COMMISSION OF THE EUROPEAN COMMUNITIES

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Report on the Operation of Euratom Safeguards

1991 - 1992

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. It is recalled that following the nuclear affairs in 1988 the Council's Atomic Questions Group had requested that the Commission should prepare a detailed report on Euratom Safeguards.

2. The European Parliament in resolution of 6 July 1988 published in the O.J. No. C235/70 of 12-09-1988 "calls on the Euratom Safeguards Directorate to submit a comprehensive annual report to the parliament which would be available to the public".

3. Consequently the Commission presented a first comprehensive report (SEC {90} 452) final with particular reference to 1988.

4. During the discussions in the Council and in response to questions from the Parliament the Commission reconfirmed its intention to prepare such an operations report on a biennial basis.

5. Consequently, the Commission presented a second report (SEC {92} 80 final) which covered the period from 1989 - 1990.

6. The aim is now to provide a comprehensive survey for the period **1991 - 1992**.

Report on the Operation of EURATOM Safeguards 1991 and 1992

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I. INTRODUCTION

Scope of this report

1. In its Report (SEC(92)80) final, after this referred to as the "1990 Report" the Commission presented the second comprehensive report with particular reference to 1989 and 1990 on the operations of EURATOM safeguards and the Commission invited the Council and the European Parliament to note its content.

2. During the discussions in the Council and in response to questions from Parliament the Commission reconfirmed its intention to prepare such an operations report biennially.

3. The aim of the present third report covering 1991 and 1992 is to provide a comprehensive survey on the operation of EURATOM safeguards in the civil nuclear fuel cycle including research and other related activities of the European Community. The survey includes the safeguards findings with particular reference to 1991 and 1992, the issues under discussion or consultation with operators or under consultation with national authorities and with the International Atomic Energy Agency (IAEA). The survey also includes a report on the illicit trade of nuclear materials, a survey on the cooperation with CIS and PECO states in safeguards, a survey on the available resources and an indication of the trends in and challenges to safeguards during the years to come.

4. The report is addressed to the Council and to the European Parliament, who are invited to note its contents.

Safeguards

5. It may be recalled that the word safeguards, in the framework of the EURATOM Treaty, means the set of measures performed to enable the Commission to satisfy itself that nuclear material is not diverted from its intended and declared uses (particularly to unlawful non-peaceful applications) (Article 77a)) and that obligations arising from International Agreements including those with the International Atomic Energy Agency (IAEA) concluded by the Community (Article 77b)) are complied with. Examples of the latter undertakings are (besides peaceful pledge) restrictions on re-transfers outside the Community, certain controls on heavy water, equipment and tritium and, notably, the three safeguards agreements concluded with the IAEA in the framework of the Non-Proliferation Treaty of Nuclear Weapons (NPT).

6. Safeguards are not concerned with nuclear safety nor with the protection of people and of the environment from the hazards of ionising radiation nor with physical protection. Nuclear safety relates to the safe design and operation of nuclear facilities. Radiation protection controls relate to health and safety, environmental protection, safe handling procedures for nuclear materials etc. Physical protection relates to the security measures taken to protect material from theft or other misuses. Safeguards may take advantage of such measures in designing verification schemes but they are, in themselves, quite independent. Whereas physical protection is mainly the responsibility of the Member States, the Commission is responsible for the application of safeguards pursuant to Chapter VII of the Treaty.

7. Chapter VII of the Treaty provides for safeguards to be applied to all civil nuclear materials stored, used or transported within the Community. The activities involved include therefore the main fuel cycle activities of uranium mining, conversion, enrichment, fabrication, power reactor operation, reprocessing and waste storage and disposal as far as ores, source or special fissile materials are concerned. Also included are the full range of other activities that use source or special fissile materials, viz.: Research and development, laboratories, service activities for the nuclear industry (e.g., analytical laboratories), research reactors and the use of nuclear materials in non-nuclear activities.

8. The EURATOM Treaty provides for the application of safeguards to all civil nuclear material as a basic function of Community law, establishing to this end a direct relation between the Commission and operators; Member States are also associated in the application of EURATOM Safeguards within the limits set out by the Treaty and its implementing Regulation. The NPT provides for the application of safeguards by the IAEA in the non-nuclear weapon States of the Community; IAEA safeguards also apply in nuclear weapon States following "voluntary offers" by those States. These IAEA safeguards are exclusively aimed at ensuring, as appropriate, non explosive or peaceful use of safeguarded material and apply world-wide on a contractual basis, through safeguards agreements and entailing a direct relation only between the IAEA and its Member States. In the Community, the Safeguards Agreements concluded by EURATOM, the Member States and the IAEA ensure the necessary coordination between the two safeguards systems.

Legal bases

9. The obligations and responsibilities of the Commission of the European Communities in the field of safeguards are set out in Articles 77 to 85 of Chapter VII of the EURATOM Treaty.
It is European law.

10. The provisions of Articles 77 to 85 of the Treaty specify:

Art. 77: In essence, the Commission shall satisfy itself that the nuclear materials are not diverted from their intended uses as declared by the users and that the provisions relating to supply and any particular safeguarding obligations assumed by the Community under an agreement concluded with third countries or with an international organisation (e.g., the International Atomic Energy Agency (IAEA)) are complied with. Pursuant to this article, EURATOM Safeguards also monitor, and report on, the application of Chapter VI of the Treaty.

Art. 78: The declaration by operators of the basic technical characteristics of the installations as well as the need for Commission approval of techniques to be used for the chemical processing of irradiated materials.

Art. 79: Requirements on operators to maintain a system of nuclear materials accounting, including recording and reporting. Obligation on the Commission to promulgate a Regulation;

Art. 80: Deposit of excess special fissile materials not in use;

Art. 81: Inspections; right of access; procedures in case of opposition;

Art. 82: Recruitment of inspectors. Follow-up procedures involving Member States in case of infringement;

Art. 83: Sanctions in case of infringements by operators;
It may be mentioned in this context that the Commission imposed in 1992 a sanction on a Community undertaking following an infringement.

Art. 84: Scope of safeguards and exclusion for materials intended to meet defence requirements;

Art. 85: Adaptation by the Council of the procedures for applying safeguards.

11. Commission Regulation (EURATOM) No 3227/76 of 19.10.1976 (O.J.E.C. No L363 of 31.12.1976) as amended by Commission Regulation (EURATOM) No 220/90 of 26.01.1990 (O.J.E.C. L22 of 27.01.90) and Commission Regulation (EURATOM) No 2130/93 (O.J.E.C. L191/75 of 31.07.93), specifies general obligations on operators with respect to the provision of basic technical characteristics, recording, reporting, advance notification of transfers. The regulation also specifies the requirement to adopt Particular Safeguards Provisions (PSP) for each installation.

12. The Community has concluded agreements in the nuclear field with the U.S., Canada and Australia. To verify that the undertakings included in those agreements are carried out, the Commission acting through its EURATOM Safeguards Directorate tracks relevant material under specific safeguarding obligations, each identified by an appropriate code ("flag").

13. The Community has concluded three Safeguards Agreements with the IAEA based on model agreement INFCIRC/153, but including a protocol regulating the interface between the EURATOM and IAEA safeguards' systems:

13.A. Agreement[1] between the Community, its Non-Nuclear Weapon States (NNWS) and the IAEA;

13.B. Agreement[2] between the Community, the United Kingdom (UK) and the IAEA;

13.C. Agreement[3] between the Community, France and the IAEA.

Means

14. In order to fulfil the mandate of Article 77 of the Treaty, the Commission has, since 1958, deployed a corps of EURATOM safeguards inspectors. The funds are provided through budget chapter B4.2.

15. In accordance with the legal provisions referred to above the EURATOM safeguards inspectors of the Safeguards Directorate DG XVII-E ("DCS") perform inspections in the nuclear installations and perform related headquarters accountancy evaluation and follow-up.

16. Inspections and accountancy supported by appropriate logistics are the main pillars of EURATOM safeguards; no adequate verification can be carried out unless these operate effectively.

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1) Published in IAEA document INFCIRC/193

2) Published in IAEA document INFCIRC/263

3) Published in IAEA document INFCIRC/290

II. *SAFEGUARDS OPERATION*

Number of Installations, Material Balance Areas (MBAs) and stocks of nuclear material

17. In the "1990 Report" the Commission presented the number of **Material Balance Areas** (MBAs) under Euratom safeguards separately from the number of Locations Outside Facilities (LOFs)[1], Carriers, Intermediaries etc..so as to enhance transparency, i.e. to separate the **installations** with large (equal to or more than one effective kg.[2]) inventory or throughput of nuclear material from those 46% (end 1992) of all installations under safeguards where less than 2% of the cumulative inspection effort was spent due to their tiny quantities of nuclear material.

    Table II.1.1. presents the number of material balance areas (MBA) and the number of large installations under Euratom safeguards. It may be noted that an MBA is the basic safeguards entity i.e. an area such that a) each transfer into or out of it and b) the physical inventory of nuclear material can be determined.

    Table II.1.2. presents the number of installations of types LOFs, Carriers, intermediaries etc. including those "installations" which are, for purposes of IAEA safeguards, combined into 1 accounting and reporting unit referred to as CAM (see Glossary attached).

18. The above tables II.1.1. and II.1.2. give also the summary of the MBAs under IAEA routine inspection. MBAs under IAEA safeguards in NWS are inspected by the IAEA if designated to this effect by the latter, pursuant to the provisions of the Agreements INFCIRC/263 and INFCIRC/290.

19. Among the MBAs listed in table II.1.1. there are 60 MBAs, located in France and the United Kingdom, referred to as "mixed" MBAs. At these MBAs, civil and non-civil material are handled, processed or stored together either simultaneously or sequentially.

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1) Locations outside facilities (LOF) are MBAs holding less than 1 effective kilogram but more than the upper limit for CAM facilities (see Glossary attached).

2) For the definition of an effective kilogram cf. Regulation 3227/76, quoted under paragraph 11 above, article 36 (o).

Table II.1.1

MBAs and installations under Euratom Safeguards holding more than or equal one effective kg.

(Status 1992-12-31)

Type	Install-ations	MBAs in Member States													MBAs EUR	MBAs IAEA[1)]
		B	DK	D	E	F	GR	IRL	I	L	NL	P	UK	COM[2)]		
Research laboratories	57	4	1	8	1	13	-	-	2	-	2	-	23	3	57	21
Mines	21	-	-	6	1	-	-	-	1	-	-	13	-	-	21	0
Concentration	7	1	1	2	2	1	-	-	-	-	-	1	-	-	8	0
Transformation, conversion	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0
Enrichment	6	-	-	2	-	1	-	-	-	-	2	-	4	-	9	6
Fuel Preparation	5	-	-	-	-	2	-	-	-	-	-	-	4	-	6	0
Fuel Fabrication	19	3	1	7	2	6	-	-	1	-	-	-	4	-	24	14
Reprocessing	14	-	-	1	-	5	-	-	2	-	-	-	9	-	17	3
Research Reactors	51	3	2	14	3	12	1	-	7	-	2	1	5	1	51	34
Zero Energy Critical assemblies	15	2	-	11	-	2	-	-	-	-	-	-	1	-	16	13
Power Reactors	128	7	-	28	10	57	-	-	3	-	2	-	21	-	128	50
Storage	56	2	2	19	-	14	-	-	6	1	-	1	27	4	76	37
TOTAL Euratom	380	22	7	98	19	114	1	0	22	1	8	16	98	8	414	/
TOTAL IAEA		21	6	86	16	1	1	0	21	1	8	2	7	8	/	178

1) Under IAEA routine inspection.
2) COM stands for Commission of the European Communities

Table II.1.2.
LOFs, Intermediaries, Carriers and other installations holding less than 1 effective kg.
(Status 1992-12-31)

Type	Member States													EUR	IAEA
	B	DK	D	E	F	GR	IRL	I	L	NL	P	UK	COM[2)]		
LOFs equal / above CAM limit	3	3	43	1	13	2	2	14	0	11	1	21	3	117	82
LOFs below CAM limit,	3	3	38	1	31	0	0	3	0	3	0	117	0	199	50
CARRIERS, INTERMEDIARIES, WASTE CONDITIONING AND OTHERS	1	1	10	2	2	0	0	8	2	1	2	8	0	37	0
TOTAL Euratom	7	7	91	4	46	2	2	25	2	15	3	146	3	353	/
TOTAL IAEA	6	6	79	2	0	2	2	17	0	14	1	0	3	/	132

2) COM stands for Commission of the European Communities.

Stocks of nuclear material

20. The following table II.2 gives the stocks of civil nuclear material by the end of 1989, 1990, 1991 and 1992 for the MBAs listed in tables II.1.1. and II.1.2.

Table II.2

Stocks of nuclear material as on 31 December (in tonnes)

Material Category	Cat.	1989	1990	1991	1992
Uranium Depleted [1]	D	112 600	124 400	130 600	139 300
Natural [1]	N	47 000	44 000	47 400	47 100
Low Enriched [1]	L	28 900	32 000	33 400	35 500
High Enriched [2]	H	13	13	13	13
Plutonium [2]	P	170	203	268**)	292*)
Thorium [1]	TH	2 100	2 600	3 200	3 800
Total effective kg [3]		199 000 kg	231 000 kg	293 000 kg	318 100 kg

1) Rounded to nearest 100 t.

2) Rounded to nearest t.

3) Art. 36(0) of Regulation 3227/76.

*) It may be noted that on 31.12.92 approximately 72 tonnes of the Plutonium stock was in form of fresh i.e. reprocessed Plutonium.

