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Safeguards Analytical Laboratory: Sustaining Credible Safeguards

Report by the Director General

Summary

- The Agency's ability to provide independent and timely analysis of safeguards samples, one of the cornerstones of the safeguards regime, is at risk because of ageing technical infrastructure and analytical equipment at the Safeguards Analytical Laboratory. Security at the facility does not meet UN system standards while the severe lack of space available to perform multiple operations involving nuclear and radioactive materials undermines Agency safety requirements. A number of important human resource concerns also need to be addressed.
- Options for strengthening the Agency's analytical capabilities, for addressing the current deficiencies and alleviating the safety and security concerns have been evaluated and are presented in this report.

Recommended Action

It is recommended that the Board:

- Take note of the need to strengthen the Agency's independent analytical capability for safeguards, in particular sensitive particle analysis techniques;
- Take note of the additional funding requirements as detailed in paragraph 30;
- Encourage Member States to contribute extrabudgetary support; and
- Take note of the fact that supplementary regular budget appropriations may be required should sufficient extrabudgetary contributions not be received.

Safeguards Analytical Laboratory: Sustaining Credible Safeguards

Report by the Director General

A. Background

1. This report draws attention to problems that result from the ageing of the Safeguards Analytical Laboratory (SAL), outlines options to mitigate risks to the sustainability of operations, and presents initial estimates of funding needed to address these problems. Options are also presented for strengthening the Agency's analytical capabilities.

2. In November 2006, a workshop of technical experts from Member States and the Secretariat was convened at Seibersdorf, Austria, to discuss scenarios to ensure the sustainability of operations at SAL. The participants recognized that urgent action was needed and recommended that a cost–benefit analysis be undertaken of various options to upgrade the infrastructure of SAL.

3. SAL consists of two main parts, the Nuclear Laboratory and the Clean Laboratory. The Nuclear Laboratory is located in rented space on the premises of the Austrian Research Centres at Seibersdorf. It performs destructive analysis of both nuclear material samples and radioactive environmental samples. The Clean Laboratory, located in a dedicated building within the Agency-owned laboratory premises at Seibersdorf, screens non-radioactive environmental samples and performs bulk and particle analysis on approximately 20% of them. The remaining 80% of environmental samples are sent to the Agency's Network of Analytical Laboratories (NWAL) for measurement.

4. SAL is a crucial component of the NWAL, established by the Agency to support its overall safeguards verification effort. Generally, the NWAL works well for analysis of environmental samples but virtually all nuclear material samples are being analysed at SAL, due to reduced availability of network laboratories for such analyses. Efforts to identify and qualify new network laboratories are under way, especially for nuclear material analysis, to serve as a backup for SAL.

5. Particle analysis of environmental samples is one of the cornerstones of the current safeguards verification system, allowing the possibility to detect undeclared activities. However, the Agency lacks the equipment and expertise to independently validate, through its own measurements, the results of the analyses carried out by the NWAL.

6. The Agency expects the overall demand for analytical services to remain stable in the foreseeable future, with moderate fluctuations. At current capacity, SAL can process around 800 nuclear material samples and 500 environmental samples per year, but it is considered prudent to plan for additional peak loads.

7. Given SAL's central role in the implementation of safeguards, the consequences of a protracted shutdown, caused, for example, by failure of a critical component of the ventilation system at the laboratory, need to be addressed.

B. Statement of problem

B.1. Infrastructure

8. The Nuclear Laboratory facility was built in the mid-1970s and many key components of its technical infrastructure are not designed to meet current programmatic needs and Agency security and safety requirements. There is an increasing risk of failure of these components, including the central ventilation system that assures the safe containment of radioactive substances. Failure of this system would jeopardize the work of the laboratory. There is a severe lack of space and multiple operations have to be carried out in a limited area, thus increasing the risks to the safe handling of nuclear and radioactive materials. In addition, perimeter security does not meet current Agency and UN system standards, which is a serious concern.

9. The Nuclear Laboratory has always been compliant with the relevant safety regulations agreed between the Agency and Austria, and this compliance has been verified by regular safety inspections by Austrian authorities. However, although much effort has been invested to upgrade safety and security at the Nuclear Laboratory, it is not fully compliant with the current Agency safety requirements and security guidelines, and it cannot be made compliant without significant investment.

