VERIFICATION MATTERS

Verifying the Non-Proliferation Treaty

Challenges for the 1990s

Owen Greene

November 1992

Foreword

International confidence in the Non-Proliferation Treaty's safeguards system was dealt a severe blow by the belated discovery of Iraq's clandestine nuclear weapons programme. The credibility of the present verification system associated with the NPT is low, a fact which could further undermine the treaty regime unless it is corrected.

This new VERTIC Report examines the weaknesses of existing safeguards and proposals for reform to reduce the risk of proliferation from activities at both declared and clandestine facilities. It also discusses the challenges for verification posed by ex-nuclear states that inherently pose special proliferation risks, and by the spread of nuclear materials and sensitive technologies. It proposes a range of measures that, taken together, would greatly improve the reliability of the NPT verification regime in the 1990s, and argues against some proposals that have recently gained some credence. So far, progress towards meeting the challenges of verifying the non-proliferation treaty in the 1990s has been painfully slow.

The Report was written by Owen Greene, a member of VERTIC's Oversight and Advisory Board and Lecturer in International Relations and Security Studies at the Department of Peace Studies, University of Bradford. I am immensely grateful to him for taking over this project at short notice when I was finally persuaded to be realistic about the effect pregnancy and childbirth has on a Director's energy levels! Deep gratitude also goes to Philip McNab, VERTIC's Administrator, for his tenacity and expertise in getting the report produced.

VERTIC owes a great debt to the Ploughshares Fund (San Francisco) for initiating and funding this project and for their patience during its production.

Verifying the Non-Proliferation Treaty aims both to stimulate and inform an important policy debate. The findings in this document deserve serious consideration – and action within the near future. Nuclear proliferation is a constant source of concern in the world today. In order to halt the spread of nuclear weapons, the Nuclear Non-Proliferation Treaty and its verification regime need urgent strengthening. This report identifies how that can be achieved.

Dr Patricia M. Lewis
Director, VERTIC
London, November 1992

Acknowledgement

The author gratefully acknowledges the invaluable comments of Ian Bellany, David Fischer, John Simpson and John Walker, but – as always – takes full responsibility for any remaining omissions and errors. He would also like to thank Patricia Lewis, Philip McNab and Kim Tay for their critical roles in the production and launch of the report, and indeed in stimulating him to write it.

CONTENTS

1 Introduction 1

2 The IAEA safeguards system 4

2.1 Introduction 4

2.2 The existing IAEA/NPT safeguards system 5

2.3 Strengthening safeguards on declared activities 12

Design information on new facilities 13

Improved transparency and universal reporting 14

Increasing inspection frequency 15

Refocusing the inspection effort 17

Devolving responsibility for safeguards 19

Surprise inspections and an enhanced IAEA/NPT safeguards regime 21

Reforming IAEA 'culture' 22

Participation of nuclear-weapon states 24

3 Special IAEA inspections at undeclared sites 25

3.1 Introduction 25

3.2 Access to information 27

3.3 Carrying-out special inspections at undeclared facilities 29

3.4 The UN Security Council and the Special Inspection Regime 31

3.5 The role of special inspections 32

4 Extending the regime to strengthen the NPT verification system 35

4.1 Introduction 35

4.2 Safeguarding 'ex-nuclear' states 35

4.3 Restrictions on 'sensitive' materials and facilities 38

5 Nuclear Export Controls and the safeguards system 46

6 Conclusions 49

6.1 Building Confidence 49

Deficiencies in current safeguards 50

Inappropriate methodologies 51

Lack of resources 51

Political will 52

6.3 Structure of the Verification Regime 52

Concerns of developing states 52

Involvement of UN Security Council 53

7 Proposals For Action 55
The overall approach 55
Safeguards at declared sites 55
Priorities for further strengthening 56
Undeclared facilities 56
Special inspections 57
Establish an 'enhanced' full-scope safeguards system 58
Increasing and refocusing safeguards resources 59
Reforming IAEA culture 59
Increased acceptance by nuclear weapon states of safeguards on civil facilities 60
Ex-threshold' or 'transitional' states 60
Closing loopholes 61
7.1 Strengthening long-term commitment to the NPT after the Cold War 62

1 Introduction

The nuclear non-proliferation regime has evolved rapidly since 1990. In several respects, the regime has been greatly strengthened. France and China have recently become parties to the Non-Proliferation Treaty (NPT), making all declared nuclear-weapons states – and all the permanent members of the UN Security Council – full members of the regime. In early 1992, the UN Security Council for the first time declared that the proliferation of weapons of mass destruction poses a 'threat to international peace and security'. Under Chapter VII of the UN Charter, this would legitimise future sanctions or military action by the Security Council against states guilty of such proliferation.

France, Germany and other West European states have belatedly tightened their nuclear export controls considerably, allowing the Nuclear Suppliers Group to strengthen and extend multilateral export controls, and particularly to insist on full-scope safeguards as a condition for the supply of sensitive technologies. Several 'threshold' states – Argentina, Brazil and South Africa – have taken steps to renounce nuclear arms by joining the NPT or accepting full-scope safeguards. North Korea has recently engaged in negotiations for a safeguards agreement, after several years' delay. Russia has succeeded to the NPT as the successor state to the USSR, and nearly all of the other states of the former Soviet Union have promised to join the NPT as non-nuclear-weapon states. The USA and Russia are committed to substantial nuclear disarmament programmes, thus building international confidence in their compliance with Article VI of the NPT.

By November 1992, there were 155 parties to the NPT. Several more are expected to join shortly, making the treaty the most widely supported of its type. Concerns about covert nuclear weapon programmes in some non-parties to the NPT – such as India, Pakistan, and Israel – remain intense. There is wide agreement that international measures to limit and reverse such programmes need to be maintained and intensified. However, progress towards these objectives may be slow: indigenous capacities in these states are now sufficiently developed that export controls can have only a limited effect, and the regional insecurities and ambitions underlying their nuclear programmes seem intractable in the short term. Instead, international attention has increasingly focused on the problems of ensuring that NPT states themselves comply with the non-proliferation regime.

Iraq ratified the NPT in 1969 and since the early 1970s has accepted 'full-scope' International Atomic Energy Agency (IAEA) safeguards. The fact that it was able to pursue a substantial covert programme to develop nuclear weapons for over a decade without even attracting adverse reports from the IAEA or any major NPT member state has exposed the limitations of the NPT verification system. Even at the end of 1990, a senior IAEA official publicly affirmed that he was entirely satisfied with Iraqi co-operation and compliance with IAEA safeguards. If Iraq had not invaded Kuwait in 1990 and subsequently become a defeated pariah state

subject to UN Security Council Resolution 687, there are real doubts whether the verification system would have exposed the nuclear programme before Iraq had been able to build a nuclear weapon (sometime after 1993, according to the information now available).

Up to now, weaknesses in the IAEA safeguards system have often been excused with the argument that a state would not sign the NPT if it intended to develop nuclear weapons. Thus the safeguards system has, in large measure, evolved as a confidence-building regime: it has not, in practice, been developed to detect reliably covert nuclear weapons programmes. Moreover, it was initially designed primarily to safeguard nuclear facilities in developed states, particularly Japan and Germany, and the IAEA still devotes over 70% of its safeguards budget to inspections in Western and Central Europe, Canada and Japan. Arguably, these are not today the regions of the world where the need for verification of compliance with the NPT is greatest.

Clearly safeguards and export controls are not sufficient by themselves to prevent the spread of nuclear weapons. The key objective is to universalise adherence to the NPT and the principle of non-proliferation, and to consolidate states' political commitment to non-nuclear security policies. If a state is determined to build nuclear weapons and is willing to bear the great political and economic costs of doing so, safeguards and export controls can only slow them down. The gradual diffusion of nuclear technologies and 'know-how' reduces the technical obstacles to constructing a crude nuclear bomb. Nevertheless it is important to raise obstacles to the acquisition of nuclear weapons as high as possible, to buy time for broader regime-building.

Lack of confidence in IAEA full-scope safeguards would be serious: it could not only undermine the NPT regime, but also the effectiveness of recently strengthened export controls. There is now wide agreement that the IAEA/NPT safeguards regime should be reformed and strengthened. However, recent developments have not only highlighted limitations in IAEA/NPT safeguards. The NPT verification and compliance regime also involves intelligence collection and action by NPT member states, the UN Security Council and some regional organisations, and is closely linked to the implementation of multilateral export controls. Inadequacies in this broader verification regime must also now be addressed.

The reform process has already begun; but progress has so far been limited and slow, and a number of key issues remain unresolved. This report aims to examine the challenges confronting the NPT verification regime in the 1990s and to discuss proposals for meeting them. The next chapter examines IAEA full-scope safeguards, recent reforms, and priorities for the further development of the IAEA verification system for declared facilities. Chapter 3 discusses the prospects for establishing an effective 'special' inspection regime, designed to investigate

suspicions of undeclared nuclear facilities. Chapter 4 examines the particular challenges to the NPT verification regime posed by 'ex-nuclear states' and the possession of fissile material stockpiles and sensitive technologies, and the ways in which the regime might be extended to improve verifiability. Chapter 5 examines the relationship between the strengthening of multilateral export controls and the verification system. The sixth chapter summarises the main conclusions and Chapter 7 puts forward proposals for the overall strengthening of the non-proliferation regime in the next few years.

2 The IAEA safeguards system

2.1 Introduction

The International Atomic Energy Agency (IAEA) was established in 1957. Although it is part of the general UN system, it is an independent international organisation governed by its own General Conference, Board of Governors, and Director General. It was created as an integral part of the efforts to realise the [US Eisenhower Administration's] Atoms for Peace policy,[1] as is reflected in the objectives set out in Article II of its statute:

> 'The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose'[2]

Thus, from the beginning it had two principal roles: to promote the peaceful uses of nuclear energy in member states, and to apply 'safeguards' – a system of accounting and inspection procedures – to peaceful nuclear activities to provide assurance that they did not serve military purposes. It also had a role in promoting nuclear safety.

At first, the role of promoting nuclear technology and nuclear energy took precedence, with the safeguards system designed to improve conditions for international nuclear trade by building confidence that such trade would not contribute to nuclear proliferation. From the early 1960s, increasing emphasis was given to the role of safeguards in deterring or providing timely warning of nuclear proliferation. The first substantial safeguards system was adopted in 1964-6 (defined in IAEA document INFCIRC/66): this system still forms the basis for the INFCIRC/66 rev 2 IAEA safeguards on facilities in states such as India that do not accept 'full-scope' safeguards.

The IAEA's verification role developed substantially after the Non-Proliferation Treaty (NPT) came into force in 1970. The treaty obliged all parties to ensure that IAEA INFCIRC/66 safeguards were applied to their nuclear exports to non-nuclear-weapon NPT states, and also obliged all parties that were non-nuclear-weapon states to place all of their nuclear activities under a new IAEA/NPT safe-

---

1. H. Blix, Director General of the IAEA, Statement to the Thirty-Sixth Session of the General Conference of the International Atomic Energy Agency, IAEA, 21st September, 1992.

2. Statute of the International Atomic Energy Agency, Article II, as reproduced, for example, in D. Howlett and J. Simpson (eds), Nuclear Non-Proliferation: a reference handbook, Longman, 1992, p. 143.

guards system. In 1971, the IAEA established a model 'full-scope' safeguards agreement for this latter purpose, defined in IAEA document INFCIRC/153. On the basis of this document, each non-nuclear-weapon state party to the NPT must conclude a detailed safeguards agreement with the IAEA appropriate to its particular nuclear activities.

Thus the verification organisation for the NPT is different from that of most other arms control treaties. Typically, such treaties establish their own verification system, and if a verification organisation is set up it is designed specifically for the new arms control regime. This will, for example, be the case for the forthcoming Chemical Weapons Convention. In contrast, the NPT made use of an already established organisation, and moreover one which had other roles besides verification. Membership of the IAEA did not (and still does not) coincide with membership of the NPT. Indeed, during most of its operation since 1970, several prominent members of the IAEA's powerful Board of Governors refused to sign the NPT: India, Pakistan, China, France, Brazil, Argentina and South Africa were examples of such states. Indeed, some of these states were sharply critical of the treaty. Further, since the IAEA is tasked both to promote the spread of nuclear technology and to prevent proliferation, there was from the beginning a built-in conflict of interest.

In some ways, the use of the IAEA for verification facilitated the implementation of the NPT. As an established organisation with experience in safeguards, it already had some appropriate expertise. Its already wide membership made it possible to conclude many INFCIRC/153 safeguards agreements relatively rapidly. The IAEA's technical assistance programme, helping with the application of nuclear technologies in the areas of energy, health, agriculture and basic research, provided an incentive for developing states to accept safeguards. For many developing states, such technical assistance was the quid pro quo for accepting a discriminatory treaty in which they were forbidden to develop nuclear weapons while existing nuclear weapons states were allowed to continue with their weapons programmes.

Nevertheless, from the 1970s many analysts expressed doubts about the adequacy of the IAEA safeguards system. Pressure for major reforms grew throughout the 1980s. After the revelations about the Iraqi nuclear weapons programme, these pressures have become intense. In order to examine and assess proposals for reform, it is necessary first to outline the existing INFCIRC/153 safeguards system.