**) The unusual increase between 1990 and 1991 is due to the declaration of Pu Production in the power reactors upon discharge rather than upon shipment from the site.

21. The following table II.3 gives the distribution of the stocks (end 1992) as a function of the MBA type.

Table II.3

Distribution of Stocks (31-12-1992)
(rounded to the nearest %)
as per MBA type and element category.

Type	Element Category					
	D	N	L	H	P	T
Research Laboratories	1	~0	~0	4	~0	1
Research Reactors & Critical assembly	~0	~0	~0	43	1	1
Enrichment	51*)	9	1*)	~0	~0	~0
Fuel Concentration, Fuel conversion/Fabrication	1	53	7	13	5	~0
Reprocessing	~0	~0	2	1	~0**)	~0
Power Reactors	1	14	47*)	17	36***)	~0
Storages	46*)	19	43*)	22	58	~0
LOF, Mines, others	~0	5	~0	~0	~0	98

*) The significant changes between these figures and those of the equivalent table of the previous report are due to a redefinition of the practical boundaries between categories.

**) In process only.

***) The increase between 1990 and 1991 is due to the declaration of Pu Production in the power reactors upon discharge rather than upon shipment from the site.

Safeguards approaches and implementation - Introductory remarks

22. Pursuant to Article 79 of the Treaty and to Articles 9 to 23 of Regulation 3227/76, the operators of all installations must establish a nuclear materials accounting system including recording and reporting, thereby documenting the movements and disposition of the nuclear material.

23. In other words, the up-to-date inventory of nuclear material by:

- category of material[1)]
- safeguards obligation and
- material balance areas (MBA)

as established by the operator needs to be made available for verification by inspectors, as well as the flow of nuclear materials. Verification relates to the set of activities independently performed by inspectors to establish the correctness of these records on flow and inventory in comparison with the physical reality leading to acceptance or rejection of the operator's declarations.

24. There are several, basically different, safeguards verification techniques, certain of which are **quantifiable** and others which are **non-quantifiable**. In this context reference is made to paragraphs 22 and 23 of the "1988 Report" where the basic methodology is outlined and examples are given.

25. There is no change in principle of the safeguards methodology which continues to be based on the safeguards goals comprising a **triptych** of **characteristic quantities** to be detected, of **characteristic times** describing the maximum response times of the safeguards system to an event of safeguards interest and **characteristic probabilities** describing both the risk of a false alarm and the risk of non-detection of the quantities within the specified times.

26. As far as, however, the safeguards concepts and approaches developed to implement the above goals are concerned, the increased availability and use of Plutonium in the commercial fuel cycle of the Community necessitated in 1989 through 1992 and continue to necessitate the further improvement of safeguards efficiency and the related refinement of safeguards concepts and procedures. A summary of the main developments is reported below.

1) Art. 21 of Regulation 3227/76.

27. Improvements of the efficiency in safeguarding Uranium have been achieved and are expected to be further achieved gradually through the deployment of improved instruments and equipment and through rationalisation measures adapted specifically to the intermittent inspection regime which is applied at the installations in this part of the fuel cycle, including the output of the mines, concentration, conversion, fabrication and enrichment installations (the latter require slightly different approaches due to the inherent commercial and non-proliferation sensitivity of the technology used).

Developments to be mentioned are the testing and deployment of new containment and surveillance (C/S) equipment, e.g. using front end motion detection and digital video, improved methods used for item verification, shifting from destructive assay (DA) to non destructive assay (NDA) and, last but not least, improved on-site data acquisition, handling and evaluation.
The implementation of "Random" inspections the testing of which had been reported in the 1990 Report, has been discontinued by Euratom. The tests and further evaluations have shown that any improvements of efficiency, i.e. the same effectiveness with lower cost, would be offset by more complicated and more costly logistics. Moreover, the adoption of a regulation concerning the transport of radioactive sources- an indispensable component of safeguards measurement devices- may render the effectiveness of "random" inspections even more doubtful as such transports must be notified in advance to all concerned - including to the operators. Randomness of a different kind has, however an important role in the New Partnership arrangements with the IAEA (see Chapter V.)

28. In the Uranium part of the fuel cycle as well as for LWR LEU, no significant changes in the concepts and approaches can be reported but rather gradual increases of efficiency.

29. For LWR-using fresh MOX*) the safeguards concepts continue to be based on the item verification techniques, i.e. based on the more stringent timely verification of the integrity and identity of distinguishable fuel elements using NDA, C/S and video surveillance techniques from fabrication and during all phases of reactor operations. These concepts have been implemented.

30. For safeguards of MOX fabrication installations and of reprocessing plants paragraph 101 of the Operations Report covering 1988 (SEC(90)452 final) indicated the forecast that the throughputs of recycled Plutonium was expected to increase significantly in the late 1980's and early 1990's.
This has become industrial reality, i.e.:
- A large scale reprocessing plant commenced operation in 1989;
- Two further large scale reprocessing plants are under construction and, based on present plans, are scheduled to commence operation in 1994;

*) MOX = MIXED OXIDE (U+Pu oxide)

- One large scale MOX fabrication plant is ready for operation and awaiting start up licences;
- Two large scale MOX fabrication plants are under construction and will commence operation, based on present schedules, in 1994 and 1997 respectively.

31. At these new plants continual inspection is maintained or foreseen. Following consultations with Community operators and, when appropriate, with the IAEA, modern safeguards systems have been developed and are being implemented.

32. Moreover, under the aspect of safeguards concepts the well-known concepts such as:
    - verification of the technical characteristics of the plant during the construction phases;
    - verification of the continued validity of the Basic Technical Characteristics (BTC) to be provided pursuant to Regulation 3227/76;
    - verification of all input and output streams and of the physical inventory;
    - verification of, at least monthly, of the hold-ups using various techniques;
    - maintenance of the continuity of knowledge in the input and product stores;
    - transparency

    are being used or envisaged in these large scale plants.

33. As far, however, as the approaches are concerned, the main feature of the safeguards systems for the new plutonium plants is a significant shift from inspector attended operation to unattended measurement, monitoring or surveillance operation.

    This is necessitated, inter alia, by
    a) the need to minimise radiation exposure of plant personnel and inspectors;
    b) the need to minimise stoppage for routine safeguards purposes of automated production;
    c) the requirement to use identical or similar components in all plants so as to minimise development costs and to maximise standardisation and, notably,
    d) the necessity to improve inspectors productivity due to the increasing difficulties to keep the pace between recruitment programmes and the growth of the inventories and throughputs of the nuclear material.

34. The effect is, on the one hand, a transition from operational costs, i.e. manpower, travelling, subsistence, etc. to investment costs which, albeit expensive initially, are expected to "pay off" within a limited break even time. On the other hand, these systems are also expected to minimise repetitive inspectors work thereby further contributing to enhanced safeguards effectiveness.

Safeguards approaches and implementation - Non quantifiable Verification aspects

35. Both, nuclear material accountancy methods and containment/surveillance and/or monitoring/logging systems contain quantifiable and non quantifiable aspects. Indicators or results of verification activities, which may be expressed directly or indirectly (i.e. via calibrations) in amounts of nuclear material or number of items are considered quantifiable, all others are non quantifiable. The following paragraphs of this sub-chapter report on the results of a study which was performed in 1993 based on more than 6000 inspection reports from 1990 to 1992 in order to review verification performance including the mechanisms of detection of discrepancies and anomalies.

36. Important discrepancies - involving nuclear material with more than 10% of the detection goals or problems of a generic nature influencing completeness, correctness and reliability of the operators nuclear material accountancy systems - are reported by the Euratom inspectors at an average frequency of about 30-40 per year. The evaluation presented below is based on all important discrepancies reported in the 3 years taken for the study either by inspectors based on field operations or based on headquarters treatment and evaluation of safeguards relevant data.

The individual discrepancies were analysed, as to the activity or indicator which triggered the detection of the problem. Details are given in Table II.4.

Table II.4

Type and frequency of important discrepancies reported from field operations

Type of Discrepancy	Proportion (%)
1. Major shortcomings in operators nuclear material accountancy system (organisation, quality, completeness, correctness)	24
2. Major shortcomings in operators PIT procedures	20
3. Detection of undeclared material	11
4. "Material unaccounted for" not acceptable	10
5. Nuclear material not accessible for verification	7
6. Nuclear material/equipment not used as declared	6
7. Important discrepancy between declared and measured value	6
8. Loss of continuity of knowledge (C/S) not due to inspectors equipment failure	6
9. Discrepancy related to safeguards obligations	6
10. Detection of undeclared movements by optical surveillance/monitoring	2
11. Discrepancy between declared Basic Technical Characteristics and plant situation	2

37. The indicators/activities which identified the discrepancies in this way and their frequency are given in table II.5 below:

Table II.5

Indicators/activities which lead to detection of discrepancy during inspections

Type of Indicator/Activity	Proportion (%)
1. Routine accountancy checks	30
2. Physical verification by item counting and identification	15
3. Inspector questioning validity of either operators' accountancy, or source data	13
4. Inspector performing non-routine checks, or visits/checks in areas not normally inspected	8
5. Check of Basic Technical Characteristics, use of nuclear material, obligation	7
6. Physical measurements (weighing, NDA, DA, etc.)	6
7. Review of C/S or monitoring/logging data	6
8. Inspectors noticing un-usual operations, manipulations, transfers, etc.	6
9. Specific information received from operators/contractors staff	5
10. Other information	4

38. Analysing the data on discrepancies in more detail as far as the inspectors who detected/reported the discrepancies are concerned, the following correlations were noted:

(a) there is a correlation with the length of the service in the European Commission, e.g. more than 4-5 years in the service,

(b) there is a correlation with the period of time in the same inspection group or cluster,

(c) there is a correlation with high specific experience and knowledge on the operation of the plant inspected,

(d) there is a correlation between the discrepancies detected per country and the degree of familiarity of an inspector with the language and other important features of that country.

(e) there is, as could be expected, a correlation with the professionality of the inspectors.

39. The analysis showed, that non-quantifiable aspects play a major role in the following areas:

(a) indicators arising from activities, where an operator's declaration is checked by the inspector: the detection of an alarm or discrepancy depends to a large degree on the judgement and professional experience of the individual inspector and/or the collective experience of the safeguards system as a whole;

(b) indicators, which come from various sources outside the safeguards system including operators, Member State authorities, media, other Commission or Community institutions, third states or the IAEA.

40. The major conclusions from the analysis/discussion can be summarised as follows:

- overall safeguards assurances are difficult, if not impossible to quantify,

- there are quantifiable and non-quantifiable aspects involved in both, nuclear material accountancy and in other safeguards measures such as C/S, monitoring and logging systems,

- there are essential pre-requisites necessary in order that non-quantifiable aspects can become effective,

- the inspector's competence, profile, and knowledge of the plant and the related safeguards concept is of the utmost importance,

- more flexibility and unpredictability in inspection activities - but not "random" inspections - is another important element,

- there are headquarters activities which are essential for the effectiveness of a safeguards system and are non-quantifiable by their nature,

- it is not necessary for safeguards assurances to be quantified for them to be useful.

41. The study performed was a first attempt, based on an empirical approach, to identify with concrete examples non-quantifiable aspects in nuclear safeguards. The basis chosen was the examination of the performance of the Euratom Safeguards Inspectorate with regard to anomaly detection and the detection of alarms or discrepancies over a 3 years period. The analysis yielded a variety of examples of non-quantifiable indicators or activities which play an important role in nuclear safeguards but the analysis has also left open a number of questions which will be further pursued.

Safeguards approaches and implementation - Survey of Verification techniques

42. The following Table II.6. provides an indication of the verification techniques deployed. Table II.7. provides the typical frequency of inspection and the Euratom inspection effort spent at the various types of installations. Table II.8 provides the inspection effort spent in the Community Member States.

Table II.6

VERIFICATION TECHNIQUE	TYPE(S) OF INSTALLATION
• verification and periodic reverification of Basic Technical Characteristics (BTC)	all types
• audit of accounts	all types
• item counting and identification	all types
• measurement and sampling:	
- weighing	- research laboratories, research reactors & critical assemblies - concentration, conversion - enrichment, fabrication and reprocessing plants - (certain) power reactors - (certain) storage installations - others
- non-destructive assay (NDA)	- research laboratories, research reactors & crit. assemblies - concentration, conversion - enrichment, fabrication and reprocessing plants - power reactors - storage installations
- sample taking for destructive assay (DA)	- research laboratories - concentration, conversion - enrichment, fabrication and reprocessing plants - storage installations
- participation in calibration exercises of equipment	- research laboratories - concentration, conversion - enrichment, fabrication and reprocessing plants - storage installations
- appropriate measurements (NDA and/or DA) on a low sampling basis	- LOF etc.

Table II.6

(Cont.)

VERIFICATION TECHNIQUE.	TYPE(S) OF INSTALLATION
• containment, surveillance and monitoring:	
- seals	- research laboratories, research reactors & crit. assemblies - concentration, conversion - enrichment, fabrication and reprocessing plants - power reactors - storage installations
- camera / video surveillance	- research laboratories, research reactors & crit. assemblies - concentration, conversion - enrichment, fabrication and reprocessing plants - power reactors - storage installations
- independent monitoring of key data (tank levels, temperatures and other operator data)	- enrichment - fabrication plants - reprocessing plants
- following detailed process operations and flows within the plant	- fabrication plants - reprocessing plants
- monitoring / logging systems	- enrichment plants - power reactors - research reactors and critical assemblies - reprocessing plants - storage installations

Safeguards approaches and implementation - Inspection effort

43. The following Tables II.7 and II.8 provide the figures of the inspection effort per type of installation and in each country.

