ (field) measurements. Laboratory assets should be evaluated. Concerning data presentation and data transfer the possibility of transferring data during measurements hopefully can be tested in 2012.

Finnish mobile measurement capabilities

Petri Smolander
STUK, Finland

Finnish mobile measurement systems and strategy relies on robust mobile measurement devices with on-line data transfer capability to reach-back center. Development of measurement systems and data management systems is mainly done in-house, but the results are also available for other organizations.

Data collection system VASIKKA and central data management system SNITCH are presented. Key features of the VASIKKA data collection system are the ease of use and robust analysis algorithms with very low false alarm rate. VASIKKA can be used in several applications with different detector configurations. Several applications of the VASIKKA system are presented. One of the applications is the SONNI mobile measurement vehicle that has five detectors integrated to a single VASIKKA data collection system.

Data management system SNITCH integrates central data collection and management with several analysis tools in the reach-back center. SNITCH automates several analysis pipelines and presents the analysis results in a dashboard style web browser interface in addition to more detailed expert view to data.

STUK plans to provide reach-back support to all partner agencies in Finland. Currently the reach-back is provided to police and customs in addition to STUK's own mobile measurement teams.

Mobile gamma spectrometry for emergency preparedness in Sweden

Celina Jelinek[1], Simon Karlsson[2]
[1]Sveriges Geologiska Undersökning (SGU), Sweden
[2]Strålsäkerhetsmyndigheten (SSM), Sweden

Advanced radiation monitoring in a radiological or nuclear emergency in Sweden is performed by the National Expert Response Organisation. The organisation is led by the Swedish Radiation Safety Authority (SSM) and consists of radiation experts from the universities of Lund, Linköping and Göteborg, the Swedish University of Agricultural Sciences (SLU), the Geological Survey of Sweden (SGU), the Swedish Defence Research establishment (FOI) and Studsvik. No personnel are on-call, but the equipment shall be maintained and ready to use at all times. Yearly exercises are held for developing and maintaining measurement capacity.

Ground-based platforms for mobile gamma radiation measurements are three cars, three trailers and backpacks. The systems include HPGe and/or NaI detectors, and are placed in Malmö, Göteborg, Stockholm and Umeå.
For airborne gamma radiation measurements, the Swedish Geological Survey there have two complete detector systems (HPGe + 16l NaI) and four optional carriers. In addition detectors can be installed on helicopters. The Volunteer Air Corps can respond quickly and make measurements with backpack NaI detectors.

The mobile units are calibrated for fallout or ground contamination, using a system where point sources placed in circles in a polar coordinate system, at different distances from the detector. This takes into account specific vehicle geometries. Four different nuclides (Co-57, Ba-133, Cs-137, Co-60) are used, chosen to cover a large part of the gamma energy spectrum. The calibration is, if possible, validated by measurements on ground in Gävle (ground-based units), where there was relatively heavy Cs-137 contamination from Chernobyl. For calibration/reduction of natural radioactivity there are calibration pads in Borlänge, Sweden. Four pads, 0.5 m thick, 10 m in diameter, with defined concentrations of potassium, uranium and thorium are used.

The same software system is used for all applications of mobile gamma spectrometry in Sweden. The system can be used with one or two various size NaI-detectors, a HPGe-detector and a GM-tube simultaneously and it is used in both ground-based and aerial platforms.

Mobile measurements in Iceland - equipment and strategy

Sigurður Emil Pálsson and Óskar Halldórsson Holm
Geislavarnir ríkisins, Iceland

The Icelandic Radiation Safety Authority (IRSA) is the single entity in Iceland performing mobile radiological measurements with specialized equipment. IRSA's capabilities for mobile measurements have been growing rapidly recently. IRSA's equipment arsenal includes a very portable 3"x3" NaI Finnish Vasikka system, three NaI pods (two with two 2 litre detectors and one with a 2 litre, two 0,5 litre and one 1"x1" (crew safety) detector) for a vehicle-borne Spectral Advanced Radiological Computer System (SPARCS) from the *National Nuclear Security Administration* (NNSA) in the USA, and recently acquired pair of backpack NaI detectors with He-3 tubes for neutron detections. The Vasikka system has been in the use the longest, but we are fast gaining experience and competence in use of the SPARCS system and have ambitious plans for use of the backpacks. In this presentation, the properties of each system is described and examples of their use shown. Emphasis is placed on strong collaboration with other authorities in emergency preparedness and law enforcement. Examples of data processing will also be presented, focusing on use of shapefiles for exchanging data between different systems.

