The Safeguards Analytical Laboratory

by B.E. Clark and G.B. Cook*

In order to discharge its safeguards responsibilities, the International Atomic Energy Agency must independently verify the amount, composition, location, and movement of the nuclear material subject to safeguards. Agency verification is accomplished by material accountancy, containment and surveillance. Only material accountancy enables the State and the Agency to determine the concentration and isotopic composition of safeguarded nuclear material in a manner which satisfies the requirements of an international safeguards system. Material accountancy consists of various kinds of measurements and data collection, but we shall emphasize the measurements for determining the flow and inventory of nuclear material. An integral component of this measurement is the analysis of samples taken during the Agency's inspections of various facilities in the nuclear fuel cycle.

PAST AND PRESENT ACTIVITIES

The Agency's General Laboratory at Seibersdorf (about 30 kms from Vienna) has, in addition to its many international programmes, been able to administer an analytical programme for safeguards on a limited basis. As the number and different types of samples increased due to the expanding nuclear industry and the growth of safeguards activities, laboratories in several Member States also performed analytical services for the Agency. Meanwhile, a modern, new nuclear safeguards laboratory is being constructed at Seibersdorf in order to provide suitable space and facilities for safeguards requirements.

THE FUTURE

On 3 July 1973, an agreement was concluded between the Österreichische Studiengesellschaft für Atomenergie Ges.m.b.H. (SGAE) and the Agency for the lease of a Safeguards Analytical Laboratory (SAL) at Seibersdorf. SAL has now been constructed and is undergoing various inspections and tests preliminary to the official commissioning which is expected to take place in 1976. Following the commissioning and the necessary arrangements with the Austrian authorities and the SGAE, the Agency will occupy and operate SAL.

The first safeguards analytical instrument has recently been installed: a Jarrell-Ash 3.4 meter Ebert emission spectrograph. Also magnets have been received for the Agency's ORNL-type, two-stage thermal emission mass spectrometer. The re-location of other

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The newly-completed IAEA Safeguards Analytical Laboratory at Seibersdorf, Austria.
Photo: IAEA/Deron

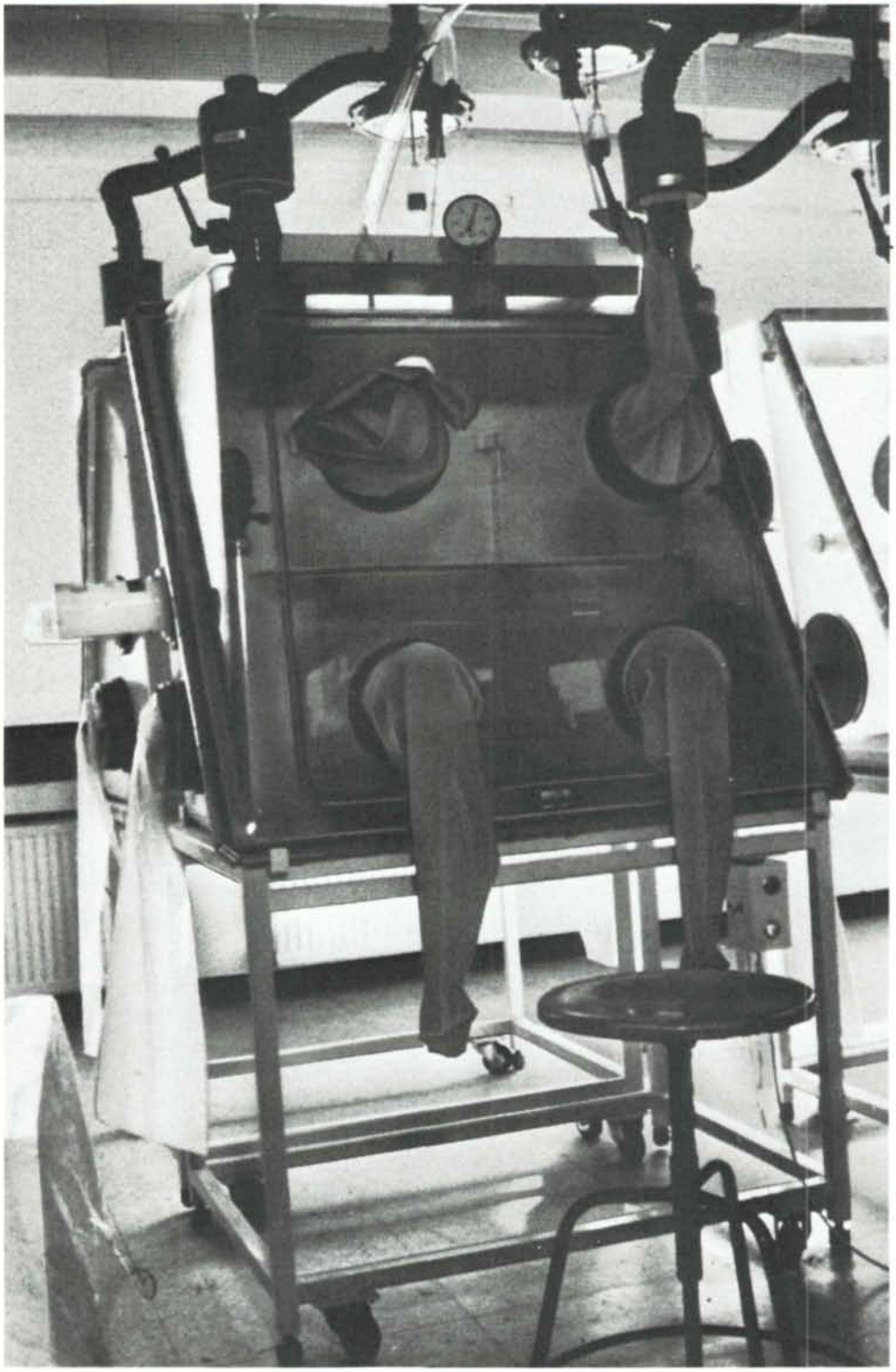
equipment and Agency staff from the General Laboratory to SAL will proceed in a way that will minimize interruption of the analytical programme now in force.

