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The Application of State-Level Integration of Safeguards in Sweden

Final Report

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Göran Dahlin, Eric Häggblom, Mats Larsson and Ingegärd Rehn
Swedish Nuclear Power Inspectorate

INTRODUCTION

Development of integrated safeguards is the most important area of current and future work on the strengthened safeguards system. In 1998, the IAEA Secretariat initiated a task with Member State Support Programmes (MSSP's) to obtain assistance from Member States in the development of integrated safeguards.

Sweden accepted the task proposal, SP-1 98/PSS-02, which is activated as Task SWE C1252. After the second technical co-ordination meeting in November 1999, the SKI started to discuss and develop a structure for a report. The draft report was prepared for the third meeting in Vienna March 22nd-24th 2000. A first orientation meeting, with SKI participation, took place in Helsinki, in December 1999, with representatives from Finland and the UK. A second meeting was organised by SKI in Stockholm, in February 2000, in which representatives from IAEA, Finland and Euratom participated. The structure of the report was presented and discussed. After the February meeting, SKI conducted a thorough analysis of what was actually pointed out in the Task Definition and structured the report to fulfil the requirements of the task.

This report consists of four parts. The first part gives a brief description of the history, the current situation and the future of the Swedish nuclear programme. The main activities of the Swedish promotion of non-proliferation are listed. The second part deals with implementation of safeguards in Sweden. The third part deals with the conditions and circumstances that would make it possible to proceed with safeguards integration and a proposal for integrated safeguard measures to be applied at declared facilities in Sweden. The fourth part provides a summary.

This proposal is not based on a thorough analysis as to what extent all plausible acquisition paths to acquire nuclear material for explosive devices are covered. It is, however, understood that such analysis is of value to IAEA in the development of its integrated safeguards concept for a State. This proposal is designed to contribute to that developmental work.

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1. HISTORICAL OVERVIEW AND CURRENT SITUATION

The Swedish nuclear policy and program have been evolving during the years since the Second World War. In Annex 1 geographical locations and some additional information of the nuclear sites in Sweden are provided.

1.1 Nuclear programme before 1968

During the closing stages of the Second World War nuclear techniques were already being discussed in Sweden. In 1944 the Swedish Defence Research Establishment (FOA) was founded, and in 1947 the tasks related to acquisition of nuclear weapons were expanded. In addition, a company that could deal with the industrial use of nuclear technology for civil purposes was formed in 1947, AB Atomenergi. The company was owned mainly by the State with some private shareholders.

The nuclear programme that was formed was to enable Sweden to produce nuclear weapons by use of indigenous source materials. In Sweden there are vast uranium resources and mining started at Ranstad in 1965.

During the 1950's, several research reactors were taken into operation. The first one was the R1 at the Royal Institute of Technology in Stockholm, using natural uranium and heavy water. At AB Atomenergi's facility in Studsvik, the R2 (50 MW) material test reactor (MTR) using MTR fuel as well as several small research reactors were started. In Stockholm the Ågesta pressurised heavy water reactor (HWR) for heat and electricity production was taken into operation in 1963. Another HWR, which was built at Marviken, did not get permission to start due to safety reasons.

The concept for this period of time was to use heavy water, uranium of Swedish origin, and to build power plants that, together with the acquired knowledge, could also be used to produce nuclear weapon material.

1.2 Nuclear programme 1968-1975

After a great deal of political discussions and considerations, Sweden abandoned the plans for acquisition of nuclear weapons and signed the NPT in 1968. This step signifies a very distinct difference in the approach to the nuclear area and to the future use of nuclear energy in Sweden. Sweden knew that it wanted to use nuclear power for peaceful purposes only. The development of the "Swedish way" to produce electricity with heavy water reactors was abandoned.

The first BWR was built and went into commercial production in 1972. A Swedish company constructed it with the help of experience gained while being involved in the development work associated with the peaceful part of the "Swedish way". They had no experience of constructing BWR's but, when the decision to build a full-scale nuclear power station was taken, they took the chance.

In 1970 a decision was taken to stop the production at the Ranstad uranium mine as the prices on the world market for uranium had decreased to the extent that mining in Ranstad was of no commercial interest. In 1974 the Ågesta reactor was closed down because the safety systems had to be up-graded and this was considered too expensive. The shutdown of those two facilities marked the end of the "Swedish way".

1.3 Current Nuclear programme 1975-

1.3.1 Nuclear fuel cycle and power plants

The decision to build the first BWR reactor was followed by a decision to build a further 8 BWR's and 3 PWR's. The BWR reactors were constructed by ASEA Atom and the PWR's by the US Company, Westinghouse. Although Sweden has decided not to build new reactors and has already closed down one reactor, Westinghouse Atom AB (former: ASEA Atom, ABB Atom) can deliver BWR reactors for export. The two latest reactors went into operation in 1985. Sweden has one LEU fuel fabrication plant operated by Westinghouse Atom AB. The former mining and concentrating plant at Ranstad is used to recover uranium from filters, etc. from the fuel fabrication. There is a Central Interim Storage Facility for Spent Nuclear Fuel (CLAB).

1.3.2 Nuclear activities in the Studsvik area

A research reactor (R2) was built at Studsvik during the period 1957-1959. It was built in connection to the Atoms for Peace programme, with financial support from the USA. Studsvik also has a hot-cell laboratory and facilities to recover uranium from metal scrap. In addition, there are some decommissioned laboratories and reactors at the site.

Studsvik was initially a state owned research establishment. Today it accommodates several private companies. Some of these companies handle nuclear material or deal with nuclear related techniques. In the pond at the R2 reactor there is a small reactor called R2-0. This was rebuilt during 1999 and will partly be used for Boron Neutron Capture Therapy for cancer treatment. In addition, Studsvik has a library that contains many reports on nuclear research and activities.

Studsvik has the facility to store and treat nuclear material from companies/institutions which no longer have use for the material.