2.2 The existing IAEA/NPT safeguards system

Under the NPT, the IAEA's mandate for safeguarding facilities in non-nuclear-weapon NPT states is as follows:

'Each non-nuclear State Party to the Treaty undertakes to accept safeguards...for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this Article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal facility or is outside any such facility. The safeguards required by this Article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere'.[3]

The phrase 'preventing diversion of nuclear energy' is unclear, whereas the reference to 'source or special nuclear materials' is more specific. Thus, INFCIRC/153 limited the application of safeguards to fissile materials (particularly enriched uranium and plutonium) and their precursors ('source material'). Unlike the INFCIRC/66 rev 2 system, nuclear technologies or facilities are not in themselves subject to safeguards. The agreement specifies that safeguards are for the 'exclusive purpose of verifying that such [source or special] material is not diverted to nuclear weapons or other nuclear explosive devices'.[4]

The objective of INFCIRC/153 safeguards is 'the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection'.[5] However, there is an obligation on the IAEA that safeguards should be implemented 'in a manner designed: to avoid hampering...international co-operation in the field of peaceful nuclear activities, including the exchange of nuclear material; to avoid undue interference in the State's peaceful nuclear activities, and in particular the operation of facilities'[6]; and also to 'protect commercial and industrial secrets and other confidential information coming to its knowledge in the implementation of the Agreement'.[7]

During the negotiations to establish the INFCIRC/153 system, developed non-nuclear-weapon states were determined to limit the extent to which safeguards imposed burdens on them that would not be imposed on nuclear-weapons states

---

3. Treaty on the Non-Proliferation of Nuclear Weapons, Article III.1.

4. IAEA Information Circular No. 153 (INFCIRC/153), The structure and content of agreements between the Agency and States required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, paragraph 2.

5. Ibid, Paragraph 28.

6. Ibid Paragraph 4.

7. Ibid Paragraph 5; see also constraints on inspections in paragraphs 76, 78-80, 87-88.

such the United States and the United Kingdom. States such as Germany and Japan were particularly concerned that intrusive inspections could reveal commercial secrets and place them at a disadvantage to their competitors in the nuclear-weapon states. Thus it was decided that safeguards should impose as light a burden on the operators of nuclear facilities as possible.[8]

Thus safeguards were applied only to the flow of special nuclear materials, which was to be measured only at 'strategic points' in a nuclear plant. As far as possible, such measurements were to be made by instruments rather than human inspection, to minimise the intrusiveness, frequency and intensity of IAEA inspections. Guidelines were developed to set agreed upper limits to the number of 'man-days' inspectors could spend each year at each type or size of facility (known as 'maximum routine inspection effort' (MRIE). Sometimes an 'actual routine inspection effort' (ARIE) was also agreed. In practice, IAEA inspections have not typically reached their MRIE, and some states have insisted that the ARIE figures constitute the real maximum.[9] This practice began at the insistence of West European states and Japan, but now extends to many other states.[10]

Significant constraints have also been imposed in INFCIRC/153 agreements as to what an inspector can or cannot do during an inspection. Furthermore, some states have imposed delays on inspections using visa and other restrictions, and states' mandatory reports to the IAEA are frequently submitted late. Restrictions on the nationality of inspectors have further limited the efficiency of the IAEA – for example, Iraq tended to reject inspectors from OECD states during the 1980s.

Within these constraints, the INFCIRC/153 system aims to account as accurately as possible for all nuclear materials under safeguards. This material accountancy system is based on 'material balance areas' (MBAs): areas chosen so that all nuclear materials entering or leaving them are measurable and in which the inventory of the material on hand can be determined.[11] Typically these are distinct plants or parts of plants, within which strategic points for actual measurements are identified. Each month, managers for each facility report to the IAEA, via their national authorities, on all receipts, production, shipments or other changes in the inventory of nuclear materials in each MBA. Using these data, the IAEA maintains a book inventory for each such area. Inspectors periodically

---

8. D. Fischer, Stopping the spread of nuclear weapons: the past and the prospects, Routledge, London, 1992, Chapter 5.

9. J. Keeley, "The International Atomic Energy Agency and the Non-Proliferation Treaty", in E. Morris (ed), International Verification Organisations, Centre for International and Strategic Studies, York University, Canada, 1991.

10. D. Fischer and P. Szasz, Safeguarding the Atom: a critical appraisal, SIPRI/Taylor & Francis, 1985, p. 61.

11. D. Fischer and P. Szasz, Safeguarding the atom, ibid; B. Sanders, "IAEA Safeguards: a short historical background", in D. Fischer et al, A New Nuclear Triad: the non-proliferation of nuclear weapons, international verification and the International Atomic Energy Agency, PPNN Study No. 3, Southampton University, 1992.

check that these reports tally with the plants' own records, and verify physical inventories taken by the facility operators. Inspections are supplemented by containment and surveillance measures, such as cameras, video systems and tamper-proof seals. Taking the previous verified inventory as a starting point, the book inventory is compared to the actual stock determined by the physical inventory. Discrepancies are known as material unaccounted for (or MUF). If these are deemed significant, explanations or further investigations are required.

One consequence of this system of material accountancy is that the safeguards system is facility-oriented.[12] According to the guidelines associated with INFCIRC/153, it is the amount of nuclear material in each 'material balance area' that determines the 'maximum routine inspection effort' and not the overall amount of material within a state. Thus, for example, if a state has enough separated nuclear material to make a nuclear weapon, the material was inspected at least once a month if it is all at one MBA. If, however, it was divided roughly equally between two MBAs, inspections only occurred once or twice a year at each facility. A similar anomaly accounts for the fact that some 45kg of safeguarded highly-enriched uranium in Iraq was effectively only inspected once every six months before 1991.

The safeguards system does not prohibit non-nuclear-weapon NPT states from possessing enough weapons-grade plutonium or uranium to build nuclear weapons. It is for the states themselves to define what materials are appropriate for their 'peaceful' nuclear programme. It is sufficient for them to declare such materials and allow routine inspections. Ryukichi Imai, ex-Ambassador for Japan at the Conference on Disarmament, has recently outlined a hypothetical scenario indicating some of the problems this theoretically raises;

> 'Suppose an inspector observes a large number of plutonium metal hemispheres being machined under the pretext that they are new and commercially secret breeder reactor fuel. The material balance of plutonium shows nothing wrong or missing (that is, no diversion) and the inspector is not at liberty to disclose information about commercially sensitive technologies, therefore the inspector has nothing to report to headquarters. He also observes that next door to the plutonium plant is a large workshop where people are building high-explosive lenses. The inspector becomes very suspicious; but has no basis for airing any concerns because high explosives are not nuclear material, and he is prohibited from mentioning any non-nuclear commercial activities he may by chance have observed.'[13]

---

12. D. Fischer, "The International Atomic Energy Authority and Nuclear Safeguards", in D. Howlett & J. Simpson (eds), op cit -see note 1, pp. 37-44.

13. R. Imai, "NPT safeguards today and tomorrow", Disarmament (United Nations Periodic Review), Vol XV, No 2, 1992, pp. 47-57.

In practice, IAEA inspectors would not interpret the inspection guidelines so rigidly: in this example a report would surely be made. Nevertheless, if a state kept two 4kg quantities of safeguarded Plutonium at different facilities, they might each be inspected only once every 6–12 months. In the time between inspections, the plutonium could be machined and brought together within a device to produce a nuclear weapon. This is a hypothetical situation, but it indicates some of the shortcomings of a 'facility-oriented' safeguards system that focuses solely on verifying that significant quantities of nuclear materials have not been diverted, while placing no restrictions or safeguards on other facilities or activities that would be closely associated with a nuclear weapons programme.

Moreover, the IAEA applies safeguards to nuclear materials in a plant only after the state concerned declares the plant to be a 'facility' within the INFCIRC/153 definition, and provides information on it. No data needs to be provided on nuclear research installations that contain less than 1 'effective kilogram' of nuclear material.[14] Thus (until very recently) the safeguards system permitted a state not to provide any information on a laboratory or pilot plant developing reprocessing or enrichment methods where equipment is tested with non-nuclear materials.[15]

Further, INFCIRC/153 only requires that information on new nuclear facilities shall be provided 'as early as possible' before nuclear material is introduced into the facility. As a result of an over-permissive judgement by an IAEA legal officer in the early 1970s, this has been interpreted in subsidiary agreements made with inspected states before late 1991 to mean that information should normally be provided no less than 180 days before the introduction of nuclear materials. However, even this interpretation is by no means universal: in practice some states have not provided relevant data until just before the facility went into operation. The IAEA has no right to delay operations in order to study the design information and establish appropriate safeguards. Still less has it the right to insist that nuclear plants are designed to facilitate reliable safeguards. It is noteworthy in this context that Iraq was not in breach of its safeguards agreement for failing to inform the IAEA of its Electromagnetic Isotope Separation plant (which was discovered by UN Special Commission inspectors).

If the state does not inform the IAEA about an operating nuclear facility containing notifiable quantities of nuclear materials, then it is breaching its obligations under INFCIRC/153. However, in practice the IAEA has only been able to make enquiries about or inspect facilities that have been officially declared by the state concerned. It relies solely on information supplied by the state or on information collected by inspectors in the course of INFCIRC/153 inspections, or provided by

14. INFCIRC/153, op cit (see note 4), paragraph 106.
15. As discussed, for example, by B. Sanders, op cit (see note 11), p. 4.

nuclear suppliers. The IAEA's Board of Governors has traditionally insisted that the Agency should not establish (official) procedures for gathering or assessing information supplied by third parties (such as press reports, 'whistleblowers' or national intelligence reports). Thus in practice the NPT safeguards system has only applied to declared facilities.

IAEA safeguards are designed in principle to assure the detection of the loss of a 'significant quantity' of nuclear material from a safeguarded peaceful nuclear facility within a 'conversion time' so that authorities can be alerted before diverted materials can be made into a weapon. The task of quantifying these objectives was delegated to the Standing Advisory Group on Safeguards Implementation (SAGSI) – an advisory group of technical safeguards experts.[16] In 1977, SAGSI submitted numerical estimates of 'significant quantities' and 'conversion time' to the IAEA's Director of Safeguards.

A 'significant quantity' (SQ) was estimated as the amount of material that a 'beginner' state would require for its first nuclear explosive. It was provisionally set at 8kg for plutonium, 25kg for highly-enriched uranium (HEU – more than 20% U-235), 75kg of low-enriched uranium (LEU), and 8kg of Uranium 233. The 'conversion time' was set at 7–10 days for plutonium or HEU, 1–3 weeks for pure unirradiated oxides or nitrates of these materials, 1–3 months for plutonium in spent fuel, and about one year for low-enriched or natural uranium. SAGSI suggested that a provisional guideline for effective safeguards would be a 90–95% probability that diversion of a significant quantity of nuclear material would be detected within the conversion time, with a false-alarm probability of less than 5%.

These SQ values look high today: they were based on a 1967 UN report, and modern weapons techniques apparently allow nuclear weapons warheads using up to 50% less nuclear materials than the SQs quoted above.[17] With the development and diffusion of technology and 'know-how' since 1967, a number of non-nuclear weapons states may potentially be able to make a nuclear warhead using less material than assumed in the original UN report. However, even if the current SQs and SAGSI guidelines are accepted, there is considerable scepticism about whether current IAEA safeguards meet them.

A major source of concern relates to plutonium in reprocessing and fuel fabrication plants and uranium in fabrication and enrichment plants, where there are

16. See, for example, M. Miller, Are IAEA safeguards on plutonium bulk-handling facilities effective?, Nuclear Control Institute, Washington DC, 1990; see also R. Bolt, "Plutonium for all: leaks in global safeguards", Bulletin of the Atomic Scientists, December 1988, pp. 14-19.

17. D. Fischer, "Innovations in IAEA Safeguards to meet the challenges", in D. Fischer et al, The New Nuclear Triad, op cit, p. 39.

intrinsic uncertainties in the amounts of nuclear materials at the plant.[18] Thus, in a large plant, material balance calculations will often indicate non-zero values of MUF even if no diversion has taken place, and assessments of compliance with safeguards must rely on statistical tests. If the variance of MUF is small compared to an SQ, then there is a high probability of reliably detecting diversions of a significant quantity of nuclear materials. However, such small variances are extremely difficult to achieve in a plant processing large quantities of material. Even if the variance of MUF is less than 1% of the quantity of material measured (a target that would be hard to achieve), its absolute value will over time exceed an SQ. For example, the minimum detectable amount of diverted plutonium in a substantial reprocessing plant, using the SAGSI criteria for reliability, has been estimated to be between 6 and 30 SQs using existing safeguards procedures.[19] These uncertainties might be reduced by the use of 'near real-time accountancy' and other new procedures, but these are largely untried in practice, vulnerable to deception, and still unable to reduce the deviation MUF to less than an SQ.[20]

In practice the IAEA does not always strictly use the SAGSI guidelines as criteria of the adequacy of safeguards for such nuclear facilities. Instead, safeguards have been used mainly as confidence-building measures and significantly lower detection probabilities have been accepted as adequate (for example, at fuel fabrication plants). Whereas many might find this acceptable for countries such as Japan and EC states, where there are presently few suspicions about the existence of covert nuclear weapons programmes, the same is not true for some enrichment or reprocessing plants established elsewhere (such as North Korea or Brazil). So far, such plants in less developed states have tended to be relatively small and 'low-tech,' and thus technically more amenable to safeguards. However, this will not necessarily remain the case, and in any case the spread of such facilities increases the risk of 'break-out' from the NPT.

Indeed, there has for some time been concern that present IAEA safeguards for such facilities would be inadequate. For example, in the USA, the Carter Administration accepted the logic of the SAGSI objectives, and also defined 'timely warning' as the detection of a diversion early enough to allow diplomatic action to prevent the fabrication and insertion of the diverted material into a first bomb that is otherwise complete (i.e. significantly shorter than the conversion time). On this basis the US judged that existing IAEA safeguards were inadequate for nuclear bulk-handling facilities such as reprocessing and enrichment plants. Partly for this reason, it decided to oppose exports of reprocessing facilities, even

---

18. See, for example: F. Berkhout and W. Walker, "Safeguards at Nuclear Bulk Handling Facilities", in J. Poole and R. Guthrie (eds), Verification Report 1992, VERTIC, London, 1992 pp. 199-209; M. Miller, op cit, see note 16.

19. M. Miller, ibid; R. Bolt op cit (see note 16).

20. F. Berkhout and W. Walker, "Safeguards at Nuclear Bulk Handling Facilities", op cit (note 18).

under full-scope IAEA safeguards. Since then, this position has more or less been maintained by the United States (except in relation to developed close allies such as France and Japan).