Table II.7

Typical inspection effort per type of installation

Type of installation	Typical frequency of inspection ranging From	To	Inspection effort - man-days Euratom 1990	1991	1992
Research laboratories	1/a	12/a	313	352	435
Research reactors & critical assemblies	2/a	6/a	342	227	249
Mines and concentration plants	0/a	2/a	12	16	23
Enrichment plants	12	1/week	677	643	666
Conversion and fabrication (uranium natural, LEU)	12/a	1/week	1102	1011	1058
Conversion and fabrication (HEU and MOX)	12/a	continual	1322	1491	1356
Reprocessing	12/a (when not operating)	continual	2275	2067	2130
Power reactors	2/a	24/a	921	984	929
Storage installations	1/a	daily	537	906	849
Other (LOF, etc...)	0 *)	4/a	63	60	221**)
			7564	7757	7916

*) Holders of small amounts of depleted and natural uranium or thorium used for non-nuclear purposes are inspected on a sampling basis or when discrepancies following declarations (also from other operators) need to be resolved.

**) Includes specific effort for verification of basic technical characteristics in large-scale Pu processing plants not yet operational.

Table II.8

Cumulated Inspection Effort per Country
(Expressed in mandays / year and %)

Country	Mandays 1989	Mandays 1990	Mandays 1991	Mandays 1992	% 1992
BELGIUM	594	627	627	740	9.35
DENMARK	21	18	33	15	0.18
GERMANY	2237	2170	1823	1323	16.1
GREECE	6	4	5	4	0.05
SPAIN	170	147	185	202	2.55
FRANCE	2013	2408	2572	2838	35.86
IRELAND	2	2	2	2	0.02
ITALY	165	155	101	71	0.89
LUXEMBOURG	0	0	0	0	0.0
THE NETHERLANDS	137	129	130	160	2.02
PORTUGAL	7	6	5	4	0.05
UNITED KINGDOM	1967	1812	2187	2462	31.11
COMMISSION	98	86	71	92	1.16
TOTAL	7417	7564	7757	7916	100.00

44. In relation to tables II.6 and II.7 it may be noted that the frequency and intensity of inspections are also influenced by the established quantified inspection goals which depend on the strategic value, amounts and types of nuclear material, on the probabilities of detection and the detection times. These quantified inspection goals are reviewed from time to time so as to take account of new safeguards concepts and of the progress in research and development.

45. The safeguards approaches for "mixed" MBA's (see para.19) differ from those applied elsewhere in respect of their objective:

- For installations handling civil material exclusively the objective set out in Article 77 of the Treaty applies to all nuclear material in inventory or throughput[1].
- For installations handling or storing civil and non-civil material simultaneously or sequentially the objective set out in Article 77 of the Treaty applies equally to this civil material, a key condition being that there should be no net loss in quantity and quality of the civil material in a plant.

46. Whenever discrepancies are detected:

- within the operator's accounting system
- between two operators
- from information obtained through the IAEA or through third countries for exports / imports into and out of the Community
- between operator's records, reports and inspection findings

they are followed up immediately. Anomalies are unresolved discrepancies or prima facie evidence of an irregularity discovered as a result of records/reports examination or other inspection activities which may lead to the opinion that the terms of the Treaty or other legal instruments have not been respected. The resolution of anomalies requires a sequence of actions normally additional to the safeguards measures indicated in table II.6. Anomalies once fully established, i.e. unresolvable, would be reported to and considered by the Commission as a presumed infringement of the Treaty.

1) Plus, where applicable, to the equipment.

Safeguards approaches and implementation - Findings

47. The following paragraphs of this chapter provide findings resulting from the application of the safeguards measures in 1991 and 1992.

Research laboratories, research reactors & critical assemblies

48. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7.

49. Following the reports of the inspectors, 78 (15%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

50. These communications and direct consultations with operators or government authorities aim at further improving safeguards implementation relating, inter alia, to:

- the promptness and correctness of records and declarations;
- the inventories of difficul-to-access nuclear materials;
- the definition of safeguards measures to be applied to nuclear materials contained in wastes and discards.

Mines and concentration plants

51. The safeguards measures applied at these installations are described in table II.6 and the inspection effort spent is described in table II.7.

52. Following the reports of the inspectors, 7 (43%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

Enrichment plants

53. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7.

54. Following the reports of the inspectors, 11 (4%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

55. In relation to centrifuge enrichment plants it may be noted that: In 1983 an international project, referred to as the Hexa partite Safeguards Project, provided recommendations on how commercial centrifuge enrichment plants should be safeguarded while minimising the risk of dissemination of sensitive technology.

56. These recommendations to the IAEA included, apart from the "classical" safeguards measures listed in table II.6 above, "Limited Frequency Unannounced Access" (LFUA) to the cascade areas during which inspectors can satisfy themselves that the plants are operating as declared by the operator. Euratom observes these recommendations for the inspections conducted together with the IAEA. As to the inspections in the enrichment plant in which the Commission operates alone, these recommendations are applied as adjusted to the particular plant design.

57. In 1990 Euratom was informed that significant changes in enrichment technology were taking place requiring adaptations of the safeguards approaches for such plants. The necessary consultations with plant operators, government authorities and the IAEA have been initiated and continue.

58. The above mentioned communications and consultations with operators or government authorities continue, thus, in order to further improve safeguards implementation relating, inter alia, to:

- the use of instruments for Non-Destructive Assay (NDA) measurements inside the cascade area and the application of Containment and Surveillance (C/S) devices;
- further improvement of the Non Destructive Assay (NDA) measurements for the depleted uranium tails;
- measures to verify conclusively that there has been no net loss of civil material in certain installations relating, in particular, to procedures for the taking of the physical inventory.

<u>Conversion plants, fuel preparation plants and fabrication plants processing natural uranium and/or low enriched uranium</u>

59. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7.

60. Following the reports of the inspectors, 14 (8%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

61. These communications and direct consultations with operators or government authorities aim at further improving safeguards implementation relating, inter alia, to:

- Take account of certain technological developments which have strongly influenced the safeguards activities at these facilities, e.g. the availability of modern instrumentation based on neutron and/or gamma techniques. These modern instruments are being progressively introduced in the field and will lead to more effective safeguards.

<u>Conversion/fabrication plants processing highly enriched uranium and/or plutonium</u>

62. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7. It should be noted that for these installations the safeguards approach usually results in a continuous inspection regime.

63. Following the reports of the inspectors, 20 (8%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

64. These communications and direct consultations with operators or government authorities aim at further improving safeguards implementation relating, inter alia, to:

- the definition and implementation of projects to enable safeguards in these major plants;
- the testing and implementation of further advanced safeguards approaches;
- comprehensive verification measurements by modern instrumentation such as unattended measuring stations and advanced C/S equipment;
- physical inventory taking procedures;
- progressive resolution of issues related to the "mixed" character of certain plants;
- replacement of a large number of transports of samples by on-site analysis.

Reprocessing plants

65. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7. It should be noted that for these installations the safeguards approach usually results in a continuous inspection regime during the operation of the installations.

66. Following the reports of the inspectors, 45 (24%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

67. These communications and direct consultations with operators or government authorities aim at further improving safeguards implementation relating, inter alia, to:

- Fully transparent records/reports systems;
- In-process monitoring and/or C/S applications;
- Comprehensive verification measurements by modern instrumentation;
- Progressive resolution of issues related to the "mixed" character of certain plants;
- Replacement of a large number of transports of samples by on-site analysis.

68. As referred to in para. 30 above the main developments in 1991 and 1992 related to the preparations for and the coming on stream of three reprocessing plants of large throughput and complexity. This entailed:

- Obtaining detailed technical characteristics, detailed drawings, flow-sheets, process parameters etc.;
- Development of safeguards approaches;
- Intensive consultations with operators and government authorities;
- Determination of relevant specifications and planning of contracts for the safeguards system to be installed;
- Verification of BTC and of tank calibration prior to start up;
- Commencement of BTC verification (for one plant in construction stage);
- Preparation for final Commission approval under Article 78.2 of the Treaty (for two plants);

- Commission interim approval under Article 78.2 of the Treaty (for one plant);

- Implementation of safeguards at one plant following start-up.

69. Apart from the problems due to the unprecedented complexity of such new plants, the activities reported in para. 68 above for the new reprocessing plants do not give rise to particular observations.

Power reactors and storage installations

70. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7.

71. Following the reports of the inspectors, 53 (4%) statements after inspection or separate communications were dispatched containing particular observations requiring follow-up.

72. These communications and direct consultations with operators or government authorities aim at further improving safeguards implementation relating, inter alia, to:

- Step by step replacement of film cameras by modern video equipment;

- Introduction, where applicable, of monitoring and logging systems;

- Re-measurement of nuclear materials under effective containment and surveillance systems;

- Introduction of NDA measurements on fresh fuel stored under water.

73. It should be reported that also during 1991 and 1992 considerable resources in terms of both equipment and manpower were invested in applying safeguards in light water reactors using fresh MOX fuel. The inspection scheme involves using containment/surveillance (C/S) equipment to the maximum extent, however the inspection manpower spent is still too high. Efforts further to improve the C/S equipment with the aim of achieving a better balance between equipment and manpower are ongoing.

Locations outside facilities (LOF) and other installations

74. The safeguards measures applied at these installations are described in table II.6, the inspection effort spent is described in table II.7.

75. At such installations which include those where uranium or thorium is being used for non-nuclear purposes (e.g. shielding, aircraft counter weights, production of lamps, catalysts, ceramics) and those installations at the back end of the fuel cycle (not including, of course, reprocessing), safeguards, in specific instances, may rely more on the verification of Basic Technical Characteristics (BTC), than on other concepts. The discussion, however, to which intensity such measures are to be performed has not yet been concluded but considerable progress was achieved in so far as:

- the coverage, at least from the point of view of records and reports of such installations has been further extended;

- discussions with government authorities have resulted in the design of a scheme which will take full advantage of the existing systems at national level thereby saving Euratom resources.

76. On the other hand, it should be mentioned that at these installations operators frequently are not aware of their safeguards obligations, including nuclear materials accounting. This is why Euratom continues to spend a considerable effort in administration and other follow-up measures to ensure full adherence to the legal requirements. This resulted in 39 %[1] of the communications to operators of such installations requiring follow-up.

77. As far as waste treatment and disposal installations are concerned, the discussions on the implementation of appropriate safeguards techniques to be applied are still ongoing.

1) 21% in 1988, 35% for period 1989-1990

III. *ACCOUNTANCY*

General

78. Following the provisions of the Treaty and Regulation 3227/76, a nuclear material accounting system is established at all installations as described above. Reports are submitted according to the legal provisions to the Euratom Safeguards Directorate (DCS). Where appropriate, and following processing by Euratom, accounting reports are submitted to the IAEA, pursuant to the Verification Agreements.

79. At the installations the nuclear material accounting system comprises the records and reports required in Regulation 3227/76 and in the Particular Safeguard Provisions. These records must be complete, consistent with each other and with the physical reality, and must be reflected in the reports provided to DCS headquarters. Relating to these accounting reports the following table provides the number of records transmitted to DCS.

Year	Records providing for Inventory Changes	Records providing for Physical Inventories and material balances	Total
1991	437 741	398 916	836 657
1992	538 960	435 734	974 694

80. The audits of these operation declarations are carried out during inspections to check the above, and any remarks arising are addressed to the operators and followed up for actions. A particularly important task is the physical inventory exercise where the books are updated and audited and physical inventories are verified, compared and any difference identified and investigated.

81. The activities at DCS headquarters comprise the independent updating of accounts by installation based on the reports received pursuant to Regulation 3227/76, consistency checks between inspection findings and accountancy reports provided by the operators, control of external obligations and transit accountancy.

Accounting system

82. The accounting system for nuclear material follows the classical rules of bookkeeping with respect to the nuclear materials under safeguards, the basic objective being that at all times the book inventories reflect the physical reality as closely as possible in terms of amounts and timing.

83. All nuclear material accounting systems must provide for periodic exercises to take and verify the physical inventory. The frequency depends on the detection times which in themselves depend on the nature and amounts of materials involved in the flows and inventory in the installation. The normal frequency for "wash-out" type of inventory taking is once per year whereas the time interval of "snapshots" of the physical inventory in large plutonium plants may be as short as 2-4 weeks. The timing may depend on operational constraints. The objective of the exercise is to compare the physical and book situations and make adjustments as necessary to ensure that the books continue to reflect the reality as closely as possible. Each exercise leads to an evaluation to assess the acceptability of any book/physical inventory difference in relation to the activities performed.

84. The comparison between inspection findings and records/reports for activities between physical inventories is a further important element of the chain which leads to the decision whether or not the operator's accounts can be accepted by the safeguards inspectors or whether follow-up within the appropriate time intervals has to be performed. The necessity for such follow-up is frequent and requires in certain cases long term inspection and evaluation activities until a satisfactory resolution of the discrepancies is established.

External obligations

85. The control of external obligations is a further check, concerning the adherence to the provisions of the Community's nuclear agreements with the USA, Canada and Australia and/or to the contractual provisions requiring peaceful use only. The checks are based on accountancy tracking by obligation (sometimes referred to as flag control) and encompass particular exports and imports and preparation of annual reports (balance sheets) as required for the third States. Important items are the administrative procedures and inspection activities related to approval and follow-up of exchanges of safeguarding obligations.