At Studsvik, outside the fenced area, the Swedish Nuclear Training and Safety Center (KSU) trains operating personnel from the NPP's (simulator training).

It will be a challenge for the personnel responsible at SKI and Studsvik to define the site and to make the initial declarations in accordance with the Additional Protocol.

1.3.3 Direct use nuclear material; MOX-fuel, HEU and Pu in Sweden

Use of MOX-fuel is planned in Oskarshamn 2 or 3 during a period of a few years, after approval of the Swedish Government. Today the reprocessed material for that fuel is stored at BNFL, in the UK. The spent fuel was shipped to Sellafield from Oskarshamn in the beginning of the 1980's.

HEU is no longer used in Swedish research reactors, and the stored spent HEU fuel that is of US origin will be shipped back to the USA within a couple of years.

Pu (about 3 kg) in different forms is stored at Studsvik, most coming from reprocessing of fuel from the Ågesta reactor and some from FOA, when its laboratories were emptied of nuclear material. About 1,2 kg of weapons-grade Pu is in irradiated metallic natural uranium fuel from the decommissioned research reactor, R1 (Royal Institute of Technology, Stockholm). This fuel is also currently stored in Studsvik. The plan is to send it abroad for reprocessing and mix the Pu into the above-mentioned MOX fuel.

The total amount of direct use material, in the form of Pu and HEU, in Sweden is less than one SQ.

1.3.4 Export and import

Initially, the Swedish export control was regulated in the Atomic Energy Act and from 1984 in the Act and Ordinance on Nuclear Activities. Since 1995 the Swedish Act and Ordinance on Strategic Products regulates export control in the following areas; nuclear, chemical, biological and missile technology. The legislation is based on undertakings carried out by Sweden in Treaties, Conventions and Bilateral Agreements. The Swedish legislation also refers to relevant EU legislation (EC 1334/00). The competent Swedish authority for the areas besides nuclear material and equipment is the National Inspectorate for Strategic Products. The relevant Ministry is the Ministry of Foreign Affairs. According to the law, the Swedish Nuclear Power Inspectorate (SKI) handles export control of nuclear material and nuclear related equipment as specified in Appendix II to the Additional Protocol.

The import of nuclear substances is still controlled in the Act and Ordinance on Nuclear Activities. This stipulates that uranium, plutonium or other substances used as nuclear fuel may, after notifying the Swedish Nuclear Power Inspectorate, be conveyed into Sweden by a person holding a license under the Act on Nuclear Activities to acquire, possess, transfer, process or otherwise deal with such substances. This means that the nuclear facilities do not need a case by case license for import. For others, the SKI or the Government must grant a license before any import can take place, except for very small quantities for specified purposes.

1.3.5 Transportation

Uranium hexafluoride is imported for the fuel fabrication at the Westinghouse Atom facility in Västerås. The majority of the ships arrive at the west cost and the material is then transported on lorries to Västerås. Alternatively, ships go directly to the inland harbour at Västerås. From the Westinghouse Atom plant, fresh fuel, pellets and uranium oxide powder for export are usually transported on lorries to main harbours in southern Sweden and then by roro ferries to the European continent. An alternative not yet used will probably be the new Öresund Link for further road transport through Denmark to the continent. Overseas shipments of fuel to North America might occur in the future. Domestic deliveries of fresh fuel from Västerås, always go by road to the nuclear power stations.

A substantial part of the fresh fuel needed in the power stations is imported from Germany, Belgium and Spain. Ferries to southern Sweden are usually used and then road transport. Chartered ships may sometimes be used for both import and export.

The Studsvik company imports fresh MTR fuel elements from France. The fuel is transported either by air or by ferry plus lorry. The spent MTR fuel is sent by lorry to a harbour and then by ship to the USA to be taken care of there. Studsvik also receives spent fuel rods, in full or part length, for research and investigation purposes both from domestic and foreign utilities and from foreign research organisations.

All spent power reactor fuel is sent for intermediate storage at CLAB by the special purpose-built ship, M/S Sigyn, owned by the Swedish Nuclear Fuel Waste Management Co (SKB) company. Since all the nuclear facilities are located on the coastline, no road transport is needed except for a very short distance by the Ringhals plant.

1.3.6 Nuclear related production (INFCIRC/540 2a iv Annex I)

Sweden has facilities for the production of control rods, zirconium fuel channels and zirconium tubes.

Westinghouse Atom AB manufactures not only BWR and PWR fuel but also BWR control rods (as defined in Annex II 1.4) of different types, both for the domestic market and for

export. Empty BWR fuel channels may also be exported. (Fuel channels are not included in Annex II but are included in the current version of INFCIRC/ 254).

During 1999, a total of 134 BWR control rods were delivered to various nuclear power plants. Sixty-two (62) rods were delivered for use in foreign reactors and 72 for use in Swedish reactors.

Sandvik Steel manufactures a large variety of zirconium nuclear fuel cladding tubes (as defined in Annex II 1.6). The zirconium tubes are sold on the domestic market as well as on different export markets. The factory's capacity depends on the product mix. A nominal figure is about 1 million meters.

In addition, during the period when the power plants were built, many manufacturing companies were involved in the construction of different parts of the reactor system.

1.3.7 Nuclear related research and development

Nuclear related research and development issues can be divided into four different areas; research carried out by the defence community, research at the universities, research associated with final storage of spent fuel and the research carried out by individual licensees.

The defence research focuses on the protection of Sweden in a situation if nuclear weapons should be used against Sweden. Such research is aimed at gaining the required knowledge to understand the possible consequences of such an eventuality and to be prepared to take all necessary measures for protecting Sweden and the country's people. No nuclear material is involved in that research and it is handled by FOA.

At the universities, research is being carried out to develop, for example, NDA techniques for safeguard purposes or to develop further the burnup calculations.