B.2. Equipment

10. A significant part of SAL's equipment has aged to an extent which puts reliable service at risk. Examples of equipment items that are more than 12 years old are a thermal ionization mass spectrometer, a coulometer and a K-edge densitometer (having a combined estimated replacement cost of €1.5 million). The Agency therefore needs to replace and upgrade key equipment to allow SAL to continue to fulfil its mission.

11. Maintaining and enhancing the credibility of Agency safeguards requires a strong in-house capability to perform analyses in a cost-effective, accurate, confidential and timely manner. Particle analysis of environmental samples by secondary ion mass spectrometry (SIMS) provides a rapid measurement to detect possible indications of undeclared activities. The Agency's 28-year old SIMS instrument, which performs particle analysis at 'normal sensitivity' levels, breaks down frequently and needs to be replaced urgently. In addition, as noted above, the Agency must strengthen its analytical capabilities in order to be able to independently validate with its own measurements all analyses performed in the NWAL (specifically the Fission-Track/Thermal Ionization Mass Spectrometry method). This is a continuing concern.

B.3. Budgetary constraints

12. This situation is due to the lack of funds to invest in infrastructure and equipment as a consequence of budgetary constraints. Significant financial requirements of this sort cannot be met under current regular budget levels.

C. Options

C.1. Upgrading the infrastructure

13. In view of the current condition of SAL, its infrastructure urgently needs to be upgraded. However, properly addressing infrastructure concerns will require significant capital investment.

14. Two main options for upgrading the infrastructure have been considered[1]: renovation of the existing Nuclear Laboratory facility combined with construction of additional laboratory space (e.g. for a new SIMS facility), or construction of a new laboratory complex accommodating all space requirements.

15. Renovation would involve first decommissioning the Nuclear Laboratory, followed by its complete renewal at its current location. An additional facility would also need to be constructed elsewhere to address the current lack of space. The renovation process would be expected to take as much as two years, and the following points need to be borne in mind [2]:

- Under the current lease agreement of the Nuclear Laboratory facility the Agency would not be required to pay the cost of decommissioning upon termination of the lease. However, if the Nuclear Laboratory remained at the same location, its renovation would involve a substantial one-time decommissioning cost to the Agency (approximately €3 million);

- Since there is insufficient capacity in the NWAL to analyse all nuclear material samples, if the Nuclear Laboratory was closed for renovation, the Agency would need to try to make other arrangements which would be both problematic and costly; and

- Even with such a renovation, it would not be possible to upgrade the security of the present facility to ensure compliance with current requirements[1].

16. Building a new laboratory complex within a secure area of the Agency's Laboratories at Seibersdorf would provide for the most comprehensive solution by addressing all security and safety issues as well as meeting the additional space requirements. There would be no decommissioning costs for the Agency and closure of the Nuclear Laboratory during the construction period would not be required.

17. Provisional estimates indicate that the cost of the two options for the Nuclear Laboratory (i.e. renovation versus replacement) would be similar. However, a comparative assessment clearly favours the building of a new laboratory complex as the most cost-effective strategy which adequately addresses all safety, security and space issues.

C.2. Equipment

18. As mentioned in paragraph 11 above, the Agency needs to validate with its own measurements the results of particle analysis of environmental samples provided by the NWAL. The most accurate and sensitive analyses can best be accomplished by an ultra-high sensitivity secondary ion mass spectrometer (UHS-SIMS). Therefore, the acquisition of a state-of-the-art UHS-SIMS with the associated infrastructure and expert staff is at the top of the Secretariat's priorities. However, the new UHS-SIMS will need dedicated laboratory space not available within the current infrastructure. The utilization of this technique will therefore only be possible if the appropriate infrastructure upgrade discussed above takes place and additional appropriate human resources are available.

19. Implementation of the UHS-SIMS technique will not only allow particle measurements of higher sensitivity and greater accuracy, but will also enhance the Agency's independent capabilities in "fingerprinting" material. In combination with a state-of-the-art scanning electron microscope it will specifically support identification of plutonium particles and provide associated age-dating information based on the measurement of specific isotopes. It will also help by determining the ratios

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[1] Report by external consultants KWI and TUeV (Technischer Überwachungsverein, Germany).