86. All such exchanges of safeguarding obligations are approved and carried out according to a set of technical criteria which guarantee that only equivalent amounts of nuclear materials are exchanged. Equivalence must be obtained for the materials involved. A condition of performing any exchange of safeguarding obligations is that the obligation involved with the most stringent constraints shall not lose in quality or quantity.

87. International "flag swaps" are exchanges of safeguarding obligations where one quantity of material is located outside the Community and the other inside. During the 1991 - 1992 period, no such exchanges were performed. A request for an international "flag-swap" made by the European industry during the period 1991 - 1992 was rejected by one of the third states involved.

88. Internal "flag swaps" are exchanges of safeguarding obligations where quantities of nuclear material exchanged are subject to Euratom safeguards. The technical evaluation of internal "flag-swaps" is based on criteria that were updated during the calendar year 1992, after consultation with the European nuclear industry.
The practical application of the new criteria will be closely monitored during the following years and reviewed if need be.

The following table gives the data on internal flag swaps:

Year	Applications	Approved	Not-approved	Withdrawn
1990	36	34	0	2
1991	29	25	0	4
1992	40	40	0	0

89. As regards problems with respect to certain parts of Chapter VI of the Treaty, the role of Euratom safeguards is restricted to monitoring and reporting.

Transit accounting

90. In the Euratom system, receivers are obliged to report movements in exactly the same way as the shipper. Transit accounting is the cross check at the level of the reports received from operators that in fact the nuclear materials are reported as having been received as shipped. As far as shipments and receipts inside the European Community are concerned, the Safeguards Directorate follows up each transfer automatically until the official confirmation of the receipt is available. This may involve physical verifications, and any discrepancy between shipper reports and receiver reports automatically triggers a follow-up action which may lead to an anomaly. All discrepancies must be resolved or justified. If justified, the receiver is nevertheless obliged to report the movement in the same way as the shipper accompanied by an appropriate shipper-receiver difference report.

91. The response time of the Euratom safeguards system to such differences in reports on transit is less than a month for Plutonium and highly enriched Uranium. This detection mechanism of diversions is of fundamental importance. It may be reported that in 1991 and 1992 all open transit differences were resolved after appropriate follow-up action.

92. A further feature of this activity is the contribution to the world-wide IAEA system of nuclear material control. The Community record has always been good in this respect and this exercise has allowed Euratom to observe that certain countries outside the Community do not report on time or with the necessary precision. The Commission continues to help the IAEA in solving problems of this type.

Concluding remark

93. The above controls and audits provide the necessary verifications to determine whether the relevant provisions of the Euratom Treaty, the agreements with third country suppliers and the safeguards agreements with IAEA are being complied with. As regards accountancy of safeguards obligations, balance sheets and exchanges of safeguarding obligations, no particular observations apply for the period considered in this report. The usual follow-up required in the cases of late submission of reports, incomplete records and reports and/or of discrepancies took place.

IV. *RESOURCES*

Inspection manpower resources

94. The development of the staff of the Euratom Safeguards Directorate is displayed in the following table IV.1. This table also displays the inspection effort spent and the amounts of nuclear material under safeguards.

Table IV.1

Year	Staff DCS	Index	Operational inspectors	Index	Inspection mandays spent	Index	Nuclear material under safeguards in eff. kg. (by 1000)	Index
1982	179	100	108	100	4 489	100	78	100
1985	188	105	125	116	6 225	139	121	155
1986	202	113	134	124	6 196	138	139	177
1987	212	118	139	129	6 814	152	158	202
1988	228	127	155	144	7 364	164	179	229
1989	230	128	157	145	7 417	165	199	255
1990	227	127	163	151	7 564	169	231	296
1991	241	135	173	160	7 757	173	293	376
1992	263	147	199	184	7 916	176	318	408

95. The following additional remarks should be taken into account when considering table IV.1:
   a) Inspection effort is calculated through an internationally accepted definition (reference for example: Art. 98 L of the Verification Agreement), i.e. "... a man-day being a day during which a single inspector has access to a facility at any time for a total of not more than eight hours".
   b) In addition to the inspection effort spent by Euratom, the IAEA spent the following inspection effort in the Community:

Table IV.2

Year	1985	1986	1987	1988	1989	1990	1991	1992
man-days of inspection in the Community	3070	3442	3854	3591	3565	3615	3426	2195

c) The increase (in effective kg) of nuclear materials is dominated by plutonium. Currently most plutonium under safeguards is in store either in the form of irradiated fuel awaiting reprocessing or in oxide form in containers.

96. While it would be misleading to link safeguards effectiveness exclusively to inspection effort spent it is nevertheless a fact that the increase in nuclear materials must be and has been accompanied by an increase in inspection manpower. However, increase in pure inspection effort spent has been limited but accompanied by additional auditing, development, evaluation and follow-up at headquarters.

97. Safeguards inspectors work in an environment where they may be exposed to radiation by, contamination with and incorporation of radioactive substances. Appropriate repeated training and continuous surveillance of Euratom safeguards inspectors is therefore an absolute necessity. For this purpose the Medical Service of the Commission, the Safeguards Directorate and the dosimetry department of the Joint Research Centre in Ispra cooperate closely to ensure optimum radiation exposure control, related health physics services, appropriate training and, notably, strict and regular medical examinations without which no staff member is permitted to perform inspections at nuclear installations.
Whereas the (current) annual limit is 50 mSv the following distribution of radiation dose uptake was determined for 1992 for the Euratom safeguards inspectors and technical staff:

- 147 staff < 1 mSv
- 55 " 1 - 2 mSv
- 9 " 2 - 3 mSv
- 5 " 3 - 4 mSv
- 2 " 4 - 5 mSv
- 0 " 5 - 6 mSv
- 1 " 6 - 7 mSv

<u>Inspection manpower resources until 1995</u>

98. In view of the continuing increase in the number and complexity of nuclear installations within the European Community and, in particular, the corresponding increase of civil nuclear material to be safeguarded, the need should be recognised to continue to augment the number of nuclear safeguards inspectors within the years to come.

99. More specifically, the reasons for the additional manpower requirements are:

a) To meet the challenge posed by three large reprocessing plants and two large MOX fabrication plants, unprecedented in scale scheduled to start operations between 1989 and 1994 (One such plant started in 1989).

b) To ensure that the safeguards coverage will keep pace with the evolution of the nuclear industry in the Community and in particular with the increasing use of plutonium in storages or in MOX fuel for nuclear electricity generation purposes;

c) To improve safeguards further at complex installations, particularly at installations where both civil and non-civil nuclear material are handled either simultaneously or sequentially.

d) To make a safeguards contribution to the support in the nuclear field to the independent republics of the former Soviet Union (FSU, CIS). This appears essential as the initial activities performed (*) demonstrate that the safeguards systems in the FSU states are either non-existent or in need of considerable improvement.

100. Whereas, the Commission informed the Council in 1989 that a total of 99 inspection posts will be needed in the period to 31.12.1995 this plan could not be implemented due to budget shortages and the change of priorities. It may be noted from Table IV.1 that the level of staffing of the Euratom inspectorate has grown in a rather moderate way since 1991 despite growing and additional tasks. This situation is not expected to improve in the short term and a consequential decrease of Euratom safeguards effectiveness may result.

Operational credits

101. Budget chapter B4.2 provides the credits for the operation of Euratom safeguards excluding staff cost and excluding cost for the computer main frames:

a)	Budget line B4 2000:	missions
b)	Budget line B4 2010:	training, meetings and experts
c)	Budget line B4 2020:	procurement of instruments, sample analysis, transport, temporary staff, technical and scientific studies, informatics software and PCs.
d)	Budget line B4 2021:	large plutonium processing plants. The Commission has introduced this budget line in view of the significant investments necessary. (Ref. para. 30-34 above).

In addition, budget line A0 1420 provides for costs associated with radioprotection of inspectors.

(*) Please refer to Chapters VI and VII below.

102. The following credits were made available over the last five years (in MECU):

	1989	1990	1991	1992	1993
B4 2000	2,100	2,250	2,350	2,800	3,500
B4 2010	0,130	0,120	0,105	0,125	*)
B4 2020	2,500	3,800	2,300	2,125	2,000
B4 2021	/	/	2,600	4,416	5,000
Total	4,730	6,170	7,355	9,466	10,500
A0 1420	0,114	0,155	0,140	0,380	0,445
Consumed resources (%)	99,81	99,99	99,22	99,80	--

Instruments, methods and techniques

103. At the end of 1992, the Safeguards Directorate possessed the following equipment used either at nuclear installations or at headquarters.

EURATOM EQUIPMENT on 31-12-92

A. Gamma equipment

1 NIS PITMAN } hand held
7 HM4 } syst.
10 SAM II (2 channel syst.)
2 Enrichment meters
10 Pu meters
24 Davidson MCA's
7 Silena Ciceros
4 Gamma & Neutron Measurement stations
2 MTR scanners
4 Canberras
4 Element Counters
1 Pin Counter

B. Neutron equipment

2 SAM II/SNAP
4 Cercueil (pins)
1 Octagon (waste)
13 HLNCC (Pu)
11 NCC (fuel elements)
5 AWCC (HEU, LEU)
4 Phonid (LEU, HEU)
3 CIND (UF6 cyl.)
4 UFBR (FBR ass., Pu cyl.)
4 Inventory sample counter
6 Hexagones

*) Part of B4-2000 as fro 1993

C. C/S equipment

49	Minolta camera units
5	Ministar TV systems
31	MIVS TV systems
47	EUR video systems (TLR)
35	VACOSS seals
10	Night vision devices
5	P.S.U.
1	Gemini System

D. "Other" equipment

1	Pebble Sampling Device
4	ION-1 FORK (spent fuel)
1	UF6 mass spectrometer
1	UO2 mass spectrometer
1	Potentiometer (U-factor)
	Various reference materials
11	Ultrasonic thickness gauges
14	Load cells
3	K-edge densitometer
1	Spectrophometer

Total: 354 INSTRUMENTS at the end of 1992 - (310 end of 1990)

104. The application of technical measures for nuclear materials verification and containment/surveillance has largely increased over the last few years. This is illustrated in Fig. 1 attached for the years 1984 to 1992. The figures show (in percent) the number of inspections where sample taking, optical surveillance, non destructive assay (NDA) or use of seals is involved.

105. The use of technical measures per type of installation is illustrated in Figs. 2-5 for NDA equipment (Fig. 2), optical surveillance (Fig. 3), sample taking (Fig. 4) and use of seals (Fig. 5). The figures are self-explanatory.

106. 903 and 1167 samples were taken by inspectors in the field in 1991 and 1992 respectively. 588 and 872 samples were analysed on site using analytical equipment or our portable mass spectrometers. 376 and 283 samples were transported to the Commission laboratories at Karlsruhe, Ispra and Geel, where a total of 982 and 793 chemical analysis were carried out.
The mean time for transport was 31 days (53 in 1990), the mean time for analysis 38 days (46 days in 1990). The total delay time is decreasing but is still unacceptably high .
An analysis of the reasons for delay shows that transportation is a significant cause. The main reason for these long transportation times is the need to comply fully with transport regulations of radioactive material. In order to overcome this problem and also for reasons of cost effectiveness, Euratom has proposed to install two on-site laboratories at La Hague (France) and Sellafield (UK). The first steps for implementing this solution at Sellafield (design, safety aspects, contracts, laboratory clearance...) have already been taken. The commissioning of this laboratory has been delayed and should commence by 1995.
Moreover, instruments are coming into routine use which allow the measurements of most of such safeguards samples on site thereby reducing the need for transports to a minimum.

107. About 16,000 seals were placed each year by inspectors during 1991 and 1992 of which about 2000 seals were placed each year on nuclear materials exported from the Community. About 17,000 seals were removed and verified each year at headquarters. In addition about 7500 paper seals, and 40 new fibre optic seals were used and field tested in nuclear installations.

108. During 1992 (1991), 832 (936) films from optical surveillance units were developed, reviewed and evaluated at DCS headquarters in Luxembourg. The reliability of the optical surveillance units was better than 99.8%. From the video systems, about 500 (450) video tapes were replaced, reviewed and evaluated.

109. Equipment for Non Destructive Assay (NDA) was used for nuclear material verifications in 935 and 1007 inspections respectively in 1991 and 1992, equivalent to about 44% of the total number of inspections.

110. Large plant-installed measurement and surveillance systems were discussed and designed in collaboration with the plant operators concerned for reprocessing and fuel fabrication facilities. 6 video systems were installed in both 1991 and 1992 in reactors using MOX fuel or in Pu storage facilities.

<u>Informatics</u>

111. The following main systems are presently in operation (apart from a multitude of individual applications):

a) Accounting System (CMF - Comptabilité Matières Fissiles): ADP (Automatic Data Processing) and verification of operator reports. Reports to IAEA on magnetic tapes based on operator's reports but in a different format. Production of numerous reports for statistical purposes and for assisting the accounting unit in its checks.

b) Seals: Automatic data processing of approximately 17000 seals/year from fabrication, issue, placing, breaking, through to final verification.

c) Destructive Analysis: Storage and retrieval of data, both administrative and technical, related to the taking of samples for destructive analyses.

d) Inspection planning and follow-up: Input and storage of the scheduling of each inspection. Communication to IAEA of a subset of the plan. After the inspection, the system spots (identifies) the necessary follow-up actions.

e) Management: List of personnel, management of missions, productions of mission statistics, presence list etc.

f) MADES (Material Accountancy Data Evaluation System) :System to evaluate differences found in material balances.