There are many projects being conducted that are connected with the research and development of encapsulation and final storage facilities. For the back end fuel cycle there is a special encapsulation laboratory in Oskarshamn. At Äspö, outside Oskarshamn, a 450 m deep tunnel has been excavated and many different tests for final disposal in deep bedrock are going on there. These two facilities/laboratories are operated by SKB, which is a company owned by the NPP's. The main part of that research is funded by the industry.

In Sweden the licensee must have a research programme on safety issues. For the purposes of implementation of the Additional Protocol, the nuclear fuel cycle related research and development is defined in Article 18. In the protocol, theoretical and basically scientific research activities are not included. Furthermore, research and development on particular areas of application are not included. There may be cases where the need for further guidance arises.

1.4 Political background and the future nuclear programme

In 1980, a referendum took place on future use of nuclear power in Sweden. As a result of the referendum, the Swedish Parliament decided to allow the utilities to use the 12 nuclear units that were in operation or under construction at that time, but no additional plants were allowed.

It was said in that decision that the technical lifetime of a nuclear power plant could be estimated to be about 25 years (a misinterpretation by the politicians of the 25-year depreciation period used by the utilities for thermal power plants in general). The last two units under construction were planned to start in 1985 and therefore the whole nuclear programme should be phased out by 2010.

After political discussions, the first reactor was stopped in November 1999. This was the first reactor at Barsebäck. The schedule for the remaining 11 NPP's is not yet decided, but the year 2010 is no longer valid. Today the technical lifetime for the NPP's is estimated to be 40 years.

An encapsulation plant and a final storage facility must be built. The decision on where it will be located will be taken within a few years. For a long time after the production of nuclear electricity has stopped fuel assemblies will be handled in CLAB and transferred into the final storage facility.

At this time, the long-term plans for the research reactor are not known.

1.5 Non-Proliferation history, treaties, regimes, laws and policy

Although Sweden was very active in learning about the construction of nuclear bombs, strong support for international disarmament and non-proliferation existed from the beginning. Until 1968, Sweden had a double-track policy where both the nuclear weapons option and the non-proliferation as a possibility were pursued and investigated. After 1968, non-proliferation became the policy followed.

When foreign navies visit Swedish harbours or coastal waters the Swedish public expresses concern as to whether the navies are carrying nuclear weapons. This concern has been addressed but not effectively taken care of. Efforts continue in the area of disarmament and non-proliferation to eliminate the causes of such concerns.

The role of Sweden in disarmament and non-proliferation efforts extends from the late 1940's and continues today. It covers active support to place nuclear weapons under international control and participation in practically all control regimes aimed at non-proliferation and elimination of any mass destruction capability. Sweden has also made highly competent and high-ranking officers available to serve many of the institutions supporting the political work and the organisations carrying out the operative functions in this field. Sweden's involvement is briefly summarised in Appendix 1.

1.5.1 Other regimes and conventions

Sweden is a member of practically all the international regimes that are established to prevent the proliferation of nuclear weapons and other mass destruction weapons. These regimes include Zangger Committee, Nuclear Suppliers Group (NSG), Missile Technology Control Regime (MTCR), Australian Group (AG), Biological Weapons Convention (BWC), Chemical Weapons Convention (CWC) and Wassenar Arrangement (WA). In general, all exports of items that could be used for acquisition of mass destruction capability are subject to export control.

1.5.2 Laws and treaties

The engagement in prevention of the proliferation of nuclear weapons and other weapons of mass destruction is also reflected in the treaties Sweden became party to and in the evolution of the law. A brief summary of treaties and laws in Sweden, that are relevant and related to nuclear non-proliferation, is given in Appendix 2.

It may be noted that Swedish legislation had to be supplemented to enable the fulfilment of the new requirements arising from the Additional Protocol, and a new law was required. Respective proposals were handed over to the Swedish Parliament for decision to be made, and the new legislation was approved on May 2000.

1.5.3 New legislation

The new legislation consists of two parts. The first is a new act on inspection, that sets out the procedure for inspections called upon by the Protocol and defines the right to access for the inspectors. The act also states that complementary/managed access (inspection) must not

jeopardise the safety or unnecessarily hamper the operation. Complementary/managed access (inspection) in private homes is excluded. To get access to a private home you need a permit to search a person's house.

The other part consists of changes in the existing act on nuclear activities. The changes are that the act covers research and manufacture of nuclear related equipment and non-nuclear material. Moreover, imports of such equipment and material must, in future, be reported to the SKI. Exports are already taken care of by the existing reporting mechanism. Exporters must have a license to transfer such goods out of the European Union as well as to countries within the Union.

In the field of export control a new Council Regulation (EC) No. 1334/2000 setting up a Community regime for the control of dual-use goods exports has been adopted. This new regulation gave rise to comprehensive amendments in Swedish legislation. Through its council on legislation, the Swedish Government suggested a new act on products of dual use. The act comprises certain supplementary provisions to the Regulation (EC) No. 1334/2000 of June 22nd 2000. The Swedish Nuclear Power Inspectorate (SKI) is still the competent authority for export control of nuclear material and nuclear related products. The SKI reports already according to INFCIRC/415, which means that there are established routines and reporting according to Appendix II in the Additional Protocol, will be of no problem. The Council Regulation (EC) No. 1334/2000 came into force on September 28th 2000. The Swedish act on products of dual use with a supporting ordinance entered into force on January 1st 2001. At the same time, the Act on Strategic Products was withdrawn.

The Regulations determining the role and functional responsibilities of the Swedish SSAC are under revision. The work will now continue as the legislative basis has been settled. The Regulations will be a complement to the Euratom regulation 3227/76 and will cover the specific national obligations including those arising from the Additional Protocol.

The new legislation and the revised SSAC Regulation are planned to come into force when the Additional Protocol is ratified.