Working towards a flexible gamma radiation measurement system

Jonas Nilsson, Peder Kock, Karl Östlund
University of Lund, Sweden

Mobile and *in-situ* gamma spectrometry systems can usually not be extended with additional sensors or gamma detectors and are usually controlled by a Windows computer. To solve these problems, it was decided that a more flexible gamma measurement system for field use should be based around a "system on a chip" Linux computer. These computer systems has a power draw and a size that is a fraction of that of Windows computers. It also allows the use

of a vast library of open source code when writing the software controlling the detectors and storing the data acquired by them.

The detector used with this system would primarily be a NaI(Tl)-crystal and photo multiplier tube package, coupled to a Ortec DigiBASE. Because Ortec does not provide a Linux driver for the DigiBASE, a driver was reverse engineered from looking at the raw binary communication between a DigiBASE and a Windows computer.

The goal of the system is that it should be able to act as a host to a wide range of sensors relevant to field measurements. For example; a camera when doing mobile measurements or a dose rate instrument when doing *in-situ* background monitoring.

A proof of concept system was developed from the hardware and software components mentioned above. This system consist of a NaI(Tl)-detector with a DigiBASE, controlled by a system on a chip Gumstix Overo Linux computer and placed in a carbon fiber tube.

Radioactivity Dispersion unit design and testing during REFOX

Karl Östlund
University of Lund, Sweden

Recently a radioactive material dispersion unit has been developed to fill the need for better source control during in-situ calibrations and vehicle based measurements. The equipment is capable of delivering an amount of fluid between 0.1-1.0 liter/sq. meters to the ground with a preselected amount of activity mixed in from 2 separate stem solutions.
The system was developed to help with further verification of the In-Situ measurement calibrations and vehicle calibration with regards to fallout measurements. The unit can produce area sources with almost no relaxation depth down to a few centimeters, depending on the amount of fluid that is dispersed. The components are standard components in Swedish irrigation and farming including the GPS system. The computer program controlling the unit is made and sustained in house and allows the user to choose circle and non-repeated or square designs on the produced fallout field. Since the dispersion is computer and GPS controlled with a precision of a few decimeters it opens up for several possibilities of studies of building shielding factors as well as detector response and true angular response from a sector or ring design representing a certain incident angle.
A representable size of the dispersed area is 1000-5000 sq. meters and primary results show that the area source with a fairly good homogeneity depending mostly on the skills of the tractor driver showing the best uncertainty of approximately 15 %.

Some developments in environmental gamma ray spectrometry

Dr Andrew Tyler
Environmental Radioactivity Laboratory, Biological and Environmental Sciences, School of Natural Sciences, University of Stirling, Stirling, FK9 4LA, UK. Email: a.n.tyler@stir.ac.uk

The application of gamma spectrometry to environmental monitoring has become well established and in recent years systems are increasingly deployed in a number of configurations to tackle the various challenges of contaminated land and base line monitoring. *In-situ* gamma spectrometry, typically with longer counting times (minutes-hours) using higher spectral resolution HPGe, offer the opportunity for more accurate characterisation of the environmental radiation field. Mobile systems, on the other hand, tend to use larger

volume NaI(Tl) detectors with poorer spectral capabilities but superior detection efficiencies (aided by digital technologies) enabling very much shorter counting times (sub second to tens of seconds) to map the spatial change in the environmental radiation field. In either case, effective comparison with conventional sampling methodologies is often compromised by: (i) not taking account of spatial heterogeneity in sampling and matching the distribution to the spatial response of the detector; and/or (ii) changes in the vertical activity distribution, which has perhaps become the *holy grail* of environmental gamma ray spectrometry.

