

Board of Governors

GOV/2005/9

Date: 14 February 2005

Restricted Distribution

Original: English

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Item 6(c) of the provisional agenda
(GOV/2005/2)

Implementation of the NPT Safeguards Agreement in the Arab Republic of Egypt

Report by the Director General

1. The Agreement between the Arab Republic of Egypt (Egypt) and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (the Safeguards Agreement¹) entered into force on 30 June 1982. Egypt agreed on 1 April 1997 to modify the Subsidiary Arrangements to the Agreement by including an undertaking to comply with the Board's decision on the early provision of design information.²
2. As of September 2004, Egypt had declared to the Agency three facilities, and five locations outside facilities that customarily use nuclear material (LOFs). The three facilities (the 2 MW Egyptian Atomic Research Reactor, the 22.5 MW Multi-Purpose Reactor and the Fuel Manufacturing Pilot Plant) and one of the LOFs (the Nuclear Fuel Research Laboratory) are collocated on the site of the Inshas Nuclear Centre.³
3. As part of its ongoing assessment of the correctness and completeness of States' declarations under comprehensive safeguards agreements, the Agency regularly reviews publications available from open sources that may be relevant to the nuclear activities of a State. During the preparation of the updated State Evaluation Report for Egypt for 2004, the Agency concluded that it was necessary to follow up with Egypt indications derived from a number of open source documents published by the Egyptian Atomic Energy Authority (AEA) and by former and current staff of the AEA suggesting the possibility of nuclear material, activities and facilities in Egypt relating to uranium extraction and conversion, irradiation of uranium targets and reprocessing that had not been reported to the Agency.
4. On 21 September 2004, the Deputy Director General for Safeguards met with the Chairman of the AEA and other senior Egyptian officials to discuss a number of issues related to the implementation of safeguards that the Agency had identified. During these discussions, the Agency provided examples of the open source publications that had given rise to concerns that Egypt may

¹Published as document INFCIRC/302.

² Document GOV/2554/Att.2/Rev.2.

³The other LOFs are situated outside the Inshas site, and include a university, two hospitals, and a laboratory.

have carried out some nuclear activities that it had not declared to the Agency. At that meeting, the Egyptian officials agreed to permit an Agency visit to the Inshas site with a view to enabling the Agency to assess the situation.

5. A team of Agency inspectors visited Egypt between 9 and 13 October 2004, at which time they were provided access to a number of locations on the Inshas site. As a follow-on to that visit, another meeting between Agency and Egyptian representatives was held in Vienna on 22–23 November 2004.

6. Between 11 and 15 December 2004, the Agency carried out inspections in Egypt, which were followed by further discussions with Egyptian officials in Vienna on 17 January 2005 on the safeguards issues. The Agency visited the Inshas site again between 29 January and 2 February 2005.

7. On 11 February 2005, in another meeting held in Vienna, Egypt provided additional information on the previously undeclared material and activities, and submitted modified and new design information.

8. This report describes the nature of the safeguards issues involved and the Agency's verification activities to date, as well as the corrective actions taken by Egypt, and summarizes the initial findings of the Agency and next steps.

A. Verification Activities

A.1. Uranium conversion experiments

9. In the course of the meetings and visits referred to above, Egypt informed the Agency that, prior to the entry into force of its Safeguards Agreement, Egypt had imported nuclear material and had carried out uranium conversion activities using some of that material. In response to the Agency's request in September 2004 for a complete list of nuclear material in Egypt and a chronology of Egypt's past nuclear activities, Egypt provided in December 2004 a preliminary list of nuclear material which it had not included in its initial report in 1982, or which had been subsequently produced from that material and not reported to the Agency.

10. During the Agency's December 2004 inspections and January 2005 visit at Inshas, Egypt presented the material for Agency verification, and provided the Agency with access to the laboratories in the Inshas Nuclear Chemistry Building where the uranium conversion experiments had been carried out. Egypt explained that these experiments had been carried out within the framework of staff development for the front end of the fuel cycle, and that some of the equipment involved had been dismantled and the contaminated parts stored at a disposal site at Inshas. The Agency has taken samples of the nuclear material. Preliminary findings indicate that Egypt failed to include in its initial report in 1982 approximately 67 kg of imported UF₄, 3 kg of uranium metal (some of which had been imported, and some of which had been produced from imported UF₄), approximately 9.5 kg of imported thorium compounds, and small amounts of domestically produced UO₂, UO₃ and UF₄. The Agency's verification of Egypt's declarations concerning these experiments is on-going.

11. Egypt also informed the Agency that it had had a project, carried out by the Nuclear Material Authority (NMA) of Egypt, to recover uranium ore concentrate as a by-product of activities at a Phosphoric Acid Purification Plant located on the Inshas site, which Agency inspectors visited during the December 2004 inspections. Egypt indicated that, although the plant is operational, it was never able to work as designed for the separation of uranium. In addition, Egypt provided information to the

Agency about an on-going NMA programme for heap leaching of uranium ore in the Sinai and Eastern deserts. Egypt has informed the Agency that none of the uranium ore concentrate produced as a result of its leaching activities has been of a purity and composition that required it to be reported to the Agency.⁴ Egypt has transferred some of the material to NMA headquarters in Cairo and provided the Agency with access to it. The Agency intends to take samples from the material with a view to assessing its status.