1.6 Authorities and control of nuclear activities in Sweden

1.6.1 Swedish Nuclear Power Inspectorate (SKI)

The Swedish Nuclear Power Inspectorate, SKI, is the Swedish government's regulatory body that supervises all nuclear activities and controls all nuclear materials in Sweden. Within SKI, the Office of Nuclear Non-Proliferation is responsible for the operation of the Swedish SSAC, Transportation safety, and Physical protection as well as for Export control of nuclear material and nuclear related products. The SKI will also be responsible for addressing issues relevant to the implementation of the Additional Protocol. The respective ministries are the Ministry of the Environment and for export control the Ministry of Foreign Affairs.

1.6.2 Euratom

Sweden joined the European Union on January 1st 1995. Since then Euratom has been conducting its safeguard activities according to the Euratom Treaty.

1.6.3 Co-operation between IAEA and Euratom

The co-operation between IAEA and Euratom for the implementation of strengthened safeguard functions is arranged and regulated through INFCIRC/193 and the New Partnership Approach (NPA).

2. IMPLEMENTATION OF SAFEGUARDS IN SWEDEN

2.1 Traditional safeguards

Evolution and development of the nuclear programme, nuclear materials and activities in Sweden have been subject to bilateral and international safeguard inspections since 1960.

Historical and current verification inspections include the following:

1960-1972	Inspections were carried out by AEC (United States Atomic Energy Commission) according to the Bilateral Agreement with the USA.
	Between 1960 and 1970 fifteen inspections were performed by AEC. No inspections were carried out in 1971 and 1972 due to the fact that Sweden signed the NPT.
1972-1975	IAEA safeguards on material and equipment of US origin, according to the trilateral agreement. Almost all Swedish facilities were inspected.
1975-1995	IAEA safeguard inspections according to 153-type agreement.
1995-	IAEA and Euratom inspections, NPA.

Development work and field tests for strengthening IAEA safeguards system include the following:

1993-1997	Field test of unannounced inspections to develop Strengtened Safeguard Systems (SSS).
	Field test of development of IAEA use of SSAC elements
	Field test of Environmental Monitoring for Safeguards

The following references give an idea of the Swedish contribution to the development of strengthened and more cost-effective safeguards by use of new approaches, new technological means and methods, and by more efficient use of SSAC functions:

JNT C 00687 SWE	Test of SSAC / Facility CCTV Data Mail-in
JNT C 00764 SWE	Environmental Monitoring for Safeguards-Field Test in Sweden
SWE C 00403	Optimisation of Safeguards for LEU Fuel Cycles
SWE C 00805	Provision of Support for Testing Elements of Alternative Safeguard Approaches
SWE C 00682	Enhancement of Safeguards Remote Data Handling Facilities
SWE C 01064	Testing of Elements of Strengthened Safeguards
SWE C 01196	Commercial Satellite Imagery Cost Benefit Analysis and Implementation Study
SWE C 00964	Remote Transmission of Surveillance Data
SWE C 01034	IAEA Use of Long-range or Wide-Area Environmental Monitoring in the Detection of Undeclared Nuclear Activities
SWE B 01171	Training in Information Collection (open sources)

2.2 Implementation of current safeguards in Sweden

The safeguard activities in Sweden today are based on the Swedish legislation, the Euratom Treaty and the Agreement with IAEA. This means that the nuclear facilities in Sweden are subject to safeguards control by three different organisations with own inspectors and different objectives. The Swedish state inspections are carried out by the Swedish Nuclear Power Inspectorate (SKI). Before Sweden joined the EU the SKI took part in all Agency inspections but nowadays SKI normally only participate at the PIV's. Apart from the PIV's, SKI performs national inspections of its own at the nuclear facilities. IAEA and Euratom co-operate under NPA with the result that Euratom sometimes performs inspections without the presence of an Agency inspector.

Normally, Euratom/IAEA inspections at the Swedish facilities are conducted every three months except for the fuel fabrication plant where inspections take place roughly every month.

Seals at the reactor core at the BWR's and at the transport channel at the PWR's are used, as well as surveillance cameras.

3.CONDITIONS AND THE PROPOSAL FOR INTEGRATED SAFEGUARDS

The approach taken in preparing the proposal is not based on a thorough analysis as to what extent all acquisition paths by which a State, in this case Sweden, might seek to acquire nuclear material for explosive devices are covered. However, it is understood, that such analysis is of value to IAEA in the development of its integrated safeguards system to be implemented in Sweden. The proposal aims at providing practical contribution to that development work.

This proposal is intended to take into account the relevant conditions and circumstances influencing implementation of safeguards in Sweden. The proposal is also intended to provide a pragmatic basis for consideration by addressing, in general terms, the following issues:

- Circumstances and conditions that make it possible for IAEA to proceed successfully with the implementation of Integrated Safeguards in Sweden;
- Existing measures or activities that can be left "unapplied" or undone by IAEA at declared facilities (aimed at detecting diversion or unreported production of nuclear material), new measures and use of advanced technology, use of increased and enhanced co-operation arrangements;
- Possibilities to facilitate cost-effective and efficient implementation by redefining the roles and functional responsibilities of the different parties (Operators, SKI, Euratom and IAEA) for the implementation of integrated safeguards in Sweden;
- Consequences in respect of meeting the objectives of integrated safeguards in Sweden, and implications of the preparatory activities to be ready for implementation of integrated safeguard functions in a credible and timely manner.