[2] All financial figures quoted are provisional estimates with an uncertainty of ±15–25%.

of the minor uranium isotopes to greater precision. Such in-house particle analysis capability is especially important for deriving independent safeguards conclusions.

20. Because the UHS-SIMS will take at least three years to reach full operation after the order is placed, it will be necessary to ensure a reliable routine SIMS measurement capability for base load measurements by replacing the obsolete 28-year-old standard SIMS as soon as possible with the latest standard model, with the goal of making it operational within one year. Given the heavy reliance that is placed on particle analysis, and the need for some redundancy in measurement capability, the Secretariat's assessment is that it would be prudent to acquire both types of SIMS. However, the highest priority is the purchase of the UHS-SIMS.

C.3. Network of Analytical Laboratories

21. The network for analysis of environmental samples in addition to SAL consists of thirteen active laboratories in seven Member States. Generally it works well; however, the NWAL lacks sufficient capacity for sensitive environmental sample analysis, which leads to considerable delays. The Secretariat will therefore continue to seek to identify qualified laboratories in Member States that can provide this specialized service.

22. Currently, the network for nuclear material analysis in addition to SAL consists of one fully active laboratory, which has a limited capacity for Agency samples. Therefore, consideration needs to be given to adding qualified laboratories to the NWAL capable of receiving and analysing nuclear material samples. Two candidate laboratories are presently undergoing qualification procedures.

23. The Secretariat will continue to encourage Member States to nominate and support potential new laboratories for nuclear material or environmental sample analysis and stands ready to assist these candidate laboratories in qualifying for participation in the NWAL.

C.4. Human resources

24. The responsibilities of SAL have expanded over time to accommodate the more sophisticated analytical needs of the Agency's safeguards activities. An important aspect of increasing the effectiveness and efficiency of SAL will be broadening and maintaining the expertise, experience and technical knowledge of its analysts and other key staff. For example, implementation of UHS-SIMS capability will necessitate the recruitment of additional highly specialized scientific and technical staff.

D. Implementation schedule

25. The various measures indicated in this report cover a wide time scale:

- A matter of urgency is the immediate replacement of the obsolete standard SIMS with a new instrument;
- The procurement and installation of the UHS-SIMS (requiring the construction of new laboratory space) is the highest priority, with the goal of the instrument being fully operational as soon as possible;
- The first priority of the infrastructure upgrade should be to address the needs of the UHS-SIMS facility (phase 1) by 2008–2009. In parallel, planning for reconstruction of the Nuclear Laboratory (phase 2) should be initiated as soon as possible, contingent on the availability of funds, with the goal of having the new facility operational no later than 2011.

E. Financial Implications

26. In order to prepare for the infrastructure upgrade, detailed planning needs to be carried out. Such a detailed design and planning effort is estimated to cost approximately €1 million. The subsequent major capital investment of approximately €25 million is foreseen within the 2010–2011 budget cycle. Various possibilities of covering the cost of the capital investment will be considered.

27. Funding is also needed for the acquisition and installation of a standard SIMS costing approximately €1.6 million for the instrument and €0.4 million for installation.

28. The acquisition of a UHS-SIMS costs approximately €3.5 million, plus associated staffing and laboratory infrastructure costs (annual operating costs are foreseen to be approximately €0.6 million). The phased approach to the infrastructure upgrade would take into account the laboratory facilities for the UHS-SIMS as phase 1 of the construction effort.

29. A recurrent need to replace other aged equipment at SAL (see paragraph 10) through a structured programme is estimated at €1 million annually.

30. The following table summarizes the capital investment requirements[3] and associated timeframes:

Action **Timeframe**	**2008**	**2009**	**2010**
Detailed planning of phase 1 and phase 2 of the new SAL	€1.0 million		
UHS-SIMS purchase	€3.5 million		
UHS-SIMS infrastructure (phase 1)		€3.5 million	
UHS-SIMS installation			€1.2 million
Standard SIMS purchase	€1.6 million		
Standard SIMS installation		€0.4 million	
Construction and commissioning of new Nuclear Laboratory building (phase 2)			€25 million[4]
Replacement of aged equipment	€1.0 million	€1.0 million	€1.0 million
Total	**€7.1 million**	**€4.9 million**	**€27.2 million**

[3] All financial figures quoted are provisional estimates with an uncertainty of ±15–25%.

[4] This figure includes a €5 million contingency.