It must be noted that for the required confidentiality reasons (Art.194 of the Treaty), the DCS informatics systems are physically separated from the Commission network.

112. Personal computers (PC) are an indispensable tool to assist inspectors in the field as well as for purposes of headquarters evaluations. Particular attention is given to ensure compatibility between the hardware as well as between applications at the installations. The PCs are integrated with the main-frame computer through a LAN (Local Area Network).

113. The following list gives a survey of the hardware available and used exclusively for safeguards:

- Siemens 7560, 1.7 mips and 36 terminals and 7 hardcopy devices
- 2 UNIX computers (Olivetti 3B2 and NCR600) for office automatization including word processing etc. with 37 work stations
- 120 personal computers.
- 1 UNIX computer (NCR 600) for access to the public packet switching data network (x25). Ciphered faxes can be transmitted with this network.
- 2 Ciphered faxes to exchange confidential documents with the IAEA.

114. Relating to software the main components are the following:

- Operating system BS2000 allowing batch and on-line processing
- Database management system ADABAS including query language NATURAL
- Database management system ORACLE including query language SQL
- Database management system dBASE III and oracle, for the operation of the personal computers and other software for PC's as WORD FOR WINDOWS, EXCEL, and others.

115. It is expected that the development of informatics will proceed in further decentralising hardware while maintaining an integrated architecture permitting strict software compatibility and, of course, assuring strict data security.

Support from the Joint Research Centre (DG XII-JRC)

116. DG XII-JRC supports the Euratom safeguards directorate by performing and financing a number of essential activities in the R&D field:

- Development of instruments, methods and techniques as well as analysis of safeguards samples: Cost about 3,5 Mio ECU per annum.
- Radiation protection (dosimetry and expertise) of the safeguards inspectors.
- Training of safeguards personnel at ISPRA, mainly at the recently established PERLA laboratory.

117. The support by DG XII-JRC to the safeguards directorate is coordinated by a rigorous project management. The total number of such projects amounted to 23 (1991) and 38 (1992).

118. Moreover, a very effective cooperation took place with the Transuranium Institute (TUI) in Karlsruhe in the framework of the follow-up of illicit trade and transfers of nuclear materials (see chapter VI. below).

119. Finally, it should be highlighted that, in 1992 JRC personnel started performing missions in the framework of the construction of the On Site Labs (OSL).

120. The continuation of the support by DG XII-JRC to the Euratom Safeguards Directorate in an effective and efficient manner is essential.