3.1 Conditions and circumstances

The conditions and circumstances that are considered relevant and that shall therefore be taken appropriately into account in State-wide considerations, decision-making and planning to proceed with implementation of integrated safeguards in Sweden, include:

1. Established policy and proven commitment by a State to use nuclear energy only for peaceful purposes.
2. Comprehensive Safeguards Agreement and the Additional Protocol in force.
3. Commitment to nuclear transparency, knowledge of the nuclear programme (past, present, future), type of nuclear materials and nuclear activities, including related research and development.
4. Compliance in a timely manner with the terms of the safeguards agreement, including those of the Additional Protocol – particularly compliance with timely provision of all information specified in the safeguards agreement and in Articles 2 and 3 of the Additional Protocol.
5. Increased co-operation in implementation of safeguards, use of functions and findings of SSAC/SKI, including their roles in provision of information and clarification of any questions or inconsistencies, as well as the provision of physical access, as necessary.
6. Enhanced co-operation, particularly when relevant to implementation of integrated safeguards, use of information, functions and results of activities of the Euratom inspectorate.
7. Broad-based State evaluation conducted by IAEA on the basis of all information available, clarifications obtained and complementary access implemented, as necessary, and any inconsistencies and questions satisfactorily resolved.
8. Necessary measures for verifying the non-diversion of declared nuclear material implemented by IAEA and any anomalies satisfactorily resolved or otherwise appropriately addressed. Conclusions drawn by IAEA on the absence of diversion from declared nuclear material.
9. Conclusion on the absence of undeclared nuclear materials and activities drawn by IAEA for Sweden, and decision taken by IAEA to proceed with the implementation of integrated safeguard measures at declared nuclear facilities in Sweden.
10. An undertaking by the Agency to ensure, in co-operation with Sweden and Euratom, that the conditions for continued implementation of integrated safeguards would be maintained.

Sweden participates in practically all international regimes that are established to prevent the proliferation of nuclear weapons and other weapons of mass destruction, and Sweden provides active support aimed at effective implementation of such regimes. This fact is additional evidence that the intentions and the current nuclear programme are serving only peaceful purposes.

3.2 Integrated Safeguards proposal for Sweden

The proposal is based on the assumption that the above conditions are fulfilled and that the circumstances promoting implementation of integrated safeguards in Sweden exist. In particular, that IAEA has concluded that "there is credible assurance of the absence of undeclared nuclear materials and activities" in Sweden, both in declared locations and elsewhere in Sweden. In addition, that IAEA has decided to proceed with the implementation of integrated safeguards in Sweden.

Such credible assurance, as it relates to absence of enrichment and reprocessing, appears to permit reductions in the traditional safeguards verification, particularly when the object is less sensitive nuclear material and does not contain significant quantities of un-irradiated direct use material (HEU or Pu).

It is understood that routine interim inspections for timeliness purposes and for confirmation of absence of unreported production can be addressed appropriately by greater use of unannounced inspections and by measures implemented to assure the absence of undeclared nuclear materials and activities.

As a precaution, it should be possible to maintain conditions facilitating a return to traditional safeguards implementation, if IAEA one day will be unable to draw conclusions on the absence of undeclared nuclear materials and activities in Sweden.

For the purpose of further argumentation it appears reasonable to make the following proposal for integrated safeguard measures that are applicable for implementation at declared Facilities and LOF's in Sweden and that are aimed at detecting the diversion of declared nuclear material:

- One PIV annually at each MBA. IAEA will carry out necessary measures and inspection activities to assure that the results of the PIT are correct. IAEA will make maximum use of services (increased co-operation) and results available through activities of the Swedish SSAC, including those of SKI. It is expected that the resources and results of the Euratom's activities will also be used effectively by IAEA, thus ensuring maximum cost benefits from the enhanced co-operation (Enhanced Partnership Approach) between IAEA and Euratom.
- No interim routine inspections will be carried out by IAEA. It is understood that full and successful implementation of all measures of the Additional Protocol at declared sites and elsewhere in Sweden would have a major preventive impact on any possible motives or incentives to divert the nuclear material from the declared facilities. The possibilities to detect any indications and indicators of diversion or unreported production of HEU or Pu would also increase, thus providing additional deterrence.
- One or two unannounced inspections for, as applicable, material balance verification and quality assurance purposes, as well as to contribute to deterrence. It is expected that such inspections would be co-ordinated between IAEA and Euratom.
- Neither seals nor surveillance cameras are needed to retain and monitor the nuclear material in the facilities. When the Agency has concluded that there are no undeclared facilities, particularly for reprocessing, there will be no need to monitor or seal nuclear material between PIV's, as no facility exist to which the material can be diverted. If the Agency also decides to change the timeliness criteria for spent fuel at LWR's and storage facilities to 12 months, there will be no need for surveillance or seals, as the inventory will be verified at the annual PIV's.
- Advanced technology, C/S and NDA instruments, with or without remote monitoring capability, may be used on any nuclear material to avoid repetition of costly verification measurements, and, as regards fresh MOX, also to increase the detection capability of diversion providing additional deterrence. Such technology and measures may also be used in any special safeguards situation, when considered appropriate.

Current inspection activities and the Swedish proposal for future inspection activities are shown in Annex 3.

The proposal for new facilities, for the conditioning facility and for the final storage of spent fuel should be addressed as safeguard approaches for those facilities are being devloped.

4. SUMMARY

The role of Sweden in disarmament and non-proliferation efforts extends from the late 1940's to the present. It covers active support to place nuclear weapons under international control and participation in practically all control regimes aimed at non-proliferation and elimination of any mass destruction capability. Sweden has also made available highly competent and high-ranking officers to serve many of the institutions and organisations supporting the political work and operative functions in this field.

Until 1968, Sweden had a double-track policy where both the nuclear weapons option and non-proliferation as a possibility were pursued and investigated. After 1968, non-proliferation became the established policy, and the nuclear programme, materials and activities have since served exclusively peaceful purposes.

It appears possible that the IAEA could, after a short period of initial implementation, be in a position to draw conclusions on the absence of undeclared nuclear materials and activities in Sweden. Sweden has undertaken to ensure the transparency of its nuclear programme by providing all relevant information and by facilitating physical access, as necessary, and by addressing any questions and issues of concern in a direct and open-minded manner.

The implementation of traditional safeguards should continue effectively, to enable the Agency to draw its conclusions on the absence of diversion of declared nuclear material in Sweden in the future. Using its reporting mechanisms, the Agency should share these conclusions with Member States so as to ensure that the objectives of the strengthened safeguards are met.