12. Egypt has agreed to submit corrections to its initial report on nuclear material. The Agency has asked Egypt to submit design information for the Nuclear Chemistry Building, including the new storage area in the basement where the recently declared nuclear material is now located.

A.2. Uranium and thorium irradiation experiments

13. In December 2004, Egypt acknowledged that, between 1990 and 2003, it had conducted experiments involving the irradiation of small amounts of natural uranium in its reactors to test the production of fission product isotopes for medical purposes, and that it had not reported these experiments to the Agency. These activities are said to have involved 12 experiments using a total of 1.15 g of natural uranium compounds at the 2 MW research reactor (between 1990 and 2003), and four experiments using a total of 0.24 g of natural uranium compounds irradiated at the 22.5 MW reactor (between 1999 and 2000). In addition, Egypt informed the Agency that nine thorium samples had been irradiated in the 2 MW research reactor. Egypt also informed the Agency that the irradiated targets had been dissolved in three laboratories located in the Nuclear Chemistry Building, but that no plutonium or U-233 was separated during these experiments. Egypt explained that the laboratories had not been declared to the Agency because they had been intended only to be used for radioisotope production. Egypt has indicated that it conducted similar experiments prior to the entry into force of its Safeguards Agreement, and between 1982 and 1988, but that it has been unable thus far to locate relevant source documentation with respect to such experiments.

14. In December 2004, the Agency took environmental samples from the Nuclear Chemistry Building laboratories said to have been involved in these experiments with a view to confirming the information provided by Egypt. Egypt also provided for Agency examination documentation relevant to the irradiation experiments. In February 2005, Egypt provided modified design information for the two reactors. Egypt has also agreed to submit relevant inventory change reports (ICRs).

A.3. Preparatory activities related to reprocessing

15. In March 2001 and July 2002, the Agency wrote to Egypt concerning the results of the analysis of environmental samples taken from the hot cells at the 2 MW research reactor which indicated the presence of traces of actinides and fission products. In July 2003, Egypt replied, attributing the presence of the particles to the fact that damaged fuel cladding had resulted in contamination of the reactor water, and the contaminated water had infiltrated the hot cells from irradiated sample cans. The Agency has taken additional environmental samples to confirm this statement, and is awaiting the results of their analysis.

16. In December 2004, Egypt acknowledged that it had also failed to include in its initial report imported unirradiated fuel rods containing uranium enriched to 10% U-235, some of which had been

⁴ Article 34(c) of the Safeguards Agreement provides that "When any nuclear material of a composition and purity suitable for fuel fabrication or for isotopic enrichment leaves the plant or the process stage in which it has been produced ... the nuclear material shall become subject to the other safeguards procedures specified in this Agreement." In accordance with paragraphs (a) and (b) of Article 34, the Agency need not be informed of the domestic production of any material containing uranium or thorium which has not reached the stage described in Article 34(c).

used in experiments, said to have been carried out at the Nuclear Chemistry Building prior to entry into force of Egypt's Safeguards Agreement. These experiments reportedly involved laboratory scale testing of fuel dissolution in anticipation of the development of a reprocessing laboratory (see below). Egypt has presented for Agency verification one intact fuel rod (said to contain uranium enriched to 10% U-235), a number of pieces of other fuel rods (natural and enriched uranium), and uranyl nitrate solution with uranium enriched to 10% U-235. It is not possible at this stage to ascertain precisely how much uranium these materials contain, but their total gross weight (including cladding and containers) is estimated to be about a kilogram. The results of destructive analysis sampling are being assessed. Egypt has agreed to correct its initial report to include these materials.

17. In addition to the above experiments, Egypt informed the Agency that, at the end of the 1970s, motivated by its plans at that time to build some eight nuclear power plants for electricity generation, and with a view to developing expertise in the nuclear fuel cycle, it had concluded several contracts with a foreign company to build a laboratory (the Hydrometallurgy Pilot Plant) for carrying out "bench scale radiochemistry experiments" involving the separation of plutonium and uranium from irradiated fuel elements of the 2 MW research reactor. The first of the three laboratories of the Pilot Plant consists of Modules 1 through 3 containing three hot cells: the first cell is a shielded alpha cell designed for mechanical shearing of research reactor fuel, which Egypt has said was never finished due to the fact that the foreign vendor had been unable to secure the necessary export licence for the shearing equipment; the second cell contains a completed dissolver and mixer settlers for first stage fission product separation; the third cell was designed for waste vitrification but no essential equipment has been installed. The second laboratory consists of Module 4, a lead shielded glove box for second stage fission product separation using mixer settlers, and Module 5, an unshielded glove box for the separation of plutonium from uranium. The third laboratory consists of two connected glove box lines suitable for plutonium chemistry but which contain no equipment.