As far as nuclear-weapon states are concerned, the NPT does not require that they accept any safeguards on their nuclear activities. To promote acceptance of the safeguards regime amongst non-nuclear states (and particularly to reassure Germany and Japan that safeguards would not put them at a commercial disadvantage), the United States and United Kingdom made almost all of their civilian nuclear plants eligible for safeguards. However, they retained the right to withdraw any element of their nuclear facilities from safeguards if they saw fit.

In the mid 1980s, the USSR offered some of its plants for safeguards (with the same qualifications). Then in 1990 it extended its offer to cover all nuclear power plants and several research reactors: an offer that was maintained and extended after the collapse of the Soviet Union. France has similarly offered a selected number of civil nuclear facilities, and the Peoples Republic of China has offered one such plant. From the lists of 'eligible' facilities offered by the nuclear-weapons states, the IAEA selects a few within each state for the full application of safeguards. As members of the EC, all civilian plants in France and the UK are also safeguarded by EURATOM.[21]

2.3 Strengthening safeguards on declared activities

Perhaps the most urgent gap in the NPT verification regime highlighted by Iraq's nuclear weapon programme is that routine IAEA safeguards only cover *declared* nuclear facilities. The challenges of developing a verification regime for undeclared facilities are discussed in Chapter 3 below. However, as the previous section implies, there is also much scope for strengthening the IAEA safeguards regime for declared facilities.

A number of potential reforms had been on the IAEA Board of Governors' agenda at least since the 1990 NPT Review Conference. At the February and June 1992 IAEA Board of Governors meetings, a number of useful reforms were considered or agreed. These and other proposals for strengthening safeguards are considered in the following sub-sections.

---

21. D. Fischer, "The International Atomic Energy Authority and Nuclear Safeguards", in D. Howlett & J. Simpson (eds), op cit – see note 1, p. 39,40.

Design information on new facilities

At the February Board of Governors meeting, it was agreed that parties to full-scope safeguards agreements will henceforth be asked 'to provide preliminary information as early as possible on programmes for new nuclear facilities and activities, as well as modifications to existing facilities as soon as the decision to construct, to authorise construction, or to modify a facility has been taken. This information would be updated during project definition, preliminary design, construction, and commissioning phases'.[22] In September 1992, the IAEA Director General reported that existing subsidiary arrangements with safeguarded states were being renegotiated to implement this new policy.[23]

If fully implemented, this reform could substantially strengthen safeguards. If it had been in force in 1990, Iraq would have been in breach of its safeguards commitments for not declaring its electromagnetic isotope separation (EMIS) plant and its centrifuge enrichment and other facilities.[24] The reform legitimises IAEA requests for design information at the earliest stage of the development of nuclear facilities. Once design information has been provided, the safeguards system gives IAEA the right to send inspectors to verify its accuracy, and subsequently to visit the construction site to check that building work remains consistent with submitted plans. Significantly, such visits do not count as formal inspections, and thus are not subject to the limitations (in terms of frequency, duration, and intensity) of routine inspections.[25]

The submitted designs may raise questions and concerns, relating for example to the purposes of the new plant or the extent to which it can be reliably safeguarded. Up to the time of writing, the IAEA inspectorate had no explicit right to raise such questions or require design changes. However, early availability of design information would allow such issues to be pursued through other channels in a timely manner, and facilitate the use of diplomatic pressures or export controls if necessary. Nevertheless, the safeguards regime would be further strengthened if such rights were established for the IAEA. Moreover, the failure to disclose the complete facility design (or provision of false information) should be regarded as a serious safeguards violation and reported as such.

---

22. IAEA Press Release, "IAEA Board of Governors strengthens safeguards inspection regime", 26 February 1992, IAEA, Vienna.

23. H. Blix, Statement of the thirty-sixth session of the General Conference of the International Atomic Energy Agency, 26th September, 1992.

24. L. Scheinman, "The current status of IAEA safeguards", in D. Fischer et al, The New Nuclear Triad, op cit (see note 11).

25. M. Kratzer, "How can International Non-Proliferation Safeguards be made more relevant?", Bulletin of the Atlantic Council, Vol II, No 11, October 1991.

Improved transparency and universal reporting

It is clear that the more comprehensively civil nuclear activities are monitored, the more the NPT verification system will be strengthened. One way of improving the monitoring system is to increase transparency in imports, exports and inventories of nuclear-related materials.

At present, IAEA safeguards agreements impose only very limited reporting requirements on transfers of nuclear materials. No reports are requested for exports to nuclear-weapon-states. In relation to exports to non-nuclear-weapon-states, reports on U_3O_8 are required but otherwise there is no requirement to report transfers of nuclear material that is not yet suitable for enrichment or fuel fabrication. Trade in small quantities of plutonium or enriched uranium does not have to be reported to the IAEA. Nor are reports required on domestic production or inventories of materials like uranium ores or uranium ore concentrates.[26] Moreover, IAEA reporting requirements on equipment and non-nuclear materials are extremely limited.

In February 1992, Hans Blix, the IAEA Director-General, proposed to the Board of Governors that a full reporting system be established. He proposed that reports be required for all exports and imports of nuclear materials for peaceful purposes, regardless of the quantities or intended use.[27] The initial inventory of a state coming under safeguards should include all nuclear materials, including ore concentrates such as uranium 'yellowcake' (as the EURATOM system already did). Furthermore, Blix proposed that the IAEA establish a list of equipment and non-nuclear material particularly relevant to the production, processing, or use of 'special' nuclear materials. Reports would then be required for all international trade in such items, although such information would be treated confidentially to protect commercial secrets. The new reporting system would eventually apply to all states, and not just those subjected to INFCIRC/153 safeguards. Reports would be routinely verified by IAEA inspectors.

Such a universal reporting regime would allow the IAEA to monitor each state's nuclear-related programmes much more comprehensively than at present. Cross-checks could be made in the resulting data-base, to increase understanding of states' reported activities, provide scope for the detection of apparent discrepancies, and provide early warning of new activities in states. In this way, it could facilitate implementation of the new system for reporting design information.

---

26. L. Scheinman, "The current status of IAEA safeguards", op cit, p. 22.

27. J. Jennekens, R. Parsick, A von Baeckmann, "Strengthening the international safeguards system", IAEA Bulletin, Vol 34, No 1, 1992, pp. 6-10.

The Board of Governors only discussed this proposal briefly in February 1992 and then considered a revised proposal a little more fully at its June meeting.[28] The reaction was cautious but not wholly negative. In September 1992, the IAEA was in the process was establishing a limited and voluntary reporting system,[29] and the possibility of setting up a universal system is still under consideration. However, the revised June proposal for reporting nuclear materials did not include reports on the *production* of nuclear material or equipment. A number of legal, technical and economic factors were raised that might limit the scope of the reporting mechanism. Resistance to reporting obligations for sensitive equipment and non-nuclear materials is significantly stronger than for nuclear materials.

Many on the Board of Governors had little enthusiasm for the proposal that submitted reports should routinely be verified by the IAEA – such a system seems likely to be (ill-advisably) judged by the Board to be unduly burdensome on states and not cost-effective for the IAEA. Developing countries are particularly wary of such burdens and of the possibility that this might develop into a discriminatory verification regime: focusing the reporting system on international trade means that their activities may tend to be more closely monitored than those of supplier states that are in a position to produce their own equipment and materials.

At present, it seems that any legally-binding reporting system likely to be agreed will have rather limited scope and be subject only to limited verification inspections. Widespread unilateral adherence to a more extensive reporting system, particularly by supplier states, could speed the development of this potentially important aspect of safeguards.

Increasing inspection frequency

As discussed in section 2.2, the INFCIRC/153 inspection regime has developed to include a number of procedures that keep human inspections to a minimum and limit the frequency, intrusiveness and intensity of such inspections. Access of inspectors is routinely limited to 'strategic points' in the 'material balance area'. The frequency of inspections is limited according to the amount of safeguarded fissile material that is stored or passing through each facility. The so-called 'Maximum Routine Inspection Effort' at each facility is determined in advance according to criteria that have only limited relationship to the real risks of proliferation. In many facilities, even lower limits and tighter restrictions on inspections have been established.

---

28. Programme for Promoting Nuclear Non-Proliferation, Newsbrief, No. 17, Spring 1992, and No 18, Summer 1992.

29. H. Blix, op cit (see note 1).

Much of the precision and detail with which INFCIRC/153 safeguards are specified are unduly restrictive, and reduce their effectiveness. The contrast with the INFCIRC/66 rev 2 system applied to facilities in states outside the NPT/IAEA safeguards regime is striking. The latter document is relatively open-ended and flexible, allowing the IAEA considerable freedom in the way it applies safeguards and avoiding giving plant operators a full advance knowledge of the safeguards inspections they will receive.[30]

If the frequency of inspections were to increase, and inspectors were less constrained by pre-agreed limits on their activities, the reliability of safeguards would increase substantially. It is worth noting that the ARIEs establishing the detailed restrictions on IAEA inspections are not specified in the basic INFCIRC/153 document – they have been introduced over the years through subsidiary arrangements and so-called facility attachments and could be reversed without a full renegotiation of the INFCIRC/153 regime.

It is important that the principle be agreed that the IAEA should regain flexibility in the application of inspections. In practice, reforming the guidelines about inspection frequency, duration and intensity could be a difficult process. A process requiring the detailed renegotiation of each subsidiary arrangement and facility attachment could become bogged down – particularly in relation to those states of greatest proliferation concern. A clear statement is needed from the Board of Governors that agreed subsidiary arrangements are only indications of how inspections might normally be implemented, and should not be used to limit IAEA inspection rights. Japan and EC states might resist this, except in the context of a broader reform process to reassure them that the effect would not simply be to increase the intensity of inspections directed at them. However, as discussed later, this is the context envisaged here: the main objective is to permit more frequent inspection of facilities at states with relatively small fuel cycles.

One immediate way of dramatically increasing the frequency of inspections within the present accepted methodologies would be to reduce the size of the 'significant quantity' (SQ) of fissile material. As noted above, there are technical arguments to justify reducing this quantity by up to 50% – it may be possible for even a 'threshold' state (or a developed non-nuclear state) to build a nuclear weapon using significantly less material than originally estimated. Such a reduction in the SQ would have enabled the safeguarded weapons grade material in Iraq to be inspected at least once a month.

An important but simple adjustment to the present system would be to modify the extent to which the system is 'facility oriented'; that is the extent to which the

---

30. The contrast between INFCIC/66rev 2 and INFCIRC/153 is increasingly frequently noted. See for example, B. Sanders, "IAEA safeguards: a short historical introduction", in The New Nuclear Triad, op cit (see note 11).

frequency and character of inspection is determined separately for each plant. Concerns about proliferation relate to the amount of fissile material available within a whole state. If a state possesses enough fissile material to make a nuclear weapon, it should be subject to a minimum number of inspections per year determined according to the 'conversion time'.[31] Even better would be to use the concept of 'timely warning' (that is, reliable detection of diversion early enough to allow diplomatic action to prevent the production of a nuclear weapon – shorter than the traditional 'conversion time') as a guide to the frequency of inspections.

Either of the above approaches would disproportionately increase inspection frequency in those states with small fuel cycles, which do not yet possess 8kg of plutonium or 25kg of highly-enriched uranium. Such states in regions of tension tend to be those for which international concerns about possible diversion of nuclear material are greatest.

Refocusing the inspection effort

Increasing the frequency and intensity of inspections would undoubtedly strengthen the IAEA safeguards regime. However, the IAEA safeguards budget is modest. It has been frozen in real terms for seven years. For 1993 a small real increase of less than 5% was agreed to take account of the substantial increase in safeguarding tasks in North Korea, Latin America, Southern Africa and the ex-Soviet republics, bringing the safeguards budget to about $62 million.[32] In practice even this sum is unlikely to be available – it is unlikely that the ex-USSR states will pay their 13% share in 1993 (or pay the amounts they owe for 1991 and 1992). Thus, in real terms, the money actually available to the IAEA for safeguards in 1993 may be significantly less than for 1990, in spite of its new tasks and increased concern about proliferation.

In the past, the IAEA inspectorate has typically been unable to carry out even the limited number of inspections indicated by existing guidelines. A substantial increase in safeguards budgets is sorely needed. Unfortunately there seems to be no immediate prospect that budgets will be greatly increased. Therefore, while maintaining the pressure for budget increases, attention has focused on the possibility of refocusing resources and increasing efficiency.

One significant source of inefficiency arises from the restrictions many countries place on the nationality of the inspectors they will accept, and on inspectors'

---

31. D. Fischer, "Innovations in IAEA safeguards to meet the challenges of the 1990s", op cit (see note 17).

32. Programme for Promoting Nuclear Non-Proliferation, Newsbrief, No 18, Summer 1992, p. 4.

travel and inspection arrangements. Such restrictions on choice of inspectors make it hard to manage limited resources efficiently, and impose unnecessary and costly delays. The Board of Governors should insist that states accept all inspectors approved by the Board and allocated by the IAEA Secretariat, regardless of their nationality (except perhaps for facilities involving sensitive technologies, for which special inspection regimes could be arranged). Moreover, visa requirements should be waived for IAEA inspectors, or long-term multiple re-entry visas be issued.

Since the frequency and intensity of inspections are currently determined by the amount of nuclear material at each facility, until recently 80–90% of the safeguards budget was allocated to safeguarding facilities in Canada, Japan and Western Europe. Even in 1992, the proportion is about 70%, and safeguards in Canada, Germany and Japan alone account for some 60% of the safeguards budget. This raises concerns – not least in these western states – that IAEA safeguards are not focused in areas where confidence-building and verification systems are most urgently required. Arguably, it is in regions of tension, such as the Middle East, North Africa, the Korean peninsula, and Central and Southern Asia, that the incentives or pressures for nuclear proliferation is greatest. Most states in these regions where there are concerns about possible diversion of nuclear material have relatively small flows of nuclear materials. There are calls to change inspection criteria so that the IAEA reduces the proportion of its resources allocated to safeguarding facilities in Western Europe, Canada, or Japan, and focuses more on safeguards in countries with relatively small nuclear fuel cycles, such as Iran, South Africa, and Libya (and Iraq before 1991).