Under these conditions, IAEA could and would decide to proceed with the implementation of integrated safeguard measures at the declared facilities and locations in Sweden. It is proposed that IAEA would participate in annual PIV's, but would, however, detach from routine verification work to the extent possible and make full use of the results of SSAC/SKI activities as well as activities of the Euratom inspectorate. IAEA would be required to carry out the necessary measures, including sufficient independent verification activities, to assure that the results obtained are correct, and that they correctly represent the actual inventory of nuclear material. One or two unannounced inspections are foreseen to provide, as applicable, material balance verification and quality assurance, as well as to contribute to deterrence. It is expected, however, that such inspections will be co-ordinated between IAEA and Euratom to ensure the cost-effectiveness.

The use of advanced technology, C/S and NDA instruments, with or without remote monitoring capability, would be limited to situations where repetition of costly verification measurements could be avoided. As regards fresh MOX, such instruments could be used to avoid costly measurements and to increase the detection capability of diversion, thus providing additional deterrence. Such technology and measures may also be used in special safeguard situations.

The implementation of integrated safeguards in a cost-effective manner in Sweden would depend, on one hand, on the ability of the IAEA to ensure the application of all measures so that "there is credible assurance of the absence of undeclared nuclear materials" in Sweden. On the other hand, the increased use of SSAC/SKI and RSAC/Euratom would facilitate the optimal use of all resources involved in implementation of integrated safeguards in Sweden.

In order to add credibility to any decision that would reduce measures aimed at assuring the absence of diversion of declared nuclear materials, the value of the measures of the Additional Protocol should be better understood in that respect. The confidence in the ability of the IAEA to draw conclusions on the absence of undeclared nuclear materials and activities in a State is expected to increase as experience is gained.

The roles and functional responsibilities of the four parties; Operator, SSAC/SKI, Euratom and IAEA shall be reviewed and modified as appropriate, to ensure optimal resource utilisation for implementation of integrated safeguards. The infrastructures of the SSAC/SKI and the RSAC/Euratom and their current implementation practices shall be also reviewed and improved or modified as necessary, to ensure adequate response to the new requirements.

Sweden has actively supported the strengthening of IAEA safeguards in the past and is interested in continuing to give its support, in order to facilitate early implementation of integrated safeguards in Sweden and elsewhere.

During the 1950's and 1960's a political battle about procurement of nuclear weapons took place. It was finally ended in 1968, when Sweden signed the NPT. Before 1968, the Swedish nuclear programme concentrated on building heavy water reactors and exploiting the vast but low-graded uranium resources. Since 1970, the nuclear programme has been clearly oriented towards light water reactors.

Nuclear material with US obligation has been verified in Sweden since 1960, and IAEA control has been applied since1972. The Safeguards Agreement (153-type) came into force in 1975 (INFCIRC/234). A proposal for how integrated safeguards could be applied in Sweden is submitted, (Annex 3).

The recommendations are:

- One PIV per MBA annually, no other routine inspections.
- Two unannounced inspections.
- Neither seals nor surveillance cameras.
- Advanced technology under certain conditions.

Appendices

1. Non-Proliferation History and the Current Situation
2. Enhanced Co-Operation Arrangement for Integrated Safeguards Implementation

Annexes

1. Map with Swedish Facilities
2. Facilities and Flow of Nuclear Material
3. Number of Safeguards Inspections and the Swedish Proposal

References:

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INFCIRC/540 Corrected	
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JNT C 00687 SWE	Test of SSAC/Facility CCTV Data Mail-in
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SWE C 00403	Optimisation of Safeguards for LEU Fuel Cycles
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Appendix 1.

Non-Proliferation History and the Current Situation

A brief summary of the role of Sweden in disarmament and non-proliferation efforts.

The role of Sweden in disarmament and non-proliferation work extends from the late 1940's to the present day. It covers active support to place nuclear weapons under international control and participation in practically all control regimes aimed at non-proliferation and elimination of any mass destruction capability.

Sweden has made available highly competent officers to serve many of the institutions supporting the political work and organisations carrying out the operative functions in this field.

The engagement of Sweden may be briefly summarised as follows:

Late 1940's	United Nations Atomic Energy Agency Strong support to place existing US nuclear weapons under international control – which failed.
1955	First international UN Conference on the Peaceful Uses of Atom Energy, Swedish Chairman, S. Eklund.
1961-1997	Director Generals of the IAEA, a very active role in the NPT negotiations
1975	Member of Zangger Committee
1978	Member of Nuclear Suppliers Group, NSG
1986	Swedish Support Programme to IAEA safeguards started
1991	Swedish support to former Soviet states started
1993	Field tests for strengthened safeguards
1996	Active role in the CTBT negotiations and development of measuring systems
1990's	Active role in the FMCT negotiations and arranging two international workshops (1997, 1999)

Other Regimes and conventions

Sweden is a member of practically all the international regimes that are established to prevent the proliferation of nuclear weapons and other mass destruction weapons. These regimes include Missile Technology Control Regime (MTCR), Australian Group (AG), Biological Weapons Convention (BWC), Chemical Weapons Convention (CWC) and Wassenar Arrangement (WA). In general, all exports of items that could be used for acquisition of mass destruction capability are subject to export control.

Appendix 2.