Fig. 1 Usage of Technical Measures

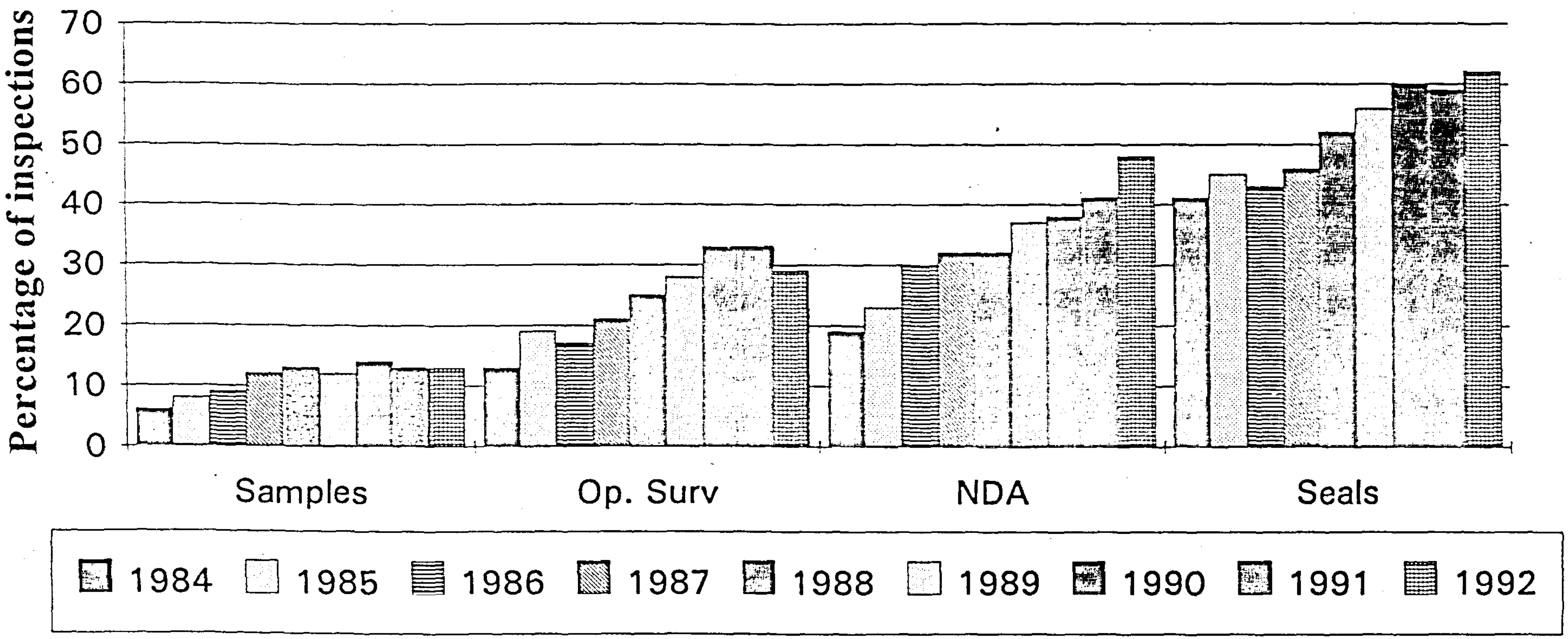


Fig. 2 Usage of NDA Equipment

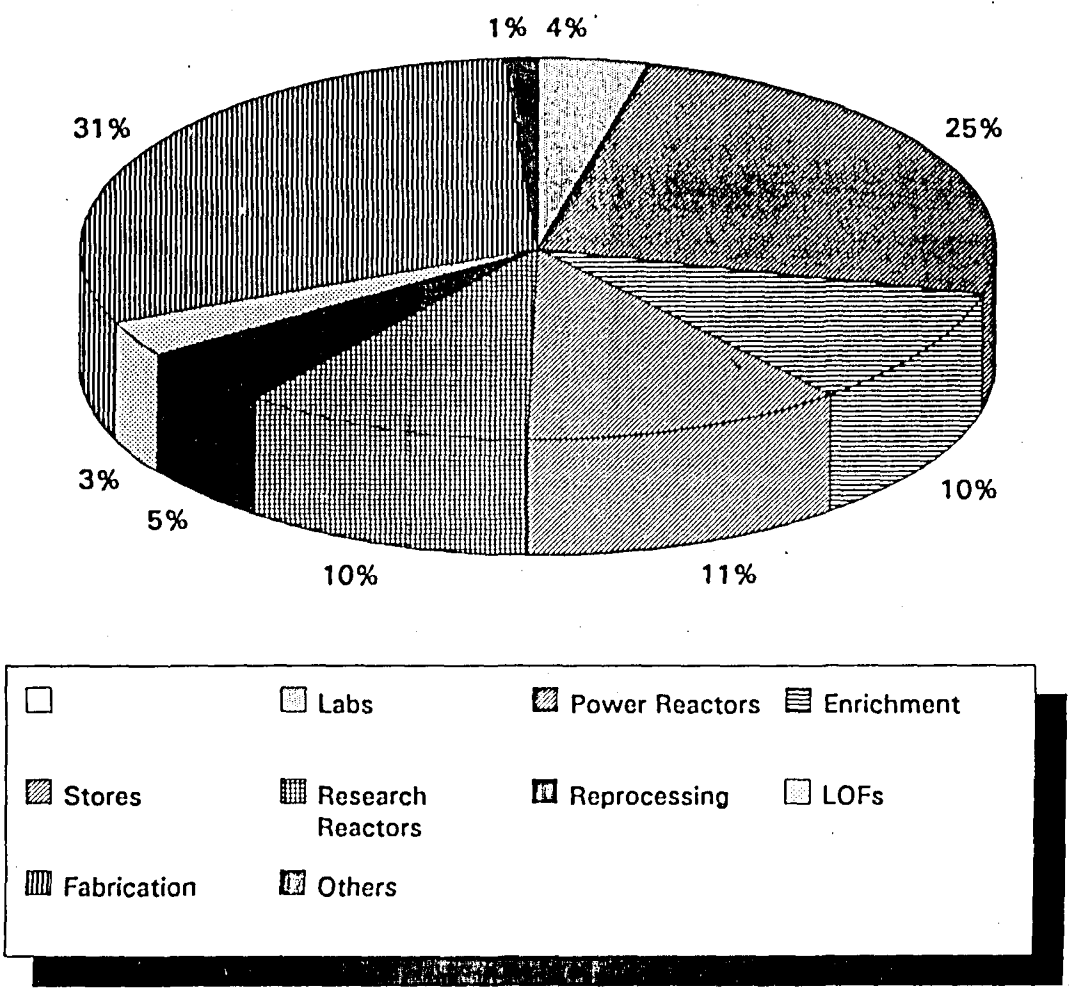


Fig. 3 Usage of Optical Surveillance

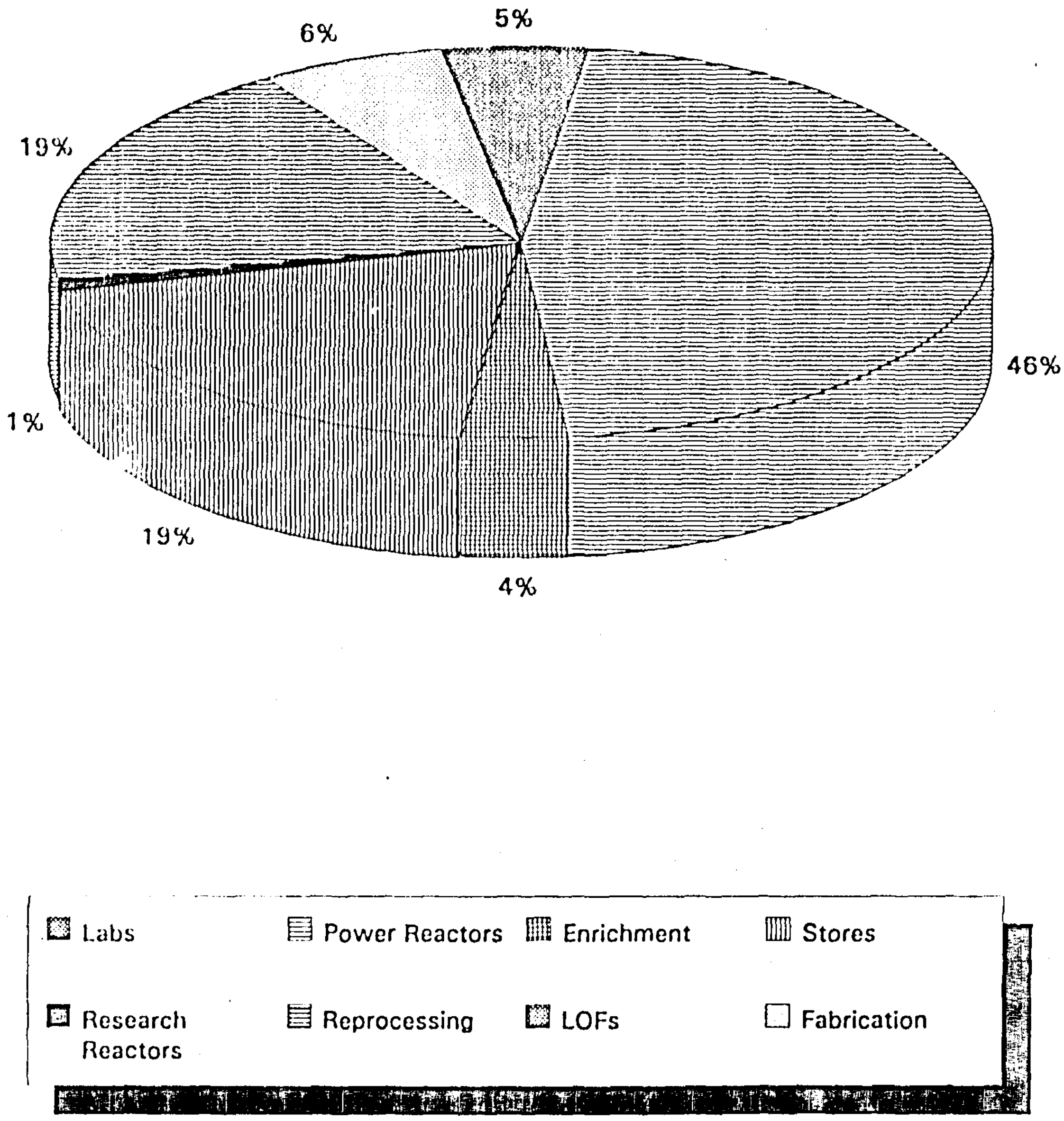


Fig 4 Taking of Samples

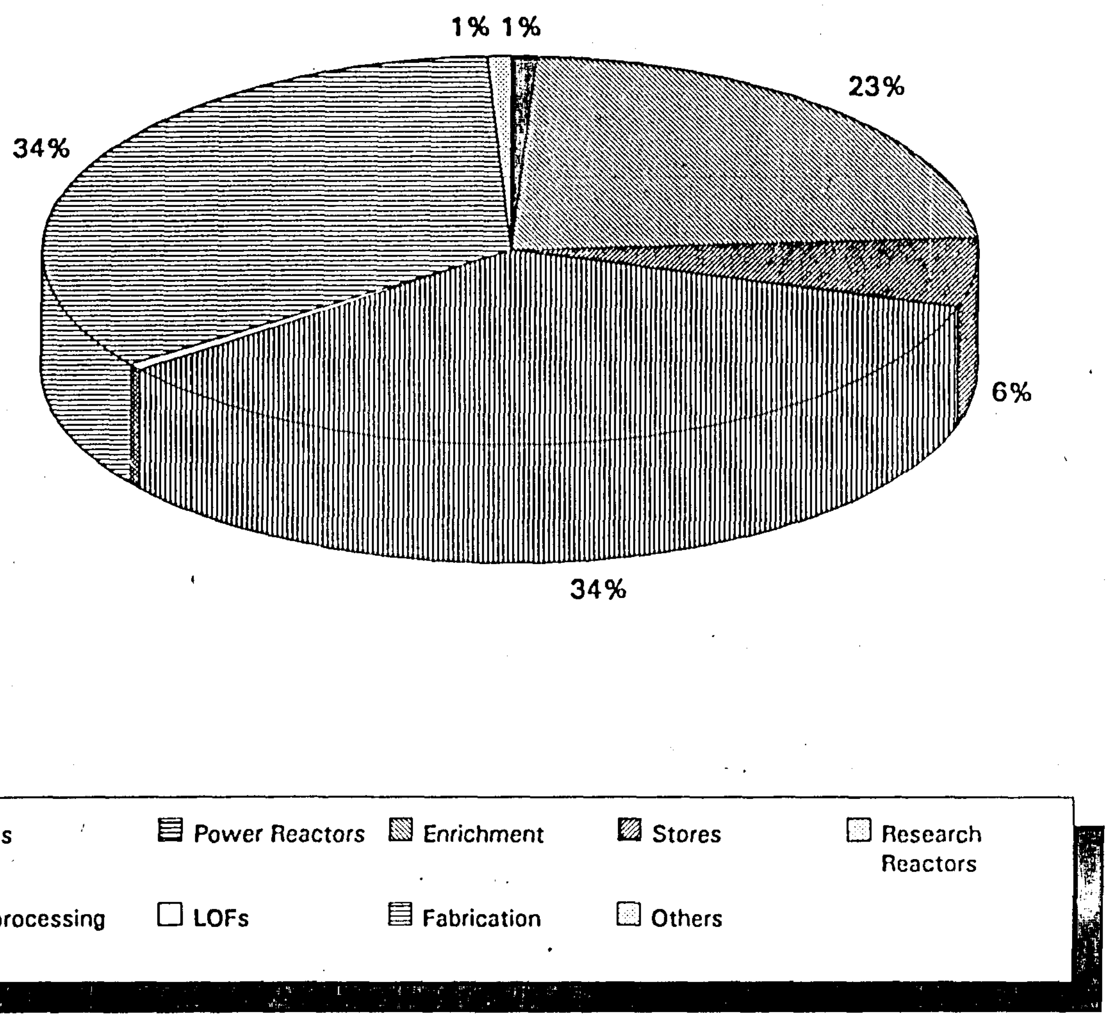
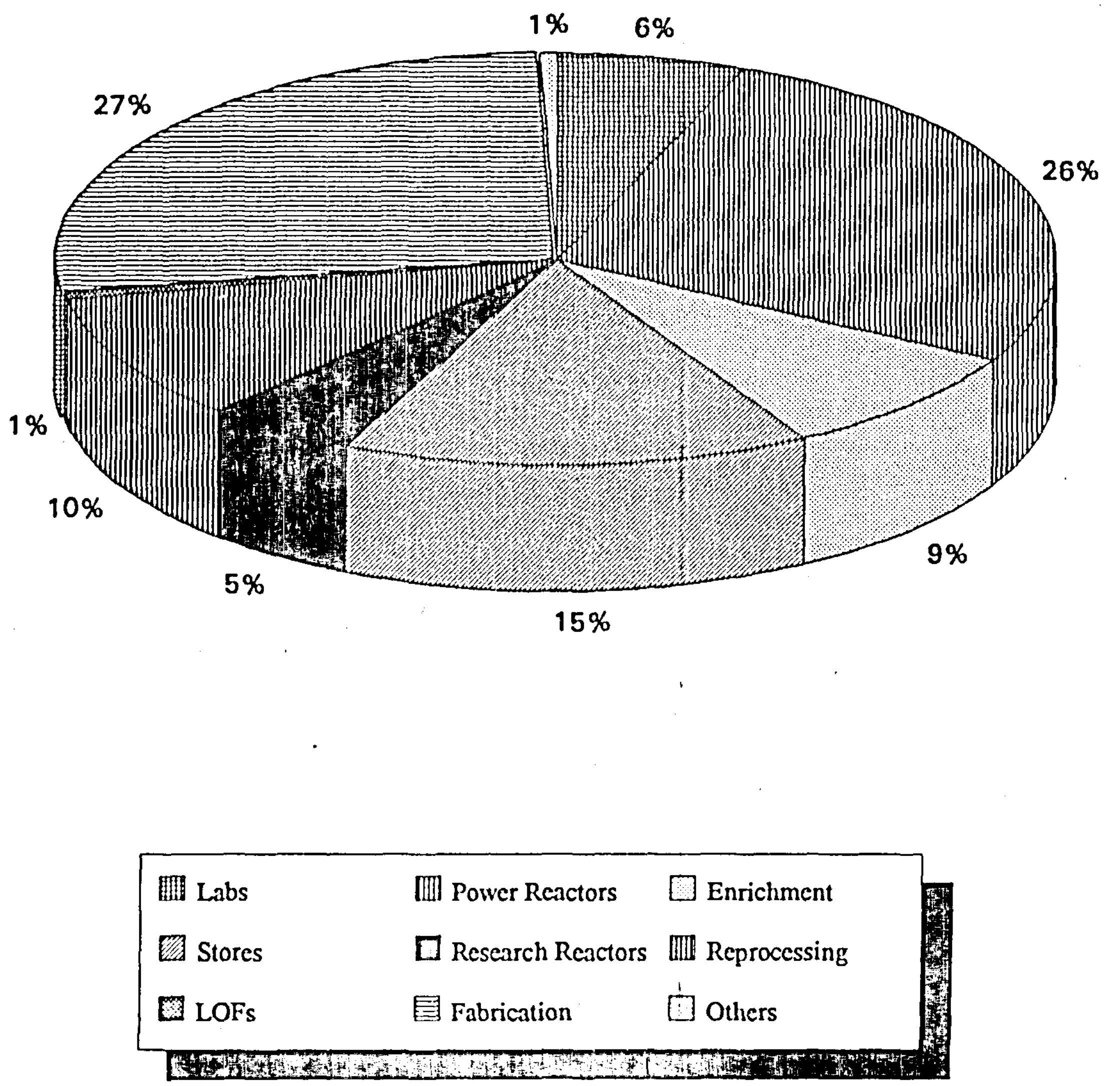


Fig. 5 Usage of Seals



V. *RELATIONS WITH THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)*

121. The IAEA, a member of the UN family of specialised agencies, is the international Agency responsible on a world-wide basis, inter alia, for carrying out safeguards under the Non-Proliferation Treaty or other agreements relating to the peaceful use of nuclear energy. As already described above (para. 13) three Verification Agreements have been concluded between the Community, its Member States and the IAEA. They establish the responsibilities of Euratom, its Member States and the IAEA for the implementation of IAEA safeguards.

122. The structure of the relations with the IAEA may be summarised as follows:

- Participation of the IAEA in Euratom inspections. This is a daily operational task. At about 50 % of all Euratom inspections IAEA inspectors participate.

- Reporting of the nuclear material movements and inventories pursuant to the provisions of the Verification Agreements and support to the IAEA system of world wide accounting for the transit of nuclear materials.

- Meetings of the Liaison Committees pursuant to Art. 25 of the Protocol to the Safeguards Agreements. The purpose of these meetings is to discuss, coordinate, negotiate general issues relating to IAEA safeguards in the Community.

- Negotiations of documents of a technical/legal nature called the **Facility Attachments** (F.A.) or **installation attachments**. This requires a major negotiation effort on all sides. Some 50 Attachments, including the attachments for new installations and existing attachments in need of revision, still need to be negotiated, about 200 being already in force.

- Numerous contacts and working groups, participation in seminars, common training activities;

- Collaboration with the IAEA in the development, testing and implementation of instruments, methods and techniques.

123. A number of developments took place in 1991 and 1992 which continue to give rise to extended discussions and negotiations on the implementation of the three Safeguards Agreements.

124. These developments include:

- Due to the declared intent of several countries outside the European Community that they aim for the establishment of "regional" safeguards systems and have, reportedly, indicated their objectives to negotiate for the same terms as Euratom in the Verification Agreements, the IAEA is in a delicate position, since notably these countries in their current negotiations are reported to link their acceptance of full scope IAEA safeguards with the acceptance, a priori, of a regional system. The political discussion of "regional" safeguards systems is relevant for the relations between the IAEA and Euratom. (see below)

- The IAEA has developed a set of "Safeguards Criteria for 1991-95" and a document was officially provided to Euratom at the end of 1990. The Commission services undertook to analyse these criteria with respect to safeguards methodology, compliance with the Verification Agreements and accompanying understandings (e.g.. Observation and Joint Teams), compliance with facility attachments concluded as well as with basic Community policy such as on the unity of the European nuclear market. Analysis of the criteria was completed in 1991.

- The experience of Euratom in the design and implementation of safeguards systems for the large plutonium processing plants show that their features require a shift from classical human-interference inspections to fully automated and largely unattended systems leading to concepts and approaches Euratom considers essential to perform high quality safeguards. As one of these plants may be jointly safeguarded by Euratom and the IAEA the negotiations on the safeguards concepts have led to a consensus on a so-called "base line approach".

- The New Partnership Approach (see below).

125. In 1991, the above mentioned analysis of the IAEA safeguards criteria for 1991 - 95 led to a number of conclusions:

- The IAEA had spent an inspection effort in the NNWS of the Community disproportionately high in comparison with third countries;

- No full account had been taken of the Euratom safeguards system;

- Certain provisions of the Verification Agreements would - when applied formalistically - appear to impede the IAEA <u>rights</u> for independent safeguards conclusions.

126. In recognising these issues the Commission and the IAEA agreed, in March 1992 to base their relations on a New Partnership Approach (NPA) the essential features of which comprise:

- improving the cooperation during the planning of and carrying out of inspections by making more use of the "one man one job" system;
- rendering the decision making procedures of the Liaison Committee more effective;
- pooling resources, to the extent possible, for inspectors training, procurement of material, shared analysis, development of instruments or, more generally, to cooperate more closely in the logistics field;
- thereby enabling the IAEA to reduce its inspection effort in the Community.

127. Implementation of the NPA started in 1992 for light water reactors and fabrication plants (LEU) but a more detailed agreement on the NPA could only be concluded in February 1993. It is expected that the NPA could be fully implemented from the end of 1994.

128. In essence the NPA under implementation is establishing a balanced compromise:

- On the one hand certain provisions of the Verification Agreement are re-interpreted; this relates notably to the principle of observation, the right of each organisation to decide on the activities it needs to perform in order to achieve its safeguards objectives and to a disjunction of Euratom and IAEA tasks.
- On the other hand, under the NPA, once implemented, the IAEA will reduce its inspection effort in the NNWS of the Community by more than 50% (compared with 1990) and this reduction will be more than at places where a regional safeguards system does not exist.

129. In other words, the NPA provides for an intensified cooperation between the IAEA international safeguards system and the EURATOM system which is, so far, the only existing regional safeguards system. This improvement of the Commission's collaboration with the IAEA in the safeguards field is regarded as an indispensable element to confirm the European Community's uniquely high non-proliferation credentials.

VI. ILLICIT TRADE[1] AND TRANSFERS OF NUCLEAR MATERIAL

130. Following the dissolution of the former Soviet Union in 1991, the centralised system for nuclear materials accountancy, control and physical protection has lost its grip or has disappeared entirely in the various republics. As far as could be analysed by the end of 1992, in a number of republics no system had been put in place which would perform the functions of the above mentioned controls against theft of nuclear material, illegal trade of nuclear material and against hazards to the population concerning contamination/radiation.

131. As a consequence a trickling of nuclear material i.e. uranium but also some plutonium, could be observed in the neighbouring countries of the former Soviet Union and also in the European Community. Mechanisms observed were invariably similar since individuals tried to obtain and to sell nuclear material but also other radioactive substances[2] such as Cesium 137 and Strontium 90 of no relevance as far as bomb fabrication is concerned but involving a significant health risk for carriers and the public.

132. Although no clear indications existed and still do not exist at present, the development, however, of organised "black markets" can not be excluded and this is one of the reasons why, from the beginning, the Euratom Safeguards Directorate has actively been involved in various actions in order to:

- implement safeguards on nuclear material according to Chapter VII of the Euratom Treaty, e.g. when necessary, by sending an inspector "sur place";
- establish appropriate bilateral contacts and cooperate with national/local authorities and courts when a case occurred and when it was specifically requested by the Member State;
- receive and distribute information relating to radioactive substances and sources comprising other than nuclear material;
- provide expertise, high precision analysis and information in close cooperation with the Euratom Institute for Transuranium Elements in Karlsruhe when requested by Member States;
- set up a data bank: it appears indeed of paramount importance to centralise information on the cases which occurred in the Community and to gather very detailed "fingerprint" information to enable deduction of the origin of the material.

