

The NRPA's Mobile Laboratory

The NRPA has in recent years initiated a range of projects to increase its level of nuclear emergency preparedness including terrorism situations. As part of this work, a mobile laboratory has been developed which serves to enhance NRPA's crisis handling capabilities at, for example, an incident location. Such a laboratory allows for the measurement of environmental samples and personnel who may have been contaminated by radioactive materials. The laboratory is based upon a specially designed container which can be outfitted with a range of equipment according to the demands of different situations. It is also possible to take elements of the equipment out in the field, independent of the laboratory itself. The laboratory will have an important role both in emergency situations and in ongoing activities both nationally and internationally.



All photos: Norwegian Radiation Protection Authority

NRPA has as part of its emergency preparedness systems, identified a range of accidents and incidents with the potential for contamination of people and the environment with radioactive materials where a mobile laboratory will play an important role. These situations can be in relation to reactor accidents at nuclear power plants abroad, at Norway's own research reactors, accidents involving nuclear powered vessels in Norwegian waters or in Norwegian ports of call. Accidents can also arise at reprocessing or production facilities for nuclear fuel or in

relation to radioactive sources used in medicine, industry or research. In relation to such accidents, it is possible to see the potential for release of radioactive materials to the surroundings.

The objective with respect to the establishment of a mobile laboratory has been, amongst others, to develop facilities for sample collection, reception and preparation and the measurement of samples of environmental materials and personnel in the field at accident or incident sites. By having available equipment at an incident or accident

location, such sampling as may be required can be conducted rapidly and the expedient production of reliable information facilitates the decision making process and dissemination of information to the public. The mobile laboratory can also be deployed for situations in other countries where NRPA is requested to provide assistance in accordance with conventions and agreements.

Construction of the laboratory

The laboratory is constructed of laminated panels with excellent insulation properties mounted in a galvanised steel frame. External dimensions are 606 cm x 244 cm x 244 cm. The container is designed such that it can be lifted by both crane, truck with container hoist and can be transported by truck, ship, train and aeroplane (Defence Forces Hercules).



The container can be raised by various means.



Transport of the container with a Hercules plane of the Defence Forces.

Internally, the container is centrally divided in two by a sliding door such that one half facilitates the preparation of samples and the other functions as a measurement laboratory where instrumentation is located. The laboratory is equipped for connection to external power supplies (230 and 400 V) as well as featuring an internal diesel generator, facilities for connection to external water supplies, air conditioning and internal climate control for operation in adverse

weather conditions. The sample preparation section of the laboratory is equipped with facilities for working with and preparing samples for measurement. It includes, amongst other things, a fume hood, facilities for connecting to water supplies, sink, freezer, refrigerator and microwave facilities.



Facilities for sample preparation

The laboratory's other section is equipped as a measurement laboratory and control room with work stations for the control of instrumentation, analyses and communication (fax and telephony, e-mail, internet and IT facilities) that allow for the transfer of measurement data to NRPA's headquarters.



Workstations for control of instrumentation and communication.

Instrumentation

The mobile laboratory contains different types of measurement instruments such as are required for a laboratory that will deal with a range of incidents and accidents involving radioactive materials and where the determination of the types, amounts and dissemination of radioactive materials are of consequence. Measurements can be conducted on materials (such as soil, water, vegetation, foodstuffs etc.) that are brought to the

laboratory for preparation and measurement but one can also transport mobile measurement equipment from the laboratory into the field for mapping/investigations of areas which are or can be contaminated with radioactive materials.



Instrumentation for gamma measurements mounted in lead shielding.

Installed in the mobile laboratory are two HPGE detectors for high-resolution gamma measurements where one of these detectors is electrically cooled. The first detector is calibrated for the determination of radioactive contaminants in a wide range of environmental sample types when mounted in lead shielding. The detector can also be mounted in a layout suitable for the measurement of radioactivity in personnel.



NRPA performs routine whole body measurements on vulnerable population groups in Norway. In 2005 the mobile laboratory was deployed for measurements on reindeer herders in Snåsa and in Kautokeino.

Whole body measurement is conducted by seating the person on a seat where the behind and beneath of the seat is shielded with 50 mm of lead and the detector itself is shielded with 10 mm of lead. The seat and its shielding consist of an integral unit that can be removed from the container in its entirety to free place for other purposes and needs.



Portable high resolution gamma detector for field usage.

The second detector is a portable detector cooled with liquid nitrogen and connected to a portable spectrometer that constitutes a complete system for field measurements. This detector is also calibrated for the measurement of environmental samples and can be easily mounted in the container's lead shielding for usage. The laboratory also includes systems for other types of stationary gamma measurements (NaI detectors) in addition to portable handheld instruments.

For dose rate measurements in the field, a handheld instrument is used which can facilitate the use of a range of detector types for the measurement of alpha, beta and gamma radiation as well as neutrons. The instrument can measure extremely low radiation levels in the surroundings and also has the capability to separate the contributions of natural variations in the radiation background from those of anthropogenic radioactive contamination.



Dose rate monitor with probe for differentiation between natural background radiation and anthropogenic radioactive contamination.

The mobile laboratory is also equipped with instruments for measurement of radioactive materials other than those that emit gamma radiation. To establish the presence of materials that emit alpha and beta radiation in a contaminated area one can conduct measurements on specific types of sample materials (air filters, precipitation, etc.).



Portable instrumentation for measuring alpha and beta radiation in contaminated sample materials.

Sampling equipment

For measurements conducted to identify the type of radioactive contamination and to map the extent and concentration of such contamination, it is important that environmental samples are taken according to standardised methods. The laboratory is outfitted with equipment for sampling of soil and sediment profiles as well as air samplers for the measurement of airborne radioactive materials.



Equipment for sampling of soil and sediment (to the left) and a portable air sampler for measurement of airborne radioactive contamination (to the right).

The air sampler can be placed out in the field and draws large volumes of air through a filter which can later be prepared and measured for levels of radioactive contaminants. The laboratory also contains diverse protective equipment and electronic dosimeters for monitoring of radiation doses to personnel participating in activities involving the laboratory.

Technical specifications

Container:

- 20 ft. ISO container constructed of laminated aluminium panels with excellent insulation mounted in a galvanised steel frame. Ext. dimensions: 606x244x244 cm.
- 4 16 A circuits. 220 V convertible to 400 V. UPS on two circuits
- Separate air conditioning and ventilation systems
- Built in diesel generator for power supply in the event of power cuts
- Fume hood, refrigerator/freezer/microwave
- Lines for telephony, data, internet, e-mail.

Equipment:

- PC's
- HPGe and NaI detectors, stationary and mobile
- HPGe whole body counter
- Alpha/Beta counters
- Dose rate monitors
- Air sampler
- Sampling equipment
- Protective equipment, electronic personal dosimeters