Such reforms might allow very substantial strengthening of safeguards in some geographical regions even without large overall safeguards budget increases. They might also improve the prospects for actually achieving such increases in these budgets. At present, major contributors to the IAEA such as Japan, Germany, and several non-nuclear western states are extremely reluctant to approve budget increases if they know that most of the extra resources are liable to be spent augmenting safeguards in their own territories. The USA, UK and France are also disinclined to increase their contributions for additional safeguards on close allies where the risk of deliberate diversion of nuclear materials is judged to be extremely low. If the emphasis in safeguards were changed to focus on states where proliferation risks were of greater concern to the major donors, the prospects for significant budget increases would be greater.

However, developing states are wary of such proposals. They would oppose arrangements that allowed the safeguards regime to be focused according to the changing wishes and concerns of the developed or nuclear-weapon states. Such states are acutely sensitive to special inspection regimes being imposed upon them by the USA and its allies. Moreover, several of the NPT states that justly suspect that they might be high on the West's list for intensive safeguards have

seats on the Board of Governors. In 1992/3, these include Libya, Syria, and Vietnam. Fellow 1992/3 Board members like Malaysia, Nigeria, Chile, Algeria, Argentina, Brazil, India, Pakistan, Paraguay and Ecuador, are likely to join them in resisting an intensification of the inspection regime focused on the South.

Developed states can exert strong countervailing pressures, but a robust non-proliferation regime cannot simply be imposed on developing states. Thus, any reorientation of safeguards to focus resources more efficiently must as far as possible be defined according to objective and universal criteria (applying equally in principle to each non-nuclear-weapon NPT state) or left to the discretion of an IAEA Secretariat whose independence is trusted.

Devolving responsibility for safeguards

On April 28, 1992, the IAEA Director General and EC Commissioner Cardosa e Cunha endorsed a new partnership approach to the implementation of safeguards by the IAEA and Euratom.[33] The aim was to make arrangements to avoid duplication in routine safeguards operations. IAEA and Euratom safeguards will now be more closely integrated, and the two organisations will share analytic resources. If the IAEA were to 'delegate' a proportion of its safeguards operations to Euratom, the Agency could substantially reduce the resources it devotes to safeguards in EC states, while maintaining the overall intensity of 'IAEA-approved' safeguards in the EC.

Euratom is well-established as an expert and reliable safeguards organisation, and the IAEA has had a long association with it. In any new relationship, the IAEA must retain the right to make its own safeguards inspections (perhaps including random challenge inspections) and to monitor Euratom operations, to ensure that an independent and reliable safeguards regime is maintained for western Europe. But if the IAEA were to devolve most of its routine safeguards operations to Euratom, it could release some 30% of its present safeguards resources for other purposes. This would allow safeguards to be intensified in other geographical areas and to be extended in scope within existing budget constraints.

However, the question will inevitably arise whether IAEA safeguards can be devolved to regional organisations in other parts of the world besides Europe. Western states might be less willing to delegate safeguards to a newly established regional verification organisation in the Middle East consisting of Arab states. Criteria need to be established on the devolution of IAEA safeguards operations to regional organisations to ensure that the arrangement with Euratom does not lead to damaging disputes or an ultimate weakening of the safeguards regime.

---

33. IAEA Press release PR 92/23, 29th April 1992.

One possible criterion is that such a regional organisation should be long established so that its independence, expertise and safeguards regime can reliably be assessed over time. Euratom is the only organisation in this category. However, recent developments in Latin America may make it hard in practice to establish this criterion. In December 1991, the IAEA signed a four-party nuclear safeguards agreement with Argentina, Brazil and the newly established Argentina-Brazil Agency for Accounting and Control of Nuclear Materials (ABACC).[34] The intention is that ABACC will act as a regional safeguards agency, intermediary between the IAEA and the states involved. Reportedly, Chile and Uruguay have expressed interest in joining this new arrangement.

Implementation of this new arrangement will take time. However, it is worth noting that although negotiations are proceeding through 1992 on detailed IAEA-ABACC safeguarding arrangements, in practice ABACC has yet to be properly established. As of summer 1992, it had a Secretary-General, but no secretariat, budget or mandate. Argentina and Brazil had yet to ratify the arrangement. The detailed implementation of the IAEA-ABACC partnership must be monitored very closely, with the IAEA retaining extensive rights to monitor ABACC operations and to conduct its own inspections. Although it is broadly modelled on the IAEA-Euratom partnership, the detailed arrangement between the IAEA and ABACC must be determined according to its distinctive requirements.

The partnership between Euratom and the IAEA also raises the question of whether a similar arrangement should be available for Japan or other developed states outside Euratom. In the early 1970s, Japan insisted that its ratification of the NPT was conditional on it being accorded any special safeguards treatment granted to Euratom.[35]

However, no international safeguards system can have credibility unless it is applied by an organisation with a significant number of disparate member states with a strong interest in ensuring that no member acquires nuclear weapons. There is at present no international organisation containing Japan in the Asia-Pacific region to which the IAEA could credibly devolve safeguard operations. Any weakening of safeguards in Japan is likely to be resisted or treated with great suspicion by several of its Asian-Pacific neighbours, particularly in view of the large amounts of separated plutonium that are planned to be produced or stored in Japan during the 1990s.

---

34. J. Simpson, "The Non-Proliferation Regime in 1991", in J Poole & R. Guthrie (eds), Verification Report 1992, VERTIC, London, 1992.

35. D. Fischer, "Innovations in IAEA Safeguards Arrangements", op cit (note 17), pp. 37-38.

Surprise inspections and an enhanced IAEA/NPT safeguards regime

Devolution of many routine safeguard operations to regional organisations offers only limited scope for making the safeguards regime more focused and effective. However, it may be possible to develop special arrangements to reduce routine inspections for states that are willing to accept increased transparency and short-notice or challenge inspections.

Short-notice random inspections carried out with relatively few restrictions can provide greater confidence of compliance with NPT commitments than a larger number of predictable and highly regulated inspections. This confidence would be further enhanced if the state involved cooperates closely with the IAEA by designing facilities so that they are particularly amenable to safeguards, and provides full and regularly updated information on its nuclear related activities.

Thus states could be offered the opportunity to join an enhanced IAEA/NPT safeguards regime in which they agree in advance that the IAEA had an unrestricted right to make at short-notice unannounced inspections at any safeguarded facility.[36] This would involve accepting without challenge IAEA-approved inspectors, waiving visa requirements (or issuing long-term multiple entry visas), and imposing no limits on the numbers of inspectors used to monitor its activities. Under such a regime, the state would also agree to all the reforms in safeguards discussed above, such as providing information on all nuclear-related plant design at the earliest possible stage and reporting fully on the production and international trade of nuclear and nuclear-related items. It should also agree to consult with the IAEA on the designs of new facilities or equipment available for export to ensure that safeguards can easily be applied.

As states joined such a modified regime, a new category of enhanced full-scope safeguards would be established. Resources allocated to routine safeguards could increasingly be focused on states that continue to accept only the 'old' full-scope safeguards regime. The enhanced regime would be open to all non-nuclear-weapon states that already accept INFCIRC/153 safeguards. The main incentive for states to join it would be to strengthen the overall verification system and thus strengthen the NPT regime. However, adherence would also typically reduce the burden of routine inspections on the states involved: potentially attractive for states such as Japan and Canada.

Unannounced inspections are already provided for in safeguards for gas centrifuge enrichment plants, and reprocessing plants are subject to continuous inspection. Thus the safeguarding regime for such 'sensitive' facilities might

---

36. See D. Fischer, "Innovations in safeguards to meet the challenges of the 1990s", op cit (note 17), pp. 32-33.

remain separate from the enhanced regime. Moreover, there is a case for limiting the inspectorate for such facilities to citizens of states already fully advanced in these technologies.

Reforming IAEA 'culture'

The proposals for the strengthening and refocusing of the IAEA safeguards regime discussed above would command support from many in and around the Agency. Some critics, however, claim that 'the real target for reform...should be the peculiar culture of minimal restraint created both by and for the IAEA. Currently there is a built-in ambivalence among Agency administrators about finding and condemning cheaters and a wariness of increasing vigilance among sponsoring nations'.[37]

Such criticisms can be overstated and misdirected. Although some IAEA officials have displayed extreme reluctance to cause embarrassment or diplomatic difficulties, senior members of the Secretariat have frequently complained loudly about restrictions on inspections imposed by member states. Some inspectors have argued aggressively with national officials and tried to insist that they comply with their safeguards obligations. In such cases they cannot be blamed when the Board of Governors or individual member states have effectively overruled them.

Thus, to the extent that an unduly accommodating culture exists, it cannot be fully explained by the inadequacies in the inspectorate or the IAEA Secretariat. It is mainly a consequence of the guidelines for inspections established in the early 1970s. Initially the United States and other western states insisted upon a non-intrusive and accommodating approach to inspections in order to address the concerns of Germany and Japan. Later, as developing states became more strongly represented on the Board of Governors, this approach was reinforced.

In another sense, however, there are nevertheless real problems with present practice and culture in the IAEA inspectorate. Since the safeguards regime has focused on monitoring inventories of materials at declared sites, many inspectors have tended to conceive their role primarily as scientific or technical auditors, or as experts in developing and operating safeguards equipment concerned with materials accountancy. They have often lost sight of the fact that their overriding role is to try to verify compliance (and detect non-compliance) with the NPT. Even within the existing safeguards system, there is scope for greater curiosity and investigative zeal relating to states' nuclear activities.

---

37. D. Segal, "IAEA must abandon its timid posture", Defense News, 21/10/91.

A necessary condition for achieving a change of culture amongst inspectors to meet modern proliferation concerns is that the IAEA Director-General and the head of the Safeguards Department endorse and consistently back a more intrusive and investigative approach, and the Board of Governors agree to reforms to strengthen the safeguards regime. Some doubt that this is politically realistic in view of the composition of the Board and the multiple roles of the IAEA. This has led to some radical proposals.

Thus, for example, Paul Levanthal (President of the US-based Nuclear Control Institute) has advocated relieving the IAEA Board of Governors of its safeguards authority and handing over control of the IAEA inspectorate to the UN Security Council.[38] Alternatively, for example, Gordon Thompson (Director of the US-based Institute for Resource and Security Studies) argues that the IAEA's culture of restraint is closely linked with its dual role as both a promoter of nuclear technology and a verification agency.[39] His preferred approach is for the IAEA to be stripped of its promotional role, leaving it to concentrate on the verification challenges of the 1990s.

As will be discussed in later sections of this report, these proposals deserve serious consideration and raise legitimate questions. However, each would be highly controversial and could put at risk the acceptance of the reforms discussed above and even the long-term extension of the NPT regime at the 1995 review conference. Developing states would vigorously oppose ending the IAEA's technical assistance programme. Moreover, many such states would greatly distrust an international inspection regime governed directly by the present US-dominated UN Security Council.

For the immediate future, the task is to change the IAEA verification culture within existing institutional structures. Several of the reforms discussed above may contribute to this. However, useful as they may be, changes in the frequency and scope of routine inspections are unlikely on their own to encourage inspectors to be more investigative and questioning.

Management programmes are needed to encourage inspectors to be alert to unusual circumstances, and to report them even if they do not explicitly amount to pre-defined 'anomalies' in the reporting system.[40] Inspections should be embedded in a system where inspectors are involved in briefings, debriefings, and analyses of each country's overall nuclear and nuclear-related programmes

---

38. P. Levanthal, "The nuclear watchdogs have failed", International Herald Tribune, 24/9/1991.

39. G. Thompson, Strengthening the International Atomic Energy Authority, Institute for Resource and Security Studies, Cambridge, Massachusetts, September 1992. See also J. Simpson & A. McGrew, The International Non-Proliferation System, Macmillan, 1984, pp170-1.

40. As suggested, for example, by M. Kratzer, "How can international non-proliferation safeguards be made more relevant?", op cit (note 25).

and possible proliferation concerns. A system needs to be fully instituted whereby 'country officers' are nominated for each relevant state and required to follow and analyse all nuclear activities in their assigned country. Inspectors visiting facilities should at least be fully aware of publicly available information or debates relating to that state's nuclear activities. They should be briefed on any information on planned new facilities and on national exports and imports acquired ensuing from the reforms discussed by the Board of Governors. They should be particularly suspicious of nuclear facilities or projects that apparently have little economic or research value in a civil programme. Above all, they should be encouraged to regard their role as one of contributing to verifying compliance with the NPT regime rather than simply monitoring flows of nuclear materials through particular facilities.

However, management programmes tend to have limited impact unless inspection rights and procedures also change. The establishment of the enhanced full-scope safeguards system discussed above would provide experience of more pro-active procedures. If an effective special inspections regime is established, (see chapter 3), the present much-criticised culture would have further scope for change.

Participation of nuclear-weapon states

As already discussed, only non-nuclear-weapons states party to the NPT need accept full-scope INFCIRC/153 safeguards. Most nuclear-weapon states participate only to a limited, symbolic, extent – although the UK and France do accept EURATOM safeguards at their civil nuclear facilities. This is a source of irritation to non-nuclear-weapon states and tends to increase their resistance to proposals for strengthening the safeguards system. It is now time for the nuclear-weapon states to become subject to more restrictions and safeguards themselves. In verification terms it would be a waste of resources to engage in intensive inspections of all nuclear facilities in nuclear weapons states according to the existing safeguards regime. However, a particular aim should be to encourage participation in the proposed enhanced safeguards system (which need not require such intensive routine inspections), at least by agreeing that all of their listed civil facilities may be subject to the regime themselves.

Similarly, the nuclear-weapon states could facilitate the development of the proposed reporting system by notifying the IAEA of their civil nuclear and nuclear-related exports and imports. If all supplier states were to do this, then the reporting system would be rapidly established as a valuable database for IAEA inspectors.