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1) The material involved in this illicit trade has also been referred to as "vagabonding" nuclear material or other radioactive substances.

2) Radioactive substances: any substance that contains one or more radionuuclides, the activity or the concentration of which cannot be disregarded as far as radiation protection is concerned (Council Directive of 15 July 1980, O.J. L246 of 17 September 1980).

133. As from the beginning, the European Parliament, National Parliaments of Member States, the general public and the media have shown great concern in all problems in relation to the nuclear cycle in the former Eastern-Block and this problem in particular.

134. Moreover, Member States authorities have requested (through the Council's Atomic Questions Group), that this problem be dealt with at Community level.

135. It may be recalled that the Commission has initiated programmes, namely PHARE and TACIS, to stop, nter alia, further deterioration and improve nuclear safety of the eastern nuclear installations and to contribute to bring their safety standards to a level equivalent to the western standards. In order to contribute also to the prevention of a further deterioration of the accounting and control of nuclear material in CIS and PECO, specific actions outside of and in addition to PHARE and TACIS in the field of nuclear safeguards and, later, radiation protection have been initiated in 1992 between Commission services and authorities in the Russian Federation (see Chapter VII). By developing such actions, the Community will contribute to ensure that illicit trade of nuclear and radioactive materials is reduced and, if possible, eliminated at medium term.

136. In the Community, there were 14 cases known by the end of 1992 by the Euratom Safeguards Directorate which involved uranium and/or plutonium and in which to a variable degree the Commission Services cooperated with the Member State's Authorities concerned. In a few other cases, Euratom Safeguards Directorate's services were put in "State of Alert" but fortunately nothing happened. Outside the European Community a number of cases were reportedly discovered in neighbouring countries such as Switzerland and Austria of which the Euratom Safeguards Directorate was informed.

137. In the period under consideration (1991-1992), a number of cases occurred involving other radioactive substances, not submitted to safeguards. The number probably exceeds 100. The cases which involved plutonium and/or uranium were only identified in Germany and Italy since illicit traders from the east apparently crossed the Community borders by entering into these countries. For each case which appeared in Italy there were contacts with Italian authorities. In Germany, contacts involved Federal authorities, Länder authorities and criminal courts. Through an exchange of letters between the Permanent representation of Germany to the European Communities and Commission's Directorate General for Energy the structure relating to communication, coordination and analyses was established and worked well in all the subsequent cases.

138. Based on the experience gained in 1992 the Council's Atomic Questions Group requested that the relevant actions be coordinated on Community level in due recognition of the fact that the problem is an European one. These efforts started in 1993.

VII. COOPERATION WITH THE REPUBLICS OF THE COMMONWEALTH OF INDEPENDENT STATES AND EASTERN EUROPEAN COUNTRIES IN THE SAFEGUARDS FIELD

139. Concerning the European Community's programmes TACIS and PHARE, reference is made to paragraph 135 above.

140. In the field of NUCLEAR SAFEGUARDS two issues in the context of CIS and Eastern Europe had to be distinguished:

(a) Safeguarding the disarmament of nuclear weapons including the dismantling of nuclear warheads, storage and further civil use of the contained nuclear material;

(b) Safeguards on the civil nuclear materials and related physical protection.

141. As mentioned in Chapter VI of this Report, a trickle of nuclear materials has been observed from CIS territories to Western Europe through black market channels. The appearance of these "vagabonding" nuclear materials (since late 1991) had to be interpreted as a further indication of a possible disintegrating or slackening of the safeguards and control systems in CIS.

142. Member States of the EC, the European Parliament and the Commission realised that further and immediate efforts were required to collaborate with CIS republics and, as appropriate, with other Eastern European countries.

143. For such cooperation and support activities in the safeguards field the general objectives included :

- to contribute to the improvement of the accountancy and control system in CIS republics to the standards of nuclear material accountancy and control maintained in other countries - as, e.g. in the European Community - having substantial nuclear programmes;
- to contribute that such systems would comply with the safeguards requirements of the International Atomic Energy Agency (IAEA) and,
- thereby to contribute to the Non-Proliferation of nuclear materials and to the minimisation of hazards to the public through vagabonding materials.

144. In early Autumn 1992 a dialogue started with representatives of the CIS, including a meeting at the higher level during the IAEA General Conference to explore whether such support and cooperation would be welcome and requested.

145. During the discussion of the budget of the Communities en 1992, the European Parliament decided to make funds available under a special budget line B.4.2001 already for 1993 for the assistance to CIS and PECO in safeguards.

146. Thereafter the Euratom Safeguards Directorate undertook a conceptual study to identify inter alia:

- The reason for and objectives of a then future cooperation with CIS and PECO in the safeguards field.
- Possible short term (1993) approaches, plans and programmes.
- Medium term (1994) plans and programmes.

147. In essence the study concluded and suggested :

- To initiate an intensive dialogue with representatives of the Russian Federation (RF);
- To avoid duplication of activities, i.e., to ensure that the actions performed are complementary to the actions of others programmes but to liaise with
  - Member States
  - Operators of nuclear installations, research centres and experts
  - the IAEA
  - Third countries, as appropriate;
- To hold initial seminars (in Luxembourg) in order to identify:
  - Competent interlocutors
  - The needs in the safeguards areas
  - Possibilities for evaluating the effectiveness of the cooperation;

- To cooperate with the medium term objective to contribute to the establishment of a high-quality nuclear material accounting and control system in the RF on the level of installations, districts and at central control authorities

The concept was submitted in March 1993 for consideration at Commissioner level ; the necessary consent was obtained .

148. Although the action was really started after the period under consideration, it is considered useful to report on the ongoing and planned actions as well as on results obtained, viz:

- The first seminar took place from 3 to 5 May 1993 in Luxembourg comprising 14 participants from RF and Commission services. The following items were discussed and consensus was reached :
  - organisational issues such as on the establishment of a Joint Coordination Group (JCG);
  - a short term programme consisting of the organisation of workshop seminars in Luxembourg and in the RF (Russian Federation);
  - the design, testing and the implementation of a Nuclear material Accountancy and Control (NMAC) System at state level;
  - a medium -term programme defining the main directions for the cooperation between Euratom and the RF for the period 1994 to 1996;
  - information exchange.

- The second seminar took place from 9 to 12 June 1993 in Luxembourg comprising some 35 participants from the RF (Gosatomnadzor, Minatom, Kurtchatev Institute and plant operators), from the Commission services and Community nuclear industry. The results of and conclusions from the seminar - 10 lectures and discussions on accountancy and control systems plus demonstrations of safeguards equipment - and the subsequent meeting of the Joint Coordination Group were that consensus was reached on all issues, including :

  - observations on the usefulness of the seminar and lesson learnt;
  - composition of the Joint Coordination Group;
  - the short-term programme (1993):
    a) Provisions/exchange of information on the overall architecture, components etc. of the (computerised) nuclear materials and control system (NMAC);
    b) Three further seminars specifically on NMAC architecture, design and implementation;
    c) Three working parties of 2 experts each from RF on NMAC to stay in Luxembourg to carry out the work described under b) above.
  - The medium term programme (see below)

- The following medium programme of activities has been agreed :

  a) the seminars and working parties as described above during the 2nd semester of 1993;
  b) In March 1994: review and appraisal of the work performed by the working parties.

c) In April 1994 : Seminar in RF for 60-80 participants to train facility operators and national inspectors;

d) During 1994 (2 seminars - deadlines and further details will be established in September 1993): Further design, test and implementation of a computerised information system for NMAC in the RF;

e) During 1994 and 1995:
Technical support to the NMAC (for operators and inspectors)
- Methodology
- Hardware and software
- Instrumentation for measurements and control containment and surveillance equipment.
(All on a demonstration basis).

149. The following conclusions may already be drawn:

a) The concepts for the cooperation with, initially the Russian Federation have been developed;

b) The cooperation with relevant Russian authorities and operators has been initiated and will be of a very concrete nature;

c) Several seminars with wide participation from RF, Community operators and Commission services were held in Luxembourg;

d) The organisational set-up as well as the programmes for 1993 and 1994 were agreed;

e) The practical work, other than of a programmatic nature, will continue with the objective to contribute to the design, testing and implementation of a high-quality nuclear materials accountancy system in the Russian Federation;

f) The plans for the training of and technical support to facility operators and national inspectors have been established.

150. While it is considered also in the interest of the Community that the nuclear material in the CIS is well under control against misuse (e.g. Proliferation, vagabonding materials) - it is still too early for a realistic assessment on whether or not this cooperation between EURATOM and the Russian Federation in the field of safeguards will have the envisaged impact. Such a realistic assessment should be possible in 1994 when the first products resulting from the cooperation are planned to be tested and, hopefully, implemented at nuclear facilities and control authorities.

VIII. TRENDS IN SAFEGUARDS

151. Safeguards up to 1996 can be characterised through the way it will cope with the increased availability and use of plutonium in the commercial fuel cycle of the Community, through the desirability to continue to improve the effectiveness and efficiency of the safeguards operation in general and through the contributions to be made to the adhesion of new member countries to the Community, to the negotiations for and conclusions of a new nuclear cooperation agreement with the United States, to the cooperation and support to CIS and PECO and, last but not least, through the contributions to the Non Proliferation regime.

152. As far as the Euratom safeguards operation "stricto sensu" is concerned, reference is made in this respect to the trends as described in paragraphs 101 to 106 of the Operations Report for 1988 as well as to paragraphs 23 to 34 of the present report.

153. From a technical point of view, the trend reported in paragraph 106 of the "1988 Report" can be confirmed as presenting a continuing challenge to safeguards in two respects.

- For security and health physics reasons, installations are designed and operated, where the nuclear material which is subject to safeguards is more and more inaccessible (massive transport/storage containers not designed for routine opening; heavily shielded, secure storage of sensitive nuclear material). Developments now being applied include advanced measurement instrumentation and sophisticated C/S systems including monitoring/logging systems designed to react to and record events which might be of interest to safeguards. These developments will need to be continued to keep pace with design changes and adapted to specific situations. For example, a new type of installation is presently under design and may enter pilot plant stage, i.e. plants to "compact" irradiated LWR fuel elements for the purpose of later "final" disposal. It is expected that such pilot plants might become operational between 1995-2000; relevant safeguards concepts and approaches are presently being discussed with operators and with the IAEA.

- The main fuel cycle facilities, i.e. fabrication and reprocessing plants are developed to operate in a fully automated (and remotely controlled) mode. This trend continues to cause the departure from established safeguards/inspection practice, i.e. the need for Euratom:

  - to continue with the involvement of safeguards experts in the design/construction work at a stage long before commissioning;

- to increase further the emphasis on the activities related to authentication for safeguards purposes of plant design, operators measurement procedures and accounting;
- to increase further the importance of verification and re-verification of the basic technical characteristics;
- to continue in safeguards operations to try to limit the need for additional manpower, in line with the manpower provisions made by the Commission (ref. para. 91), through the development and implementation of automated, largely unattended measurement systems where feasible.

154. In 1995 the accession to the Community of four new Member States is envisaged, two of which maintain considerable nuclear programmes. Based on the 1986 precedent of the accession of Spain and Portugal as well as the 1990 German unification, considerable safeguards effort is expected to have to be spent in order to:

- Ensure that the provisions of the Euratom Treaty be fully respected.
- Establish, by appropriate safeguards measures that the declarations of the operators are fully consistent with the physical reality of the flows and inventories of the nuclear materials under safeguards at the installations.
- Integrate the new member countries and the corresponding installations into the EURATOM-IAEA collaboration in safeguards under the (NNWS) Verification agreement.

154.b It is expected that a new agreement between Euratom and the US-DOE in the field of nuclear safeguards research and development will be signed in a near future. its objective is the cooperation in mutually agreed research and development topics and the training of nuclear inspectors and specialists in order to enhance the effectiveness of nuclear fuel safeguards.

155. The safeguards contribution to the negotiation for and conclusion of a new cooperation agreement with the United States is a particularly challenging task. This new agreement needs to be a fair agreement between equal partners. The agreement should not strengthen bilateral controls and extend national legislation unilaterally to international agreements as this would adversely effect the Community interests and would be detrimental to the strengthening of the international non-proliferation regime.

156. Concerning the cooperation with and support to CIS and PECO in the safeguards field (Please refer to Chapter VII of the report) it is expected that these activities will require a dramatically increasing attention and effort of DCS due to the extreme political importance of both the safeguarding of the nuclear materials transferred from the weapons programmes to the civil cycle as well as of the basic safeguarding of the nuclear installations in these countries.

157. The strengthening of the international non - proliferation regime requires a contribution from the Euratom Safeguards Directorate in two aspects:

a) To participate in the deliberations to implement Community policy, i.e. to have the Non Proliferation Treaty extended in 1995 unconditionally.

b) To implement certain measures intended to strengthen international (IAEA) safeguards. These measures include the implementation of or contributions to the universal reporting, environmental monitoring and sampling techniques, early design information and other measures.

IX. SUMMARY

158. The effectiveness of Euratom safeguards operation depends as outlined in this report on the manner in which the inspection service is organised and motivated, on the promptness and the extent to which operators and Member State authorities fulfil their responsibilities and on the resources made available to the Commission.

159. Relating to the mandate, the intensity and depth of Euratom safeguards, the Commission has been entrusted with extensive responsibilities. However, the budgetary and manpower appropriations made available largely determine the discharge of these responsibilities as well as the ability to make progress in the way indicated in this report.