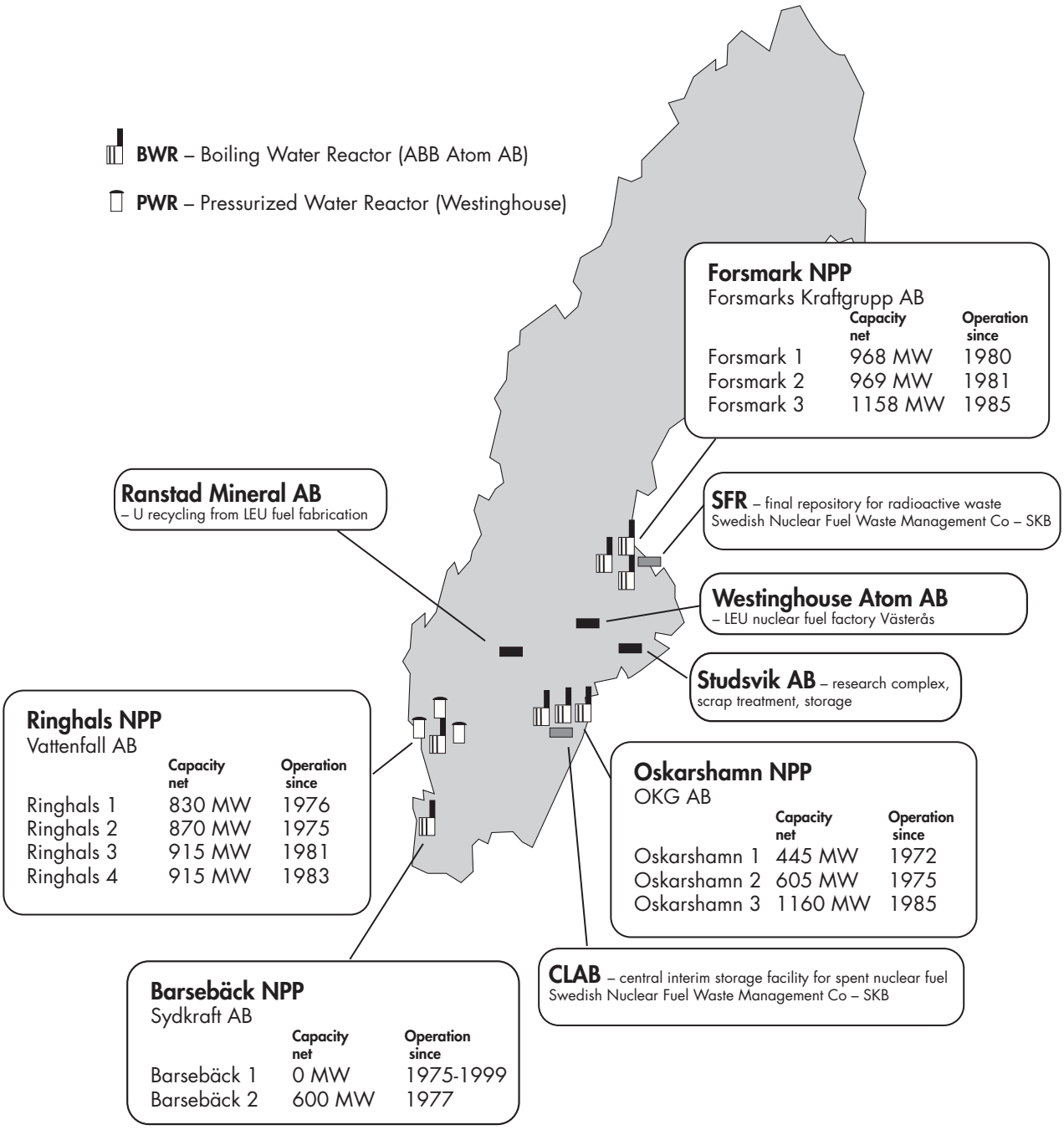
Enhanced Co-Operation Arrangement for Integrated Safeguards Implementation

A brief summary of treaties and laws in Sweden that are relevant and related to nuclear non-proliferation

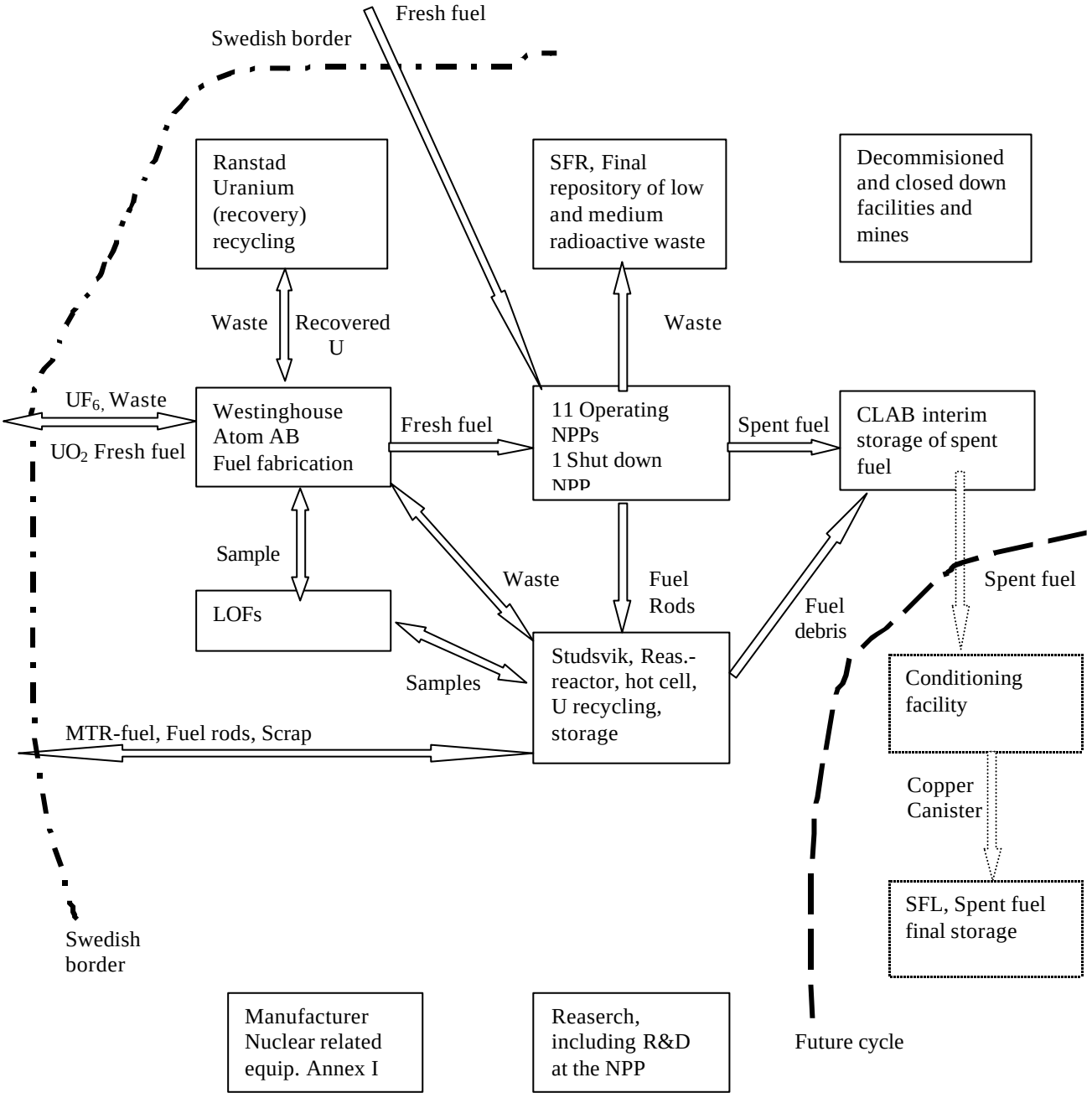
The engagement in prevention of the proliferation of nuclear weapons and other mass destruction weapons is reflected in the treaties Sweden became party to and in the evolution of its laws:

1945	Addition to the carboniferous law and change in the mine law. (Concession is needed for mining U)
1956	Atomic Energy Law
1956	Bilateral Agreement with the USA
1960	Law of Investigating and Mining of Uranium Minerals, MUM
1963	PTBT, Partial Test Ban Treaty
1968	Bilateral Agreement with Finland
1968	Bilateral Agreement with Switzerland
1968	NPT, Non-Proliferation Treaty
1970	Bilateral Agreement with Soviet Union (valid to the end of 2000)
1970	Ratification of NPT
1972	Interim Trilateral Agreement IAEA, USA, Sweden
1974	Law of Certain Mineral Resources
1975	Safeguards Agreement with IAEA
1977	Bilateral Agreement with Canada (pending since 1995)
1981	Bilateral Agreement with Australia
1984	New Bilateral Agreement with the USA (terminated 1996)
1984	Law on Nuclear Activities, Changes in Appendix
1991	Mineral-Law
1993	Law of Mass Destructive Weapons
1995	Euratom Treaty Chapter 7
1995	EC 3227/76
1995	Swedish Act and Ordinance on Strategic Products
1995	EC 3381/94 and Council Decision 94/942/CFSP
1998	CTBT, Comprehensive Test Ban Treaty
1998	The Additional Protocol was signed
2000	Change in Law on Nuclear Activities
2000	EC 1334/00
2000	Act on Inspections due to International Agreements on Preventing Proliferation of Nuclear Weapons

To be able to fulfil the new requirements resulting from the Additional Protocol, the Swedish legislation was changed on May 16th 2000.


BWR – Boiling Water Reactor (ABB Atom AB)
PWR – Pressurized Water Reactor (Westinghouse)
Forsmark NPP
Forsmarks Kraftgrupp AB
Capacity net
Operation since
Forsmark 1 968 MW 1980
Forsmark 2 969 MW 1981
Forsmark 3 1158 MW 1985
Ranstad Mineral AB
– U recycling from LEU fuel fabrication
SFR – final repository for radioactive waste
Swedish Nuclear Fuel Waste Management Co – SKB
Westinghouse Atom AB
– LEU nuclear fuel factory Västerås
Studsvik AB – research complex, scrap treatment, storage
Ringhals NPP
Vattenfall AB
Capacity net
Operation since
Ringhals 1 830 MW 1976
Ringhals 2 870 MW 1975
Ringhals 3 915 MW 1981
Ringhals 4 915 MW 1983
Oskarshamn NPP
OKG AB
Capacity net
Operation since
Oskarshamn 1 445 MW 1972
Oskarshamn 2 605 MW 1975
Oskarshamn 3 1160 MW 1985
CLAB – central interim storage facility for spent nuclear fuel
Swedish Nuclear Fuel Waste Management Co – SKB
Barsebäck NPP
Sydkraft AB
Capacity net
Operation since
Barsebäck 1 0 MW 1975-1999
Barsebäck 2 600 MW 1977

Annex 2



The Swedish Nuclear Programme

Facilities and Flow of Nuclear Material

Annex 3

Number of Safeguards Inspections and the Swedish Proposal

	SKI 1999	Euratom 1999	IAEA 1999	Proposal
LEU fuel fabrication plant	**1**	**16**	**6**	**1**
Research reactor	**5**	**5**	**4**	**1**
LWR's (12)	**20**	**71**	**45**	**12**
AFR storage	**5**	**5**	**4**	**1**
Ranstad uranium recovery	**1**	**1**	**1**	**1**
LOF's (24)	**0**	**0**	**0**	**1**
Unannounced inspections	**-**	**-**	**-**	**2**
Complementary access	**-**	**-**	**-**	**3**
Conditioning facility (planned)	**-**	**-**	**-**	Approach to be developed
Spent fuel final storage (planned)	**-**	**-**	**-**	Approach to be developed
Sum inspections and complementary/managed accesses	**32**	**98**	**60**	**22**

NB: Most of the inspections have been done simultaneously by the different agencies

In the table above, one must take into account that the Agency has made use of the NPA with Euratom, and that the figures for the inspections for IAEA in fact should have been somewhat higher. In this document and in the objectives of the SP-task, the proposal given only touches on what changes could be implemented by the IAEA and the activities of Euratom and SKI should be discussed separately.