This presentation reviews examples of the application of environmental gamma ray spectrometry. Part 1 focuses on the characterisation of environmental radioactivity through long count *in-situ* HPGe gamma ray spectrometry demonstrating the range of natural series and anthropogenic radionuclides that can be detected and compared with conventional soil sampling techniques. Using additional information from the gamma spectrum provides novel solutions to accounting for changes in the vertical activity distribution and has the potential for greatly extending the application of gamma spectrometry across a range of environmental sciences. The use of *in-situ* and soil coring techniques to calibrate and validate airborne gamma spectrometry survey work is also explored, focusing on issues of matching the spatial response of the different techniques and examines solutions to how the vertical activity distribution might be accounted for to improve measurement accuracy.

The 2nd part of the presentation will focus on the challenges of point source detection, specifically in relation to hot particles. System configurations need to be optimised to maximise the probability of detection, usually on the grounds for public health protection. A case study on the detection of particles on beaches at Dounreay is presented and the latest developments for offshore particle recovery are discussed. This section then returns to issues of contaminated land as a result of post war activities with ^{226}Ra contaminated artefacts in the environment and the role detectors play in detecting and characterising the presence of contaminated ground and artefacts.

The 3rd and final part of the presentation, briefly looks to the future and reviews new detector technologies that potentially offer the promise of a renaissance in environmental gamma ray spectrometry by bridging the capability gap between HPGe and NaI(Tl). The international standard IEC 62438 (2010), *Mobile instrumentation for the measurement of photon and neutron radiation in the environment,* is also briefly outlined.

Appendix 3: List of participants

Name	Organisation
Aage, Helle Karina	Danish Emergency Management Agency (DEMA)
Baranwa, Vikas	Geological Survey of Norway (NGU)
Boson, Jonas	Swedish Defence Research Agency (FOI)
Finck, Robert	Swedish Radiation Safety Authority (SSM)
Gogani, Jalil Bahar	FOI
Grim, Per Reppenhagen	DEMA
Gæfvert, Torbjörn	Norwegian Radiation Protection Authority (NRPA)
Halldórsson Holm, Óskar[1]	Icelandic radiation safety authority (IRSA)
Haugen, Ann-Helen	Institute for Energy Technology (IFE)
Jelinek, Cecilia	Geological Survey of Sweden (SGU)
Karlsson, Simon	SSM
Mauring, Alexander	NRPA
Nilssen, Johannes	NRPA
Nilsson, Jonas	Lund University
Nunez, Paula	IFE
Pálsson, Sigurður Emil	IRSA
Ramsøy, Tore	IFE
Sickel, Morten	NRPA
Smolander, Petri	STUK - Radiation and Nuclear Safety Authority in Finland
Tazmini, Kasra	NRPA
Tyler, Andrew	School of Natural Sciences, University of Stirling
Watson, Robin	NGU
Östlund, Karl	Lund University

[1] Involved in the activity and preparation for the seminar, but was not able to attend.

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Abstract

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This project aimed to facilitate harmonization of mobile measurement systems between the Nordic countries. The project focused on harmonizing data formats, information exchange and measurement strategies. Although the work done was funded by each member, the project established a good platform for cooperation which will hopefully continue beyond the scope of the project.

A two-day seminar was held in May 2012, where all participants presented the current status (equipment, methods used etc.), in addition to invited speakers presenting development within the field of mobile detection and in situ measurements. Exchange of experiences and information on different measurement systems and practises in use was an important part of the seminar.

The seminar was followed up by a small workshop during the REFOX exercise in Lund, Sweden, September 2012. Exchange of measurement data from the exercise was facilitated through a workspace proveded by NRPA as part of the MOMS project.

The work done in this project will be presented at the NordEx12 seminar in March 2013.

Key words Mobile measurement systems, detection systems, emergency preparedness, harmonization, data exchange, measurement strategies