160. As the use of recycled plutonium has now reached routine commercial application, Euratom safeguards continues to give the necessary priority to the control of the large plutonium fuel cycle facilities. The necessary human and financial resources have been determined for these plants and need to be available and made operational.

161. The tasks of Euratom safeguards continue further to increase within and beyond the scope provided for in the Treaty. This relates, notably, to the contributions as a regional safeguards system to world wide non-proliferation safeguards, to the negotiations of a new cooperation agreement with the United States and to the cooperation with and support to the states of the former Soviet Union in the safeguards field.

ANNEX 1

EURATOM SAFEGUARDS

Glossary of abbreviations currently used in Safeguards

AGR	Advanced Gaz-cooled Reactor
AECB	Atomic Energy Control Board (Canada)
AERE	Atomic Energy Research Establishment (Harwell)
AIEA	Agence Internationale de l'Energie Atomique (see IAEA)
AQG	Atomic Questions Group (see GQA)
ARIE 1	Actual Routine Inspection Effort (for Euratom)
ARIE 2	Actual Routine Inspection Effort (for IAEA)
ASO	Australian Safeguards Office
AWCC	Active Well Coincidence Counter
BCMN	Bureau Central de Mesures Nucléaires (see CBNM) (Geel Belgium)
BHF	Bulk Handling Facility
BMFT	Bundesministerium für Forschung und Technologie
BNFplc	Brith Nuclear Fuels plc
BSAM	Brookhaven Stablized Assay Meter
BTC	Basic Technical Characteristics (see CTF)
BWR	Boiling Water Reactor
CAM	Catch-all MBA (=Very small installations)
CBNM	Central Bureau for Nuclear Measurements (Geel Belgium)
CCAM	Commission Consultative des Achats et de Marchés
CCR	Centre Commun de Recherche (see JRC)
CCTV	Closed Circuit Television
CEA	Commissariat à l'Energie Atomique
CERT	Comité Energie, Recherche et Technologie du P.E.
CMF	Comptabilité Matières Fissiles
COPO	Coopération Politique
COREPER	Comité des Représentants Permanents
CRP	= COREPER
C/S	Containment and Surveillance
CTC	Communication to Council
CTF	Caractéristiques Techniques Fondamentales (see BTC)
CTI	Comité Technique Interministériel pour l'Euratom
CVD	Cerenkov Viewing Device
DA	Destructive Analysis (see also NDA)
DCS	Direction Contrôle de Sécurité (see ESD)
DGM	Director General Meeting
DI	Design Information
DOE	Department of Energy (UK)
DPC	Dispositions Particulières de Contrôle (see PSP)
DUCA	Determination of Uranium 235 Content Apparatus
ECSAM	European Commission Safeguards Analytical Measurement Committee
EDAN	Etat doté d'Armements Nucléaires (see NWS)
EDF	Electricité de France
eKg	Effective Kilogram
ENDAN	Etat Non-Doté d'Armements Nucléaires (see NNWS)

ENEA	Comitato Nazionale per l'Energia Nucleare e l'Energia Alternativa
EP	European Parliament
ESA	Euratom Supply Agency (see SA)
ESARDA	European Safeguards Research and Development Association
ESD	Euratom Safeguards Directorate (see DCS)
ESP	Etat des Stocks Physiques (see PIL)
EUR	Euratom
FA	Facility Attachment
FANT	Facility Attachments Negotiating Teams
FBOM	Follow-up and Balancing Of Mixes
FBR	Fast Breeder Reactor
GFK	Gesellschaft für Kernforschung mbh (Karlsruhe)
GQA	Groupe des Questions Atomiques (see AQG)
HEU	Highly Enriched Uranium
HLLC	High Level Liaison Committee (Art. 25 Protocol VA)
HLNCC	High Level Neutron Coincidence Counter
HSP	Hexapartite Safeguards Project
IAEA	International Atomic Energy Agency (see AIEA)
IAEO	Internationale Atomenergie-Organisation (see IAEA)
ICR	Inventory Change Report (see RVS)
ICT	Isotopic Correlation Technique
IMD	Inspector Mission Day
IMS	Integrated Monitoring System
INMM	Institute of Nuclear Materials Management (USA)
IPSN	Institut de Protection et de Sûreté Nucléaire, Fontenay-aux-Roses
ISM	- Inter-Service Meeting - Informatics Systems Manager
JRC	Joint Research Centre (see CCR)
JT	Joint Team
JTWG	Joint Technical Working Group
KFA	Kernforschungsanlage Jülich
KMP	Key Measurement Point (see PMP)
LASL	Los Alamos Scientific Lab (USA)
LEMUF	Limits of Error of MUF
LEU	Low Enriched Uranium
LFUA	Limited Frequency Unannounced Access
LII	List of Inventory Items (see LOI)
LOI	Liste des Objets en Inventaire (see LII
LLLC	Lower Level Liaison Committee (Art. 25 Protocol VA)
LOF	Location Outside Facility (Holding less than 1 eKg)
LOVER	LOcal VERification
LWR	Light Water Reactor
MBA	Material Balance Area (see ZBM)
MBP	Material Balance Period
MBR	Material Balance Report (see RBM)
MD	Man-day(s)
MDC	Material Description Code
MEB	Multi Element Bottle
MIS	Management Information System
MOX	Mixed Oxide
MTR	Material Testing Reactor
MUF	Material unaccounted For

NCC	Neutron Coincidence Collar
NDA	Non Destructive Analysis (see also DA)
NM	Nuclear Material
NMACT	Nuclear Material Accounting Control Team (UK)
NMTR	Nuclear Material Transfert Report
NNPA	Nuclear Non-Proliferation Act
NNWS	Non-Nuclear Weapon State (see ENDAN)
NPA	New Partnership Approach
NPT	Non-Proliferation Treaty (see TNP)
NRTA	Near Real Time Accountancy
NUMSAS	Nuclear Material Statistical Accountancy System
NVD	Night Vision Device
NWS	Nuclear Weapon State (see EDAN)
OJOM	One Job-One Man
OTTO (list)	Other Than Through Observation
PE	Parlement Européen (see EP)
PICF	Physical Inventory Control and Follow-up
PIL	Physical Inventory Listing
PIT	Physical Inventory Taking
PIV	Physical Inventory Verification
PMP	Point de Mesure Principal (see KMP)
PSEP	Particular Safeguards Evaluation Procedures
PSP	Particular Safeguards Provisions (see DPC)
PSU	Portable Surveillance Unit
PWR	Pressurized Water Reactor
RBM	Rapport de Bilan Matières (see MBR)
RCD	Réunion des Chefs de Division
R&D	Research and Development
RFS	Rapid Feedback System
RM	Reference Material
RMS	Resource Management System
RRCS	Rapport sur les Réalisations du Contrôle de Sécurité
RVS	Rapport de Variation de Stocks (see ICR)
SA	-Supply Agency (see EAS) -Subsidiary Arrangements
SAGSI	Standing Advisory Group for Safeguards Implementation
SAM	Stabilized Assay Meter
SEAM	Safeguards Effectiveness Assessment Methodology
SGHWR	Steam Generating Heavy Water Reactor
SIC	Summary Inventory Changes
SICDB	Safeguards Information centre Data Base (ADABAS data base)
SIR	Safeguards Implementation Report (IAEA)
SMS	Safeguards Management System
SOM	Senior Officers Meeting
SP	Strategic Point
SPI	Summary Physical Inventory
SQ	Significant Quantity
SRD	Shipper/Receiver Difference
SSAC	State System of Accountancy and Control
THTR	Thorium Hochtemperatur Reaktor
TLD	Thermoluminescence Dosimetry
TNP	Traité de Non-Prolifération (see NPT)
TO (list)	Through Observation (see also OTTO)
UFBR	Universal Fast Breeder Reactor Counter
UKAEA	United Kingdom Atomic Energy Authority
VA	Verification Agreement(s)

VDC	Variable Dead-time Counter
WGAR	Working Group on Accountancy and Reporting
WGGC	Working Group on inspection Goals and acceptance Criteria
WPDE	Working Party on Data Evaluation
WPIA	Working Party on Informatics and Accountancy
WPIP	Working Party on Planning of Inspections
WPIT	Working Party on Instruments and Techniques
WPSA	Working Party on Safeguards Approaches
WWTP	Working Party on Working conditions, Training and Procedures
ZBM	Zone de Bilan Matière (see MBA)

CHAPTER VII

SAFEGUARDS

Article 77

In accordance with the provisions of this Chapter, the Commission shall satisfy itself that, in the territories of Member States,

(a) ores, source materials and special fissile materials are not diverted from their intended uses as declared by the users;

(b) the provisions relating to supply and any particular safeguarding obligations assumed by the Community under an agreement concluded with a third State or an international organisation are complied with.

Article 78

Anyone setting up or operating an installation for the production, separation or other use of source materials or special fissile materials or for the processing of irradiated nuclear fuels shall declare to the Commission the basic technical characteristics of the installations, to the extent that knowledge of these characteristics is necessary for the attainment of the objectives set out in Article 77.

The Commission must approve the techniques to be used for the chemical processing of irradiated materials, to the extent necessary to attain the objectives set out in Article 77.

Article 79

The Commission shall require that operating records be kept and produced in order to permit accounting for ores, source materials and special fissile materials used or produced. The same requirement shall apply in the case of the transport of source materials and special fissile materials.

Those subject to such requirements shall notify the authorities of the Member State concerned of any communications they make to the Commission pursuant to Article 78 and to the first paragraph of this Article.

The nature and the extent of the requirements referred to in the first paragraph of this Article shall be defined in a regulation made by the Commission and approved by the Council.

Article 80

The Commission may require that any excess special fissile materials recovered or obtained as by-products and not actually being used or ready for use shall be deposited with the Agency or in other stores which are or can be supervised by the Commission.

Special fissile materials deposited in this way must be returned forthwith to those concerned at their request.

Article 81

The Commission may send inspectors into the territories of Member States. Before sending an inspector on his first assignment in the territory of a Member State, the Commission shall consult the State concerned; such consultation shall suffice to cover all future assignments of this inspector.

On presentation of a document establishing their authority, inspectors shall at all times have access to all places and data and to all persons who, by reason of their occupation, deal with materials, equipment or installations subject to the safeguards provided for in this Chapter, to the extent necessary in order to apply such safeguards to ores, source materials and special fissile materials and to ensure compliance with the provisions of Article 77. Should the State concerned so request, inspectors appointed by the Commission shall be accompanied by representatives of the authorities of that State; however, the inspectors shall not thereby be delayed or otherwise impeded in the performance of their duties.

If the carrying out of an inspection is opposed, the Commission shall apply to the President of the Court of Justice for an order to ensure that the inspection be carried out compulsorily. The President of the Court of Justice shall give a decision within three days.

If there is danger in delay, the Commission may itself issue a written order, in the form of a decision, to proceed with the inspection. This order shall be submitted without delay to the President of the Court of Justice for subsequent approval.

After the order or decision has been issued, the authorities of the State concerned shall ensure that the inspectors have access to the places specified in the order or decision.

Article 82

Inspectors shall be recruited by the Commission.

They shall be responsible for obtaining and verifying the records referred to in Article 79. They shall report any infringement to the Commission.

The Commission may issue a directive calling upon the Member State concerned to take, by a time limit set by the Commission, all measures necessary to bring such infringement to an end; it shall inform the Council thereof.

If the Member State does not comply with the Commission directive by the time limit set, the Commission or any Member State concerned may, in derogation from Articles 141 and 142, refer the matter to the Court of Justice direct.

Article 83

1. In the event of an infringement on the part of persons or undertakings of the obligations imposed on them by this Chapter, the Commission may impose sanctions on such persons or undertakings.

These sanctions shall be, in order of severity:

(a) a warning;

(b) the withdrawal of special benefits such as financial or technical assistance;

(c) the placing of the undertaking for a period not exceeding four months under the administration of a person or board appointed by common accord of the Commission and the State having jurisdiction over the undertaking;

(d) total or partial withdrawal of source materials or special fissile materials.

2. Decisions taken by the Commission in implementation of paragraph 1 and requiring the surrender of materials shall be enforceable. They may be enforced in the territories of Member States in accordance with Article 164.

By way of derogation from Article 157, appeals brought before the Court of Justice against decisions of the Commission which impose any of the sanctions provided for in paragraph 1 shall have suspensory effect. The Court of Justice may, however, on application by the Commission or by any Member State concerned, order that the decision be enforced forthwith.

There shall be an appropriate legal procedure to ensure the protection of interests that have been prejudiced.

3. The Commission may make any recommendations to Member States concerning laws or regulations which are designed to ensure compliance in their territories with the obligations arising under this Chapter.

4. Member States shall ensure that sanctions are enforced and, where necessary, that the infringements are remedied by those committing them.

Article 84

In the application of the safeguards, no discrimination shall be made on grounds of the use for which ores, source materials and special fissile materials are intended.

The scope of and procedure for the safeguards and the powers of the bodies responsible for their application shall be confined to the attainment of the objectives set out in this Chapter.

The Safeguards may not extend to materials intended to meet defence requirements which are in the course of being specially processed for this purpose or which, after being so processed, ar in accordance with an operational plan, placed or stored in military establishment.

Article 85

Where new circumstances so require, the procedures for applyi the safeguards laid down in this Chapter may, at the request of Member State or of the Commission, be adapted by the Counci acting unanimously on a proposal from the Commission and aft consulting the Assembly. The Commission shall examine any suc request made by a Member State.