3 Special IAEA inspections at undeclared sites

3.1 Introduction

The belated discovery of Iraq's covert nuclear weapons programme focused attention on the inadequacy of a verification system that focuses only on *declared* facilities. At al-Tuwaitha, for example, inspectors confined themselves to inspecting research reactors and stores of fissile material, but nearby in undeclared sites Iraq was carrying out nuclear weapons-related research and developing uranium enrichment facilities.[41] To be credible in the future, the system must also be geared to detect *undeclared* nuclear materials or facilities, which may be at *undeclared* sites. This implies that the verification regime should enable special inspections to be carried out at undeclared sites.

In fact, the IAEA has always had the authority to conduct special inspections on states under full-scope safeguards. Article III of the NPT and paragraphs 73 and 77 of INFCIRC/153 commit non-nuclear-weapon state parties in principle to allow special IAEA inspections at undeclared sites throughout their territories. Paragraph 73 of INFCIRC/153 permits special inspections '(a) in order to verify the information contained in special reports, (b) if the Agency considers that information made available by the State, including explanations from the State and information obtained from routine inspections, is not adequate for the Agency to fulfil its responsibilities under the Agreement'.[42] Special inspections under category (a) are straightforward: they are initiated by the State itself. However, the character and scope of IAEA authority to initiate inspections at suspicious undeclared sites has remained controversial and unclear.[43] Since no such IAEA-initiated special inspections ever took place at undeclared sites, these issues remained unresolved.

The Iraq experience stimulated the IAEA Board of Governors meeting in February 1992 to reaffirm that the IAEA had the authority to carry out special inspections to ensure that *all* nuclear materials that should be under INFCIRC/153 safeguards were in fact under such safeguards. The Board also reaffirmed the Agency's rights to obtain and to have access to additional information and locations in accordance with the Agency's statute and safeguards agreements.[44]

---

41. IAEA, IAEA inspections and Iraq's nuclear capabilities, IAEA, Vienna, April 1992.

42. INFCIRC/153, op cit (see note 4), paragraph 73.

43. See, for example, discussions in G. Bunn, "Does the NPT require its non-nuclear weapon parties to permit inspection by the IAEA of nuclear activities that have not been reported to the IAEA?", in D. Fischer et al, A New Nuclear Triad, op cit (see note 11), pp. 44-58.

44. IAEA Press Release, "IAEA Board of Governors strengthens nuclear safeguards inspection regime", IAEA Vienna, 26 February, 1992.

This confirmation of special inspection rights understandably received wide publicity, but it did not substantially clarify several of the key uncertainties and debates that have always surrounded this issue. Unless these are resolved, the IAEA's right to conduct special inspections cannot be effectively exercised and the verification regime to detect undeclared nuclear activities will be little stronger than before.

Iraq's programmes to develop weapons of mass destruction were revealed by an Iraqi defector and subsequently by special inspections carried out under UN Security Council Resolutions 687 and 707. These resolutions gave UN Special Commission (UNSCOM) and IAEA inspectors: 'immediate, unconditional and unrestricted access to any and all areas, facilities, equipment, records and means of transportation which they wish to inspect'[45]; permission to 'conduct both fixed wing and helicopter flights throughout Iraq for all relevant purposes including inspection, surveillance, aerial surveys, transportation and logistics without interference of any kind and upon such terms and conditions as may be determined by the Special Commission and to make full use of their own aircraft and such airfields in Iraq as they may determine are most appropriate'[46]; and 'complete implementation of the privileges, immunities and facilities of the representatives of the Special Commission and the IAEA'.[47]

While there is no doubt that such inspection powers would immeasurably strengthen the NPT verification system if it were applied to all non-nuclear-weapon NPT parties, there is equally no doubt that there is no chance of achieving agreement to establish such a system. The punitive regime imposed on Iraq after its defeat in the Gulf War is not an appropriate model for the future development of the IAEA/NPT safeguards system. Thus, the task is now to develop more generally-acceptable special inspection rights and procedures that nevertheless allow adequate verification that all nuclear materials and installations have been declared.

The IAEA Director-General has correctly identified the key requirements for a system that would provide a high-degree of reassurance that the IAEA could uncover clandestine nuclear activities:

'First, the inspectorate must have *access to information* from sources besides the state in which the inspections were performed, notably from satellites and intelligence organisations...Second, the inspectorate must have a right to timely and unrestricted access to any location which, according to credible information, might be an undeclared nuclear installation or contain undeclared nuclear

---

45. UN Security Council Resolution 707, paragraph 3 (ii), 15 August 1991.
46. ibid, para 3 (v).
47. ibid, para 3 (vii).

material...Third, the Agency may need to...have access to the Security Council, if the state in question rejects a request for a special inspection'.[48]

3.2 Access to information

Most states are not going to allow inspectors to roam around their territory in a blind search for possible hidden nuclear material or facilities. The inspectors need to know where to look.

If the proposed IAEA reporting system for the export, import and production of sensitive materials and equipment is actually established (see section 2.3), the Agency would have a more complete picture of each state's nuclear-related activities. This database, combined with a more systematic analysis of inspectors' reports and inspections relating to declared sites and early information on design plans, could help to focus IAEA enquiries. As mentioned above, the Board of Governors recently reaffirmed the IAEA's right to obtain and to have access to additional information. Thus, if questions arise, the first step might be to request further information from the state itself. On their own, however, these sources of information would not be adequate for an effective special inspection regime.

There is now broad agreement in principle that the IAEA should break with previous practice and make use of information from sources other than safeguards activities. Such sources include public information (such as press and open research reports), and satellite and national intelligence information.[49] The IAEA Director-General has revealed that the IAEA's discoveries in Iraq 'were totally dependent on the intelligence information provided by member states',[50] and the future detection of clandestine nuclear activities will also rely heavily on information from national intelligence services. In his 1991 statement to the IAEA's General Conference, Director General Hans Blix said that he saw 'no insuperable difficulty in establishing a special unit which may review and evaluate such information on a continuous basis'.[51] In practice however, it has proved difficult since then to achieve agreement on how to receive such information and then how to evaluate and use it.

National intelligence services are rarely willing to provide detailed intelligence information to foreign or international organisations, to avoid compromising

---

48. Hans Blix, Statement by Director-General to the Thirty-Fifth Regular Session of the IAEA General Conference, 16 September, 1991 (as quoted in PPNN Newsbrief, Autumn 1991).

49. L. Scheinman, "The current status of IAEA safeguards", in D. Fischer et al, The New Nuclear Triad, op cit (see note 11), p. 18.

50. Interview with Hans Blix, "IAEA Director Hans Blix: keeping an eye on a nuclear world", in Arms Control Today, November 1991, pp. 3-6.

51. ibid.

sources or revealing secrets such as the monitoring capabilities of surveillance satellites. Thus, there will be a tendency for them to provide at best only short summaries or indications of national intelligence reports, making it hard for IAEA officials to evaluate the credibility or reliability of such reports. However, the IAEA Board of Governors, with its strong representation of developing and non-western states may be unwilling to endorse special inspections against a state's wishes on the basis of intelligence reports from the United States or other nuclear-weapon or western states, unless they have been independently evaluated and deemed credible.

To some extent, this problem could be ameliorated if relevant intelligence services could be assured that information they provide to the IAEA would only be seen and assessed by a few selected Agency officials to whom they are willing to accord high-level security clearance. In the past, for example, the United States has declined to give the IAEA sensitive intelligence partly because it was concerned that all IAEA members would have access to it, and may use it against US interests.[52] The IAEA, in common with other international organisations, has a declaratory policy of allowing member states or IAEA inspectors equal access to information provided to it, regardless of nationality. This official position has given credibility to suspicions of a lax approach to sensitive information: For example to reports that it proved difficult to restrict access to sensitive nuclear-weapon programme information obtained from Iraq to IAEA inspectors from nuclear-weapon states.[53]

In practice, the IAEA can be quite a secretive organisation with an informal 'need to know' approach to sensitive information. Informal arrangements for taking account of national intelligence data are apparently being developed, on the basis of the experience of the UN Special Commission. IAEA inspectors preparing to visit Iran in October for confidence-building inspections agreed with the Iranian government were reportedly provided with national intelligence information about possible covert nuclear activities.[54] However, reliance on informal procedures leaves the regime open to challenge when it is really needed. If an IAEA special inspection regime is to be effective, the Agency will have to develop explicit secure procedures and expert assessors to which the major intelligence services are willing to provide secret information.

Blix has proposed that a small IAEA intelligence unit of two people be established to assess information received without distributing it to any other parts of the IAEA or to the Board of Governors or member states. However, this proved con-

---

52. D. Albright and M. Hibbs, "Iraq's Quest for the Nuclear Grail: what can we learn?", Arms Control Today, July/August 1992, pp. 3-11.

53. P. Zimmerman, "IAEA as policeman: out of its depth", International Herald Tribune, 25th September 1992.

54. PPNN Newsbrief, Autumn 1992, p. 11.

troversial at the Board of Governors and the exact form that such units might take remains unclear. In practice, in the short-term at least, the priority is to achieve cooperation between the IAEA and the intelligence services of Russia and of the USA, UK, France and their allies. In view of the rapidly developing cooperation between the CIA and the Russian intelligence services on non-proliferation matters, it is possible that a single small IAEA assessment unit might be staffed by officials who are each acceptable to all of these states. Additional flexible arrangements might be needed if intelligence information from other states is to be evaluated. A less politically controversial approach might be to ensure that the Director General has a small team of expert senior IAEA officials who can act as informal but trusted contact points for the major intelligence services. However, they would have to be recognised and accepted as such within senior IAEA circles if their assessments and recommendations are to be trusted and used.

It has been suggested that the establishment of a new UN Verification Agency could facilitate the use of intelligence information to initiate special IAEA inspections.[55] This may be true in principle. However, in practice the value of such an Agency would be limited and would depend critically on its design. Data made available to it from commercial satellites, international organisations, and independent research organisations such as IISS and SIPRI might provide the basis for useful assessments of proliferation risks in certain countries, provided the new agency was reasonably shielded from interference from member states and UN politics. Such assessments could not, however, replace those of national intelligence authorities with their vastly superior resources and access to classified information. In fact, efforts to establish a generic UN Verification Agency could be a distraction from the central task of developing the IAEA as the UN-related verification agency for the NPT.

3.3 Carrying-out special inspections at undeclared facilities

Once the IAEA Secretariat has credible information about possible activities in undeclared facilities, the next issue is the process by which special inspections might be initiated and carried out. A key question is whether it is for the Board of Governors or the Director-General to decide whether information available to the IAEA warrants initiating special inspections of undeclared facilities.

If the decision were to rest with the Board of Governors, then it could become highly political and special inspections would rarely be initiated against states that were not already diplomatically isolated for other reasons. Aware of this, in early

---

55. See, for example, E. Chauvistre, "The Implications of IAEA Inspections under Security Council Resolution 687", UNIDIR Research Paper No 11, UNIDIR, United Nations, New York, 1992, p. 25.

1992 the Board of Governors indicated that the implementation of safeguards is, in the first instance, the responsibility of the Director General.[56] Thus the responsibility for determining whether to initiate special inspections and for conducting them rests with him.

A number of states still seek to limit severely the categories of sites subject to special inspections. However, the majority of the Board of Governors are now clear that the Director-General would have the right to request a special inspection at any site where there is credible information that undeclared nuclear materials or nuclear facilities might be located. However, unlike the regime for Iraq, at present it is not clear that the IAEA can inspect office sites in search of incriminating documentary or non-nuclear evidence.

If the state concerned immediately agreed to such a request, or offered convincing alternative evidence to show that suspicions were unfounded, there would be no major problems. However, such cooperation cannot always be expected in the most important cases.

If the state refused to agree to the requested inspection, then the matter would inevitably be referred to the Board of Governors. Except in special political circumstances, the state could then probably delay the inspection for days or weeks, if not indefinitely. Typically, non-proliferation issues are only one amongst several concerns guiding states' policy towards other states, and this would apply to members of the Board of Governors when they decide how to approach such a dispute between the IAEA Secretariat and a state. The tendency to procrastinate and avoid forcing the issue might be strong.

In fact, there would be real dilemmas about how far to force a requested special inspection. The information on which the request was based would normally be unreliable. There would be a natural concern not to alienate a potentially innocent state. In any case, after a significant delay, the suspected materials or equipment could be moved to another location. As with the famous stand-off between UNSCOM inspectors and the Iraqi authorities outside a Ministry of Agriculture building in July 1992, if no evidence is discovered when inspectors are finally allowed inside the facility, the special inspection regime itself loses some credibility. Knowing this, states with covert nuclear programmes could manipulate the regime. As David Kay, leader of one of the UNSCOM inspection teams, has put it, 'the problem with saying "if you get the information, you'll go" is that information is ambiguous and often wrong...If I were North Korea, I would feed wrong information and then have a sudden inspection, which would find

56. L. Scheinman, "The current status of IAEA safeguards", in D. Fischer et al, The new nuclear triad, op cit (see note 11), p 19.

nothing. Can you imagine going into Algeria three times, finding nothing and then going back for a fourth inspection?'.[57]

In spite of the Director-General's statement that an effective verification regime would require the inspectorate to have the right to *timely* and *unrestricted* access to requested sites, there is doubt that the developing IAEA special inspection regime will reliably involve short-notice inspections against the wishes of the state, and access may often be constrained as a result of negotiations. This would provide time to conceal laboratory or pilot-scale clandestine activities.

3.4 The UN Security Council and the Special Inspection Regime

If a state continued to refuse to accept a special inspection even after the Board of Governors insisted that they did so, a number of sanctions are available. Those directly available to the Board of Governors are weak, and in any case it may not be advisable to impose them: suspension from the IAEA technical assistance programmes or suspension from IAEA membership itself. The more substantial action open to it would be to refer the matter to the UN Security Council. Under the UN Charter, the Security Council has the right to take enforcement actions (particularly now that it explicitly recognises proliferation of weapons of mass destruction as a threat to international security). As the case of Iraq demonstrates, only with sustained and intense pressure from the UN Security Council backed by credible threats of use of force can intrusive inspections be carried out against the wishes of a recalcitrant state.