18. In November 2004, Egypt acknowledged that, in 1987, it had conducted in the Hydrometallurgy Pilot Plant acceptance tests using unirradiated uranyl nitrate in chemical reagents purchased on the local market. In the more detailed information provided by it in January 2005, Egypt indicated that the uranyl nitrate had been mixed with a solution obtained from the dissolution of domestically produced scrap UO₂ pellets (with an estimated total weight of approximately 1.9 kg of uranium compounds), and that Egypt had reported to the Agency neither the materials nor their use in the tests. Egypt explained to the Agency that, owing to its inability to complete the facility, a decision had been taken thereafter to use one cell of the Pilot Plant within the framework of a project for the management of unused and orphan radioactive sealed sources.

19. According to Egypt, at the time its Safeguards Agreement entered into force in 1982, it did not include the Hydrometallurgy Pilot Plant in its initial declaration of existing facilities because Egypt had not considered it to be a facility since it was being constructed only to carry out bench scale radiochemistry experiments. In the view of the Agency, however, given its intended purpose and design capabilities, the Hydrometallurgy Pilot Plant was a nuclear facility, as defined in the Safeguards Agreement, and, as required pursuant to Article 42 of the Agreement, Egypt should have declared the Pilot Plant to the Agency as early as possible prior to the introduction of nuclear material into the facility.

20. The Agency has taken environmental samples from the hot cells and laboratories involved in the acceptance tests. Egypt has provided the Agency with documentation relevant to the contracts and information on their implementation. Egypt has submitted design information for the Hydrometallurgy Pilot Plant and has agreed to provide ICRs with respect to the acceptance tests.

21. In the course of the Agency's recent visits, the Egyptian authorities also showed the inspectors a new Radioisotope Production Facility under construction at Inshas. Egypt has indicated that the

facility is intended for the separation of radioisotopes from uranium enriched to 19.7% in U-235 to be irradiated at the 22.5 MW reactor, but that no nuclear relevant equipment has yet been procured for it. In accordance with its undertaking to provide early design information on new facilities, Egypt should have reported the decision to construct the new facility no later than 1997 when it undertook to provide early design information for new facilities. As a corrective measure, Egypt has provided the Agency with design information for the facility.

B. Findings and Next Steps

22. To date, the Agency has identified a number of failures by Egypt to report to the Agency in accordance with its obligations under its Safeguards Agreement, which can be summarized as follows:

- a. Failure to report on its initial inventory imported UF₄, imported and domestically produced uranium metal, imported thorium compounds, small quantities of domestically produced UO₂, UO₃ and UF₄, and a number of unirradiated low enriched and natural uranium fuel rods;
- b. Failure to report the uranyl nitrate and scrap UO₂ pellets, and their use for acceptance testing of the Hydrometallurgy Pilot Plant;
- c. Failure to report the irradiation of small amounts of natural uranium and thorium and their subsequent dissolution in the Nuclear Chemistry Building laboratories, including the production and transfer of waste;
- d. Failure to provide initial design information for the Hydrometallurgy Pilot Plant and the Radioisotope Production Facility, and modified design information for the two reactors.

23. As indicated above, the research and development activities referred to in this report were the subject of AEA and other scientific publications. Notwithstanding, and irrespective of the current status of the previously undeclared activities and the small amounts of nuclear material involved, the repeated failures by Egypt to report nuclear material and facilities to the Agency in a timely manner are a matter of concern. Egypt has explained that its past failure to report was attributable to a lack of clarity about its obligations under its Safeguards Agreement, particularly as regards small quantities of nuclear material used in research and development activities. Egypt has indicated that it will report any such material and activities in the future. As corrective measures, Egypt has provided modified design information for the two reactors and new design information for the Hydrometallurgy Pilot Plant and the Radioisotope Production Facility. In addition, following up on a previously discussed proposal by the Agency, Egypt agreed to recategorize the Nuclear Fuel Research Laboratory at Inshas as a facility, and has submitted design information for it.

24. The nuclear material and facilities seen by the Agency to date are consistent with the activities described by Egypt. The conversion equipment has been largely dismantled, and the Hydrometallurgy Pilot Plant is being used for radiological protection purposes, not for its originally planned purpose of reprocessing. The continuing small scale irradiation experiments in the two reactors will now be declared to the Agency and subject to verification. The Agency's verification of the correctness and completeness of Egypt's declarations is ongoing, pending further results of environmental and destructive sampling analyses and the Agency's analysis of the additional information provided by Egypt.

25. The cooperation extended by Egypt since the September 2004 meeting in clarifying these issues and in granting the Agency access necessary for it to carry out its assessment of the correctness and

completeness of Egypt's declarations has been welcome. Egypt has also cooperated in searching for and providing access to relevant documentation, although this effort is complicated by the fact that some of the activities involved were carried out between 15 and 40 years ago. The Agency has requested Egypt to continue to provide such cooperation.

26. The Director General will continue to report to the Board of Governors on the implementation of safeguards in Egypt as appropriate.