It is anticipated that about 15 scientists will constitute the Agency's analytical team for SAL. The modern laboratory facility and the automated, computerized equipment will enable them to perform rapid, accurate analyses on a routine basis.

Several national laboratories will also be co-operating with the Agency in an international network (NWAL). The primary objective of NWAL will be to provide measurements for the evaluation of the facility operator's accounting data. The basic mode of evaluation will be through paired comparison of the operator's and the network's measurements. To ensure that the data obtained from the network laboratories are of high quality, the Agency will administer, through SAL, a quality control programme (QCP). Some features of this QCP will be an internal quality control programme for each Member State participating laboratory, analyses of common reference standards by all participating laboratories and analysis of duplicate samples by both SAL and the other laboratories of NWAL.

THE LABORATORY

The SAL building is a new wing of the Research Centre SGAE and has a usable area of just over 500 square meters.



As the laboratory will handle radioactive material, such as plutonium, in gram amounts for analysis, Class A type laboratory conditions are required by the Austrian authorities responsible for the issue of an operating license. Correspondingly, the ventilation system plays a very important role in providing not only the necessary conditions in fume cupboards and glove boxes but also the required under-pressures and gradations of under-pressure with respect to the atmosphere in rooms and areas. The ventilation system is relatively sophisticated, being largely automatically controlled. It consists of an input of filtered air to rooms coupled with a room exhaust to maintain the necessary pressure gradients. The fume cupboards and the glove boxes have separate exhaust systems which are fitted with many protective filters and also with fire dampers and metal fire meshes to hinder the spread of fire, should it ever occur. Each fume cupboard has a coarse and a fine (HEPA) filter and in the attic storey, where the ventilation equipment is situated, there are further filters before the air is discharged to the atmosphere. As the glove boxes are the real centre of plutonium handling, their filter protection is even higher. Each glove box has two inlet and two outlet HEPA filters connected to the glove box exhaust system, which is further protected by a series of absolute filters. Reserve motors are switched on automatically, should any of the fan motors break down. The automatic control system allows for the break down of the normal electrical supply, in which case the emergency electrical supplies are switched on.

The entrance to SAL is via a reception area, leading into the changing rooms. Although it is not absolutely necessary in all parts of the SAL, a complete change of clothing will be required for those working in the laboratory. On entering the control area and passing the Health Physics room, one finds what is essentially the uranium area where uranium samples will be analysed, together with the mass spectrographic laboratory and other rooms where the radiological protection requirements are not high (e.g. the Radiometric Analysis Laboratory, the chemical stores etc.). Connection between the two floors of the SAL is by lift.

The plutonium working areas are beyond the uranium laboratories but shut off from them by doors, both in the laboratories and the corridors, with a corresponding air under-pressure. To preserve reasonable working conditions, the plutonium laboratories have windows to provide natural light. However, as normal windows are a risk point in a plutonium laboratory because of possible loss of containment caused by impact, fire or an explosion, special high temperature resistant, wire-reinforced glass is used in all windows and doors of this area. Naturally, plutonium will be handled in glove boxes and two analytical chains of boxes are available in the main plutonium laboratory. The ventilation system of the glove boxes is designed so that, if four gloves were simultaneously destroyed, the air velocity through the holes would be such that safety would be maintained and there would be no danger of plutonium escaping from the glove boxes into the laboratory.

The Agency will thus have a laboratory which will enable it to carry out its analytical responsibilities for the safeguards programme. This has been made possible by the co-operation of the Austrian Government and the close collaboration between SGAE and the IAEA.

◀ A glove-box for the dissolution of plutonium, specially constructed of PVC, at the SAL, Seibersdorf. Photo: IAEA/Deron