An awareness that requests for special inspections are ultimately backed-up by the authority of the UN Security Council should increase the credibility of the special inspection regime and deter clandestine nuclear activities. For this reason, there may be a strong case for the Board of Governors to adopt the policy of avoiding becoming involved in the details of disputes over requested inspections, and in general waiting for only a short time before referring to the Security Council any refusal to accept a special inspection of an undeclared facility.

Lacking confidence in the political will of the majority of the IAEA Board of Governors to implement an effective special inspection regime, some officials and analysts have proposed to by-pass the IAEA altogether on this issue. Such proposals have received particular support in the United States. The approach would be for the IAEA to continue to implement routine safeguards, but for the special inspections regime to be managed by a permanent unit (a version of the UNSCOM) attached to the UN Security Council. This would receive and evaluate

---

57. Quoted in J. Simpson, "The Iraqi Nuclear Programme and the Future of the IAEA Safeguards System", in R. Guthrie & J. Poole (eds), Verification Report 1992, VERTIC, London, 1992, pp. 249-253.

intelligence information from Russia and the USA and its allies, and make recommendations directly to the P5 and the UN Security Council. Any special inspections authorised by the Security Council would then be implemented by nominated inspectors, including the IAEA inspectorate. Under the control of the UN Security Council, it is argued, timely and unrestricted special inspections could be imposed.

Recent experience in Iraq is still fresh in the memory, and with the present cooperation amongst the P5 dominated by the United States, it is easy to see the attractions of such a proposal in the USA. However, this approach would leave the whole special inspection regime vulnerable to the veto of one of the P5. All of these major powers have been inconsistent in their concern about non-proliferation, according to their changing foreign policy priorities. It is important that the NPT verification regime is reasonably consistent in its implementation, and does not become a hostage to disputes between the P5 or become seen as something imposed by these nuclear-weapon states on the rest of the world.

Even if the UN Security Council were to implement such a special inspection regime consistently and P5 cooperation was maintained, it is important to recognise that the imposition of sanctions against Iraq was a special case. The UN Security Council is, in general, prone to the same tendencies to procrastinate as the Board of Governors. The factors militating against timely and unrestricted inspections would also operate in this case. Moreover, at least there are no vetoes on the IAEA Board of Governors, and decisions can be taken by majority vote.

It is important to recall that the national intelligence agencies of Russia the United States and its allies were themselves very slow to appreciate the extent or sophistication of the Iraqi nuclear weapons programme. When they did, it now appears that national authorities misguidedly ignored the warnings in the interests of other policy priorities. After the Gulf War, the intelligence agencies of the United States, UK, France and Russia have all declared non-proliferation to be one of their prime concerns. Hopefully, they can cooperate in this, so as to increase the effectiveness of the UN Security Council and the IAEA in detecting and taking timely action over attempts at non-compliance with NPT obligations.

3.5 The role of special inspections

It seems preferable to leave the special inspection regime within the IAEA's remit, and focus instead on securing close cooperation between the IAEA Secretariat and the Security Council. It is clear that the special inspection regime is no panacea for the risk of clandestine nuclear activities. Nevertheless, special inspections could contribute substantially to the credibility of the overall verification regime provided that other elements of the verification system are strengthened at the same time.

Experience in other areas of arms control indicates that a 'routine' challenge inspection regime can be particularly effective in building mutual confidence in compliance. For example, the on-site inspection procedures for the Conventional Forces in Europe (CFE) Treaty, Confidence and Security Building Measures (CSBMs) in Europe, and the forthcoming Chemical Weapons Convention all include challenge inspection procedures, where States Parties can initiate on-site inspections. This means that states can initiate inspections to allay their suspicions, without having to substantiate their anxieties to other treaty members or to an international inspectorate. Moreover, if challenge inspections become relatively routine, there is less of an implied accusation of cheating. Thus the diplomatic problems involved in initiating a challenge inspection are reduced, and states are less resistant to accepting them. This approach has been successfully pursued in relation to the CSBM inspection regime initiated at Stockholm in 1986.

The IAEA inspection regime does not involve challenge inspections. However, with good judgement on the part of the Director-General it might be possible to develop an atmosphere in which states become willing to accept timely and relatively unrestricted special inspections to defuse other states' suspicions, even where little evidence of clandestine activities is presented to the IAEA. Such an approach would be closely linked to the 'enhanced' full-scope safeguards regime discussed in section 2.3.

Recent informal IAEA inspections in Iran were treated in this spirit. The inspectors visited a number of sites mentioned by Western governments and the western press as possible locations for clandestine activities. Nothing suspicious was found.[58] In this case, the visit took several months to arrange. With such warning time, the inspections provided less reassurance than if they had been permitted at short-notice. In general, even as confidence-building measures, IAEA-initiated special inspections under INFCIRC/153 paragraph 73(b) should be requested as short-notice and relatively unrestricted inspections. Alternatively, the problem of relatively long warning times could be off-set by developing special inspections as a process lasting several months (or even years) so that a fuller picture of operations at suspect sites can be developed.

Nevertheless, if special inspections thus become associated with mutual confidence-building, and are sometimes accepted by developed as well as developing states, then it will be harder for states to justify refusal to cooperate in instances of real international concern. Once established, the Chemical Weapons Convention could strengthen the IAEA's position in this respect. Challenge inspections of nuclear-related chemical plants (for example, fuel fabrication and reprocessing

---

58. D. Albright and M. Hibbs, "Iraq's quest for the nuclear grail: what can we learn?", op cit (see note 52).

plants) will be permitted under the new Convention. Such new inspection rights will both strengthen the overall NPT verification system and make it difficult for states to prevent the IAEA from exercising special inspection rights at similar facilities.

4 Extending the regime to strengthen the NPT verification system

4.1 Introduction

Even if safeguards are strengthened on declared and undeclared sites within the existing IAEA verification regime, in ways discussed in sections 2 and 3, a number of important verification issues remain. Timely verification that fissile materials have not been diverted from bulk-handling plants such as reprocessing plants, and MOX fuel-fabrication plants, is intrinsically problematic. Stockpiles of 'civil' HEU and separated plutonium in non-nuclear-weapon states pose intrinsic risks of diversion and treaty break-out, as do provisions to withdraw fissile material for use in 'non-proscribed' military activities (for example, submarine reactors). Some sensitive technologies and non-nuclear materials are particularly associated with nuclear weapons programmes: restricting access to them would strengthen the verification regime. Moreover, the IAEA is for the first time confronted with the problem of safeguarding transitional states (previous 'threshold' states which have recently abandoned the 'nuclear option'), and existing procedures may be particularly inadequate for these states.

This section briefly examines these verification challenges, and approaches to tackling them.

4.2 Safeguarding 'ex-nuclear' states

The recent renunciation of military nuclear programmes and the acceptance of INFCIRC/153 safeguards by South Africa, Argentina and Brazil has greatly strengthened the NPT regime. So has the imposed denuclearisation of Iraq and progress towards negotiating a full-scope safeguards agreement with North Korea. Finally, it is to be welcomed that the key non-Russian states emerging from the collapse of the Soviet Union have declared an intention to join the NPT as non-nuclear-weapon states.

However, all of these states have experience relevant to nuclear weapons programmes and retain some elements of the expertise and infrastructure that would be required if they decided to restart such programmes in the future. As Iraq has demonstrated, one should not assume that states under full-scope safeguards have forever abandoned ambitions to build a nuclear weapon. Indeed, it is not clear that the Ukrainian government is entirely committed to abandoning the nuclear weapons still based in its territory. The abandonment of the Brazilian nuclear weapons programme was only reluctantly accepted by the military who, under a relatively weak civilian government, may continue to develop the infrastructure on which a nuclear option could be based. Few states are satisfied

that North Korea has abandoned its weapons programme. If a nuclear-weapons-free zone is ever established in the Middle East or South Asia, special inspection measures will doubtless be required to achieve adequate verification.

In the special case of Iraq, the UN Security Council has established a long term plan designed by the IAEA to prevent Iraq from re-starting a nuclear weapon programme. Under the plan, Iraq's nuclear materials and facilities are to be eliminated or removed from its territory. Thereafter, Iraq is permitted to use radioactive isotopes only for medical, agricultural or industrial purposes, and then only under IAEA supervision.[59] The UN Security Council must give prior permission for any imports, production or use of a long list of nuclear and non-nuclear materials or equipment that could be useful in a nuclear weapon programme. All such permitted activities are subject to safeguards, and a special inspection regime that explicitly allows short-notice inspections at undeclared facilities.

It remains to be seen how this plan is implemented. Its comprehensiveness reflects the difficulty of effectively eliminating a nuclear weapons infrastructure once it has developed, and acknowledges the importance of restricting access to a wide range of sensitive materials and equipment. However, for all other ex-nuclear (or 'transitional') states, there is no special safeguards regime. There are clear political reasons for not seeming to discriminate against or punish such states – it is important to encourage them back 'into the NPT fold'. However, they do pose distinct challenges for the NPT verification regime.

The immediate challenge is to ensure that such transitional states place all relevant nuclear materials under safeguards.[60] When states with nuclear facilities enter into the full-scope safeguards regime, they must provide full operating records of all nuclear facilities so that an initial inventory of nuclear materials and facilities can be verified. Inspectors then carry out wide-ranging special inspections to validate the data.

As the IAEA Director-General noted in his statement to the 1992 IAEA General Conference, 'There is an inherent difficulty in verifying the completeness of an original inventory in a country in which a substantial nuclear programme has been going on for a long time. It requires much effort both by the inspectorate and much openness and cooperation by the inspected party – extending beyond declared facilities and current records. Even so, as the Agency is to report what it has actually seen and verified it is hard, even in the best case, to come to any better conclusion than that after intense analysis and inspection no evidence has

---

59. UN Security Council Resolution 715 (1991), 11 October 1991; Plan submitted to the UN Security Council by the IAEA, summarised in Arms Control Today, November, 1991.

60. See, for example, discussion in L. Spector, "Repentant Nuclear Proliferants", Foreign Policy, No 88, Fall 1992, pp. 21-37.

been found suggesting that the original inventory is incomplete'[61] These remarks were made in relation to South Africa after a year during which the IAEA carried out some 77 inspections of declared and undeclared South African facilities. However, the uncertainties expressed would apply to all the transitional states listed above.

If it is virtually impossible to verify through initial intense inspections that these states have no hidden HEU or plutonium, then they technically pose a special proliferation risk. Arguably there is also an enhanced political risk: it is likely that such countries will retain some politically powerful groups that might favour the resumption of nuclear programmes. These risks are enhanced if the states continue to operate or develop sensitive nuclear facilities or equipment, even if these are subject to normal full-scope safeguards.

Transitional states should therefore be particularly encouraged to join the enhanced safeguards regime discussed in section 2.3. To avoid singling them out, one approach would be to include them in special regional arrangements within the overall IAEA system. To some extent, this process is already underway for several transitional states. The developing regional safeguards arrangements for Argentina and Brazil have already been introduced in section 2.3, and these countries have at least agreed not to maintain stockpiles of HEU. In February 1992, North Korea and South Korea ratified a declaration on the denuclearisation of the Korean Peninsula. Both parties agreed not to manufacture or receive nuclear weapons, to ban reprocessing or enrichment plants, and to set up a joint nuclear control commission and a bilateral inspection regime that could go beyond those required by IAEA safeguards.[62] The possibility of establishing an African nuclear weapon free zone has recently re-emerged, and the IAEA has been asked to prepare proposals for a special safeguards regime for a nuclear-weapon-free-zone in the Middle East.

In principle, such regional arrangements would be a convenient vehicle for arranging enhanced safeguards regimes for ex-nuclear states. However, the ABACC inspection organisation for Argentina and Brazil has yet to be properly established. The special arrangements for the Korean Peninsula are even further from being implemented, and proposals for Africa are still far from being formulated in detail, let alone agreed. The situation in the ex-USSR is still in rapid transition.

Nevertheless, the development of special safeguards arrangements to verify nuclear-weapon-free-zones containing transitional states is a priority. If the NPT

---

61. Hans Blix, Statement to the Thirty-Sixth Session of the General Conference of the International Atomic Energy Authority, op cit (see note 1).

62. PPNN Newsbrief, Spring 1992.

regime is to survive, mechanisms to deepen confidence that such states have no hidden fissile material and pose little threat of NPT break-out need to be substantially developed. It may be hoped that they will also be required as models for the denuclearisation of South Asia or the Middle East in the future – and indeed for the denuclearisation of existing nuclear weapons states. Unpromising as it now seems, the outline arrangement agreed for the Korean Peninsula provides perhaps the most promising model for development.

4.3 Restrictions on 'sensitive' materials and facilities

It shocked many people to learn in 1991 that Iraq quite legitimately possessed about 12.5kg of highly-enriched uranium (91% Uranium 235) obtained under contract from France – enough for one carefully designed nuclear bomb (and a substantial contribution even for Iraq's relatively unsophisticated nuclear weapons designers).[63] Iraq also legitimately possessed a further 10kg of highly-enriched uranium (80% U-235) supplied by the Soviet Union, together with further quantities of irradiated HEU.[64] Ostensibly, these materials were obtained to power research reactors. They had not been diverted for military purposes, and recently at least the irradiated fuel has been removed from Iraqi territory (the removal of irradiated fuel has been delayed pending arrangements being made for storing it). However, the fact that the full-scope safeguards regime only required that these materials be monitored twice a year, indicates a substantial weakness in the existing regime.

There is a strong case for introducing some restrictions on the possession of certain sensitive materials and facilities to supplement IAEA safeguards, to limit the risks of 'break-out' from the NPT and to increase the 'conversion time' for the possible construction of a nuclear weapon.

One priority is greatly to increase restrictions on possession of weapons-grade fissile materials. The IAEA Statutes promote the avoidance of excess 'special' fissile materials. One consequence of the Iraq experience is that, for the first time, the IAEA recently defined 'nuclear-weapon-usable material'. It is 'fissionable material which could be used in the manufacture of a nuclear explosive device, including separated plutonium, uranium enriched to 20% or more in the isotope U-235 (highly-enriched uranium (HEU)), and U-233'. The possession and trade of such materials should now be highly regulated. In addition to the new reporting requirements discussed in section 2, the quantities of HEU or separated plutonium for medical or research purposes should be strictly limited and restrictions

63. L. Spector, Nuclear Ambitions: the spread of nuclear weapons 1989-90, Westview Press, Oxford, 1990, p. 186.

64. D. Albright and M. Hibbs, "Iraq and the bomb: were they even close?", Bulletin of the Atomic Scientists, March 1991, pp. 16-25.

on other uses should be extremely tight. There is now no need to possess such materials to fuel research or other reactors (about half of the research reactors world-wide still use uranium enriched to over 75%, but this is now unnecessary, even obsolete).[65]

In fact, there is a strong case for moving towards a ban on the possession of 'civil' HEU (20% or more U-235) in more than the small amounts that may be required for medical, industrial, or research purposes. Existing stocks should be diluted with natural or depleted uranium, and either stored or used as reactor fuel. Within the terms of the NPT regime, recognised nuclear-weapon states would retain the right to maintain HEU stocks for nuclear-weapon purposes. However, since about 1,300 tonnes of HEU is due to be released as a result of agreed US, Russian and other nuclear disarmament measures, even nuclear-weapon states should either dilute much of their HEU stocks or place them in storage systems where the international community can have confidence that they are secure and that there is low risk of material being lost or stolen.

The collapse of the USSR has intensified fears about loss of control over HEU and other fissile materials. In 1992 there have been a series of attempts to smuggle small amounts of nuclear material out of the former USSR. The most serious incident detected so far involved the seizure of 2.2kg of LEU from a car in a Munich car park in mid-October, with a further 20kg said to be unaccounted for.[66] Instability in Russia has stimulated the US Administration to arrange to buy some of the HEU released from dismantled ex-Soviet warheads. In September 1992 President Bush announced an agreement in principle with Russian authorities to buy weapons-grade uranium for dilution and subsequent sale as reactor fuel. If implemented, the contract will involve the annual purchase of at least 10 tonnes of HEU in the first five years and no less than 30 tonnes annually for the subsequent 15 years.[67] Thus a total purchase of at least 500 tonnes of HEU is envisaged over the next 20 years. For a while, the deal seemed to depend on the outcome of an anti-dumping action brought by Uranium supplier companies that were concerned that the deal will undermine world uranium prices. However, the action has reportedly floundered because it was brought against the USSR – a state that no longer exists.

---

65. A. Schaper, W. Liebert. W. Smit and B. Elzen, "Redirecting and constraining R&D: the case of laser fusion, laser isotope separation, and the use of highly enriched uranium", in H-G Brauch et al (eds), Controlling the Development and Spread of Military Technology, Vu University Press, 1992.

66 "Weapons-grade uranium seized", The Guardian, 17/10/1992; "Uranium hits the black market", The European, 15-18th October, 1992. Note that initial reports that the recovered uranium was highly enriched proved unfounded.

67. Statement by President Bush on the Purchase of Highly-Enriched Uranium from the Russian Federation, reproduced in Newsbrief, Autumn 1992, Programme for Promoting Nuclear Non-Proliferation, Southhampton University, UK; see also report therein.

However, even with such a purchase, Russian HEU stocks will remain large for many years. Moreover, concerns do not only focus on Russian stocks. Programmes to eliminate global civil stocks of HEU through dilution, to make the materials much harder to transfer for use in nuclear weapons, are urgent.

The use of HEU as fuel in nuclear propulsion in military ships and submarines poses a potentially major loophole in any imposition of tough restrictions on the possession of HEU by non-nuclear-weapon states. INFCIRC/153 safeguards have addressed themselves solely to verifying compliance with the NPT commitment not to use nuclear materials for nuclear weapons or any other explosive devices. The NPT was deliberately constructed to accommodate non-nuclear-weapon states such as Italy that at the time were considering acquiring nuclear-propelled ships or submarines and were unwilling to submit such craft to IAEA safeguards. Article 14 of INFCIRC/153 clarifies that, while nuclear materials are being used in 'non-proscribed' military activities (nuclear propulsion, military research reactors), they can be withdrawn from safeguards.[68]

Since many nuclear propulsion systems use HEU identical to that used in nuclear weapons, this loophole rightly raised anxieties at the time. However, for almost twenty years, the use of nuclear materials for such military purposes was confined to the recognised nuclear-weapon states, and the issue received little attention. By the late 1980s, this situation was changing. Argentina, Brazil, Canada, and India were all planning the use or development of nuclear propulsion systems. Fortunately, at least the first three of these states have apparently abandoned such plans for the time being (and the submarine obtained by India has since returned to Russia). However it is possible that these or other states may seek to develop such programmes in the future.

It will be difficult to close this loophole once non-nuclear-weapon-states start to plan seriously for such programmes. This means that it is urgent to develop a combination of restrictions and safeguards for 'non-proscribed' military uses of fissile materials. The prospects of non-nuclear-weapon states agreeing in the near future to a treaty revision to ban such uses are low, especially since nuclear-weapon states have given no indication that they are willing, even in principle, to abandon such nuclear propulsion systems themselves. Informal pressures and supplier regimes can help to limit the spread of such technologies. But an immediate priority is greatly to clarify and tighten safeguards on the fissile materials involved.

Negotiations with Argentina and Brazil on the implementation of full-scope safeguards have already raised this issue. Article 13 of the 1991 four-party agreement between Argentina, Brazil, ABACC, and the IAEA explicitly states that nuclear materials may be withdrawn from safeguards 'while the nuclear material is used for nuclear propulsion or in the operation of any vehicle, including

---

68. See, for example, M-F. Desjardins and T. Rauf, "Opening Pandora's Box?: nuclear-powered submarines and the spread of nuclear wepoans", Aurora Papers No. 8, Canadian Centre for Arms Control and Disarmament, 1988.

submarines or prototypes, or in such other non-proscribed nuclear activity as agreed between the State Party and the Agency'.[69] Initially, Brazil in particular argued that this article meant that its uranium enrichment plants could also be temporarily removed from safeguards. Such an interpretation would have thoroughly undermined the credibility of the safeguards regime. Importantly, however, Article 13 does *not* explicitly state that the facilities that produce the enriched fuel could be removed from safeguards, and the IAEA has been unwilling to accept such an interpretation.

It is very important that safeguards on enriched uranium used in nuclear propulsion systems are made as tight as possible. At the least this implies full and enhanced safeguards on associated enrichment and other facilities, and thorough inspections on the uranium fuel components immediately before they are placed on the submarine and immediately after they are removed. Such fuels would typically remain on the vessel for much longer than a 'conversion time', and so procedures need to be developed to ensure that no uranium fuel is removed from the reactor during periods when the naval craft are in port. Removing such fuel would be a substantial task, and such procedures probably need not involve inspections within the craft itself. They would, however, require inspections to ensure that the reactor remained in place – perhaps involving the use of radiation detectors outside the hull. Now that such inspections seem negotiable between Russia and the United States, there would be no real case for other countries refusing to participate.

The risks of diversion of enriched uranium from military reactors would be greatly reduced if further constraints were imposed. Technically, such reactors need not use HEU: enrichment levels of 5–15% U-235 can be used.[70] Thus the use of HEU (as well as plutonium and U-233) in 'non-proscribed' military activities should be phased out, and a ban placed on its use in new equipment. Any costs (such as conversion costs) such a measure might impose on existing nuclear-weapon states should be regarded as justifiable to limit proliferation risks. Such a ban would be much easier to negotiate now, when few states use nuclear propulsion, than later in the 1990s. Argentina and Brazil have already agreed between themselves not to possess HEU for military or non-military purposes. Needless to say, the prospects for negotiating such an HEU ban would be greatly enhanced if it also applied to nuclear-weapon states, even if it had to be phased in over a long period to reduce transition costs and achieve negotiability.

Restrictions on plutonium stockpiles also need to be tightened greatly. Already, huge amounts of 'civilian' plutonium have been produced: perhaps 650 tonnes

---

69. Article 13, Four Party Nuclear Safeguards Agreement, December 13, 1991, as quoted in J. Redick, Argentina and Brazil's new arrangement for mutual inspections and IAEA safeguards, Nuclear Control Institute, Washington DC, February 1992.

70. A. Shaper et al, "Redirecting and constraining R&D", op cit (see note 65).

world-wide.[71] Some 530 tonnes of this material is estimated to be contained in spent reactor fuel. It would therefore have to be separated in order to be used for nuclear weapons: an expensive process requiring special facilities. However, some 120 tonnes of civil plutonium has already been separated, of which over 70 tonnes is in store (the remainder is contained in fast-breeder reactor or thermal mixed (uranium-plutonium) oxide (MOX) fuel cycles).[72] This separated plutonium is in a form where it could be incorporated into a nuclear weapon (though of uncertain yield, and at risk of exposing the weapon's constructors to substantial radiation doses), and therefore poses substantial risks for proliferation.

The vast majority of the separated civil plutonium is stored in the UK, France and Russia. However, Japan, Germany, Belgium, the USA and India have substantial stockpiles. Moreover, stockpiles of separated civil plutonium are set to increase dramatically during the 1990s. By 1990, some 14 tonnes of plutonium were being separated annually in reprocessing plants. By 2000 AD, on present plans, annual production will be about 25 tonnes.[73] Although there are plans in Western Europe and Japan to use much of this plutonium as fuel in new MOX and fast-breeder reactors, even if all these plans come to fruition on schedule there will be a net increase in separated plutonium stocks of 70 -100 tonnes.[74] In fact, it is highly unlikely that these new plants will come into operation as planned, increasing stockpiles further.

Moreover, it is increasingly likely that such stockpiles will be based in non-nuclear-weapon states. If Japan receives as planned the plutonium produced for it by reprocessing plants in the UK and France, stockpiles in that country will increase by at least 5 tonnes in the next decade.[75] If an international plutonium economy continues to develop, it is only a matter of time before substantial stockpiles are developed in a number of other states also.

There are great security concerns about the sea transport of large quantities of plutonium from Europe to Japan. In March 1988, a US Department of Defence report to Congress judged that 'even if the most careful precautions are observed, no one could guarantee the safety of the cargo from a security incident' if the material were shipped by sea.[76] Malaysia, Singapore and Indonesia have refused permission for the lightly-armed ships to pass through the Strait of Malacca, and

---

71. D. Albright, F. Berkhout, W. Walker, The World Inventory of Plutonium and Enriched Uranium, 1992, Oxford University Press/SIPRI, forthcoming.

72. Ibid.

73. W. Dircks, "The Fuel cycle and international cooperation: an old idea whose time has come?", The Uranium Institute Annual Symposium 1992, The Uranium Institute, 1992.

74. Ibid.

75. J. Tagaki and B. Nishio, "Japan's fake plutonium shortage" Bulletin of the Atomic Scientists, October 1990, pp. 34-38.

76. Quoted in "Japanese Plutonium Shipments Rekindle Debate", Arms Control Today, June 1992, pp. 22.

a number of other states have refused or discouraged passage through their territorial waters. Nevertheless, Japan has begun its first 1.4 tonne shipment from France. Later shipments are planned to comprise about one tonne of plutonium.

There are significant risks of accidents or hijack attempts, particularly if such shipments become routine. However, this should not distract attention from the risks of maintaining the separated plutonium stockpiles themselves. The substantial and growing civil stockpiles of separated plutonium have led to calls for proposals for International Plutonium Storage (IPS) to be reconsidered.[77] Between 1978 and 1984, the IAEA carried out a major study on an international plutonium storage system to be managed by the IAEA. The project was then shelved but could now be revived for plutonium stockpiles, and also for HEU stocks.[78]

Under such a system, such plutonium or HEU would not only be subject to safeguards, but also kept under some form of international 'custody' to reassure the international community about security. Article IX of the IAEA's statute empowers the Agency to make such arrangements, if members decide to make quantities of special fissionable materials available to it. In practice the IAEA studies of the 1980s concluded that international custody would probably mean that the plutonium would be stored at existing civilian reprocessing plants, and that an IAEA inspector and the plant manager would each have a key to the store under a dual-key system.

Even this modest proposal made little progress, mainly due to arguments about appropriate procedures when the plutonium was to be sold or released to its owner. States such as India and Argentina argued that the IAEA should promptly and automatically release the plutonium when requested to do so by the owner, with no questions asked. West Germany, France and the UK argued that the owner should at least declare the purpose for which the released plutonium was to be used and allow the IAEA to verify such use. A third, and larger, group of states wanted the IAEA to have the right to refuse or query the release of plutonium if it doubted that the owner or purchaser had a legitimate need for it.[79]

The US Carter Administration and many others came to the conclusion that any negotiable system for International Plutonium Storage would provide only weak guarantees for non-proliferation and could actually legitimise the possession of

---

77. See, for example, Hans Blix, Statement by the Director-General to the Thirty-Sixth Session of the General Conference of the International Atomic Energy Authority, 21 September, 1992; W. Dircks, Deputy Director-General of the IAEA, "Nuclear Fuel Recycling – the IAEA Perspective", speech at the Japan Atomic Industrial Forum, April 1992.

78. See, for example, C. Van Doren and R. Timerbaev, Letter to editor, Arms Control Today, April 1992, pp. 25, 27.

79. See, for example, D. Fischer, Stopping the Spread of Nuclear Weapons: the past and the prospects, op cit (see note 8), pp. 177-179.

separated plutonium. In the 1990s, there is a case for establishing a strictly controlled International Plutonium Storage system in Europe and Japan, where almost all the civil plutonium stockpiles are presently located. A joint EURATOM-Japan proposal to the IAEA that the Agency manage such a tightly-regulated international storage system jointly with them might be more immediately acceptable to the Board of Governors than a proposal for a global system. Then, if the worst happens and other non-nuclear-weapon states decide to stockpile plutonium, there would be an established and relatively strict regime that they could be pressured to join.

However, such an IPS system should at best be regarded as a stop-gap and unsatisfactory approach to the proliferation problem posed by stockpiles of nuclear-weapon grade fissile materials. It would be better to try to eliminate such stocks. As discussed above, there are few if any civilian requirements for HEU, and stockpiles of HEU should be diluted with natural or depleted uranium as soon as possible. Similarly, separated plutonium and plutonium released through dismantling weapons should be processed in ways that would make it difficult to use for weapons purposes. One promising option is to use the plutonium to make mixed uranium-plutonium oxide (MOX) fuels and burn these in special adapted light water reactors under secure conditions. The waste emerging from this process would be highly radioactive and about as difficult to use for weapons purposes as normal high-level reactor waste. However, such options are still in development, and the economic case for fabricating MOX fuels and using them in special reactors seems to be increasingly weak. It would be just as effective for non-proliferation purposes, and almost certainly cheaper, directly to dilute the separated plutonium with existing highly-radioactive reactor waste.

The latter policy might offend those who are aware of the immense resources devoted to separating the plutonium from reactor waste in the first place. However, it is important to acknowledge that there are now massive plutonium surpluses and that, although separated plutonium has potential value as weapons material, it has little value for civil uses. Fast-breeder reactor programmes are now widely regarded as being uneconomic until at least the middle of the next century. They have only seriously been pursued in Russia, Western Europe and Japan. Russia is in economic crisis. In Western Europe such programmes have either been closed down (as is the case in the UK and Germany) or are indefinitely suspended (as for the Superphenix in France). In Japan, the plans to run the prototype Monju fast-breeder reactor remain officially in place, but they are coming under increasing criticism (including from the powerful nuclear utility companies).[80]

The growing plutonium surplus also puts into question the requirement for reprocessing programmes. At present these are concentrated overwhelmingly in

---

80. "World status report: Plutonium", Energy Economist, May 1992.

France, UK, Russia, Japan and India. However, the possible spread of reprocessing technology poses severe risks for the NPT. The problems of achieving SAGSI detection goals through safeguards at reprocessing, fuel-fabrication and other nuclear bulk-handling plants have already been noted in section 2.2. The current construction of what the IAEA has identified as a reprocessing plant in North Korea (called a 'radio-chemistry laboratory' by the North Korean authorities) has generated a great deal of international concern. North Korea is under intense pressure to abandon the project rather than simply accept safeguards, not least from the Japanese government. The concerns are justified, but lack consistency when voiced by Japan and West European states that insist in other international fora that their own reprocessing programmes can be fully safeguarded and are necessary for economic security.

The NPT verification regime would be greatly strengthened if reprocessing facilities were phased out and uranium enrichment plants were greatly restricted and combined with a global ban on producing HEU. To be negotiable, such restrictions would have to include nuclear-weapon as well as non-nuclear-weapon states, at least in relation to their civil programmes. However, there may be a prospect of agreeing to cut-off the production of military as well as civilian HEU and separated plutonium. On 13 July 1992, the United States Administration formally announced that it would halt all production of plutonium and HEU (in fact these had been halted in 1988 and 1964 respectively).[81] Russia and France are considering similar actions, but the UK and China have so far provided no indication that they would follow suit. However surpluses of separated plutonium and HEU discussed above, and the implementation of nuclear disarmament measures, imply that such a ban might be achievable during the 1990s. In terms of verifiability, substantial work has already been carried out on the verification of an a fissile material cut-off agreement. Adequate verification seems quite possible.[82]

---

81. President Bush's Non-Proliferation Statement, summarised in Trust and Verify, No. 30, July/August 1992.

82. See, for example, G. Thompson, "A programme for controlling fissile material", in F. Barnaby (ed), Plutonium and Security: the military aspects of the plutonium economy, Macmillan, 1992, pp. 202-238 and references therein.

5 Nuclear Export Controls and the safeguards system

Since the early 1970s, the NPT regime has been bolstered by multilateral guidelines on nuclear exports established by groups of nuclear supplier states. Between 1971 and 1974 a group of fifteen supplier states, known as the Zangger Committee, agreed a number of 'understandings' on export controls, mutual information exchange, and a 'trigger list' of nuclear-related materials and equipment that should only be exported under IAEA safeguards. Later, in 1976, a second suppliers group, known as the London Club, agreed to a set of Nuclear Suppliers Guidelines which extended export controls to a range of technologies associated with reprocessing, enrichment and heavy water production plants. The London Club also agreed to exercise restraint in the export of such sensitive technologies and to seek commitments that imported enrichment technologies would be used only to produce low-enriched uranium.[83]

The London Club did not meet between 1980 and 1991, although the Zangger Committee did develop its trigger list somewhat during the 1980s. In practice, the implementation of export controls by some members (notably, West European states) was weak and there were important loopholes in the regime. Since early 1991, the export control regime has been considerably tightened and extended. In March 1991, the nuclear suppliers group met at The Hague, and established a working group 'to examine all possible arrangements that supplier countries could use to control nuclear related dual-use items' (that is items with both civil and military applications).[84]

At their meeting in Warsaw on 3 April 1992, the Nuclear Suppliers Group – now comprising 27 supplier states – agreed on common export controls for a list of dual use items and undertook not to transfer nuclear facilities, equipment, components, material, and technology to non-nuclear-weapon states unless they accept full-scope IAEA safeguards.[85] The 27 states involved were Australia, Austria, Belgium, Bulgaria, Canada, Czech and Slovak Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, UK, and USA.

The Nuclear Suppliers Guidelines are not a formal part of the NPT, but they nevertheless form an important component of the non-proliferation regime. Their relevance for a report on strengthening the NPT verification system relates

---

83. See, for example, O. Greene, "Multilateral export controls", in P. Eavis (ed), Regulating arms exports: a programme for the European Community, SaferWorld, September 1991.

84. Quoted in R. Timerbaev, "A Major Milestone in Controlling Nuclear Exports", Eye on Supply, No 6 Spring 1992, Monterey Institute of International Studies, pp. 58-65.

85. Ibid; see also PPNN Newsbrief, Summer 1992.

both to their links with the full-scope safeguards system and to the information exchange and consultations between the members of the Nuclear Suppliers Group that is involved in an export control regime.

Firstly, by restricting the export of certain categories of technology to states that accept full-scope safeguards, the Nuclear Suppliers Group has increased the incentives for states to join the IAEA/NPT verification system. It would have been much better for the non-proliferation regime if such a requirement had been imposed twenty years ago. Recent changes of policy, notably by France, the UK, and Germany, allowed this requirement to be agreed. Nevertheless, anticipation of such requirements was reportedly one of the factors that persuaded Argentina and Brazil to accept such safeguards.

However, as discussed in section 2, the full scope safeguards regime remains weak. It would both reduce the proliferation risks and encourage participation in the enhanced full scope safeguards system proposed in section 2.3 if access to sensitive nuclear related technologies were further restricted to states that opted to join the enhanced safeguards regime. Similarly, states that do not cooperate in a timely way with requested IAEA special inspections should be denied access to proliferatory technologies, and indeed perhaps other technologies.

Secondly, effective export control regimes involve supplier states in close consultations over sensitive exports. The NPT verification regime depends partly on the effective monitoring of the international trade in sensitive technologies. Iraq succeeded in purchasing a wide range of sensitive technologies through the use of front companies and a wide range of suppliers, particularly in Western Europe and North America. The nuclear suppliers group should improve their coordination and also keep the IAEA fully informed. The data collected on dual- and nuclear- technology trade would contribute significantly to any IAEA register of exports and imports of sensitive materials and technologies (as discussed in section 2.3).

There are certain technologies that the nuclear supplier group should consider restricting entirely. In view of the discussion of Section 4.3, these may include HEU and plutonium, reactors requiring HEU as fuel, and reprocessing or enrichment technologies. It may also include new proliferatory technologies, such as Laser Isotope Separation. As was also discussed, such restrictions would be more just and effective if the supplier states themselves phased out large scale use of such equipment or materials.

It is also important that new nuclear suppliers adopt the new Nuclear Supplier Group Guidelines and also keep the IAEA informed of exports they are associated with. China is particularly significant in this regard: it does not yet accept full-scope safeguards as a condition of supply. Brazil and Argentina are likewise not part of the nuclear suppliers regime, although the latter state has indicated that it

will abide by NSG guidelines from now on. The position of Ukraine, Belarus, and Kazakhstan in this context remains unclear. However, it is extremely important that these new states are fully integrated into the nuclear suppliers regime, as well as joining the NPT as non-nuclear states.

6 Conclusions

The Non-Proliferation Treaty regime has developed rapidly over the last two years. It has been greatly strengthened by developments such as the accession to the treaty by France, China, and South Africa, the acceptance of full-scope safeguards by Argentina and Brazil, and the tightening of Nuclear Supplier Group Guidelines.

The period between now and 1995 is likely to be a turning point for the NPT. With the end of the superpower nuclear arms race, radical nuclear arms reductions, and the possibility of full cooperation on NPT issues amongst the permanent members of the UN Security Council, the non-proliferation regime could be greatly strengthened. Indefinite extension of the NPT could be assured at the 1995 Extension Conference with widespread expectations that the regime will become truly global and reliable. Alternatively, however, UN Security Council cooperation on this issue may prove short-lived. The fragmentation of the Soviet Union, growing multipolarity and regional insecurity, and the spread of sensitive proliferatory technologies and stockpiles of fissile materials, could lead to new nuclear weapon states and incomplete 'denuclearisation' of states like Ukraine and Kazakhstan. Brazil and South Africa may also retain elements of a nuclear weapons 'infrastructure' remain 'suspect' states. In this context, it may prove difficult to prevent the 1995 Review Conference from breaking up amidst mutual recriminations. At best, the NPT would receive half-hearted endorsement with wide expectations that proliferation is inevitable.

The revelations about Iraq's clandestine nuclear weapons programme have rocked confidence in the NPT's verification regime. The limitations of present full-scope IAEA safeguards, long appreciated by specialists, have now been brought out into the open. International attention is now focused as much on verifying that existing NPT members are complying with their treaty obligations as it is on limiting proliferation by states that have not yet joined the NPT.

6.1 Building Confidence

Lack of confidence in the verification system could undermine the non-proliferation regime. Unfortunately, although it takes years to establish the credibility of a verification regime, confidence in it can quickly be destroyed by one major failure. Protests from the IAEA that the full-scope safeguards system was not really designed to provide reliable verification of non-proliferation, though valid, are beside the point.

For years the governments of IAEA member states, and sometimes the Agency itself, had encouraged the impression that it *was* so designed. In fact, the NPT verification system largely relied on national intelligence services to detect covert

nuclear weapons programmes, and nuclear activities at undeclared sites. In the case of Iraq, the system of informally relying on national intelligence services to bolster the safeguards regime failed miserably. Such intelligence services were apparently slow to draw the attention of governments to the existence or extent of Iraq's programmes to develop weapons of mass destruction. Even after the 1991 Gulf War, they were surprised and sceptical of information provided by Iraqi defectors. Most importantly, as their intelligence services began to emphasise concerns about Iraqi programmes, their governments tended to play them down, in the interests of trade or perceived foreign policy interests. The IAEA was apparently unaware of the intelligence reports – in any case the agency did not appreciably increase its scrutiny of Iraqi activity, still less initiate special inspections. If anything, some senior IAEA officials tended to be publicly sceptical of reports of Iraqi covert programmes. Finally, the case of Iraq demonstrates the great weaknesses in the scope and implementation of nuclear and dual technology export controls. Now international confidence in states' compliance with the NPT can only be restored or maintained through a substantial strengthening and extension of the overall NPT verification regime.

Deficiencies in current safeguards

The limitations of the established full-scope IAEA safeguards system are manifold. They focus only on checking that 'civil' fissile materials at facilities declared to the Agency by member states have not been diverted to military purposes. Further explicit constraints are that safeguards should: not hamper international trade in nuclear equipment or fissile materials; avoid as far as possible interfering with a states' nuclear activities or the operation of its facilities; and maintain confidentiality over any information obtained as a result of inspections that does not explicitly relate to diversion of nuclear materials. Until recently, in practice the IAEA officially had to ignore information other than that provided by the inspected state or gathered by its own inspectors. Thus, IAEA/NPT safeguards in practice provided no check on activities at undeclared sites, except to the extent that confirmed cases of 'material unaccounted for' (MUF) would increase suspicion of the existence of such sites. Safeguards imposed no restrictions on: the development of a nuclear weapons infrastructure; the design and testing of the non-fissile components of a nuclear weapon; or the accumulation or import of nuclear weapons-grade fissile materials.

Even the safeguards on fissile materials at declared sites are inappropriate or inadequate in several respects. Full-scope, routine IAEA safeguards procedures have been specified with great precision and detail in ways that reduce their effectiveness. There are serious limits on the frequency, intrusiveness and intensity of such inspections, particularly in 'facility attachment' agreements, that particularly limit safeguards on the medium- or small-sized facilities that are frequently an object of concern in 'suspect' states. Inspectors are limited in their routine

inspections to 'strategic points' in facilities, and their visits may be delayed and constrained by visa restrictions.

Inappropriate methodologies

The methodologies used to determine the 'appropriate' (in practice, maximum) inspection effort at a facility take little account of the relative proliferation risks. They are largely determined according to the amount of fissile material (relative to the 'significant quantity' deemed necessary for a crude nuclear weapon) at each facility. Thus states such as Canada with large fuel cycles are subject to intensive inspections whereas Iraq, with just over one 'significant quantity' of HEU, distributed over two sites, was until 1991 inspected only about twice a year.

Moreover, there are no restrictions on nuclear bulk-handling facilities (such as reprocessing, enrichment and fuel fabrication plants) for which it is particularly difficult to verify reliably that a significant quantity of fissile material has not been diverted. The IAEA has no right to insist that facilities are designed to facilitate safeguards. There are exemptions from safeguards for fissile materials used for 'non-proscribed' military purposes such as fuelling military research reactors or nuclear propulsion systems. At present only nuclear-weapon-states use nuclear propulsion for naval vessels, and such bulk-handling plants are also overwhelmingly based in these states and their close allies in Europe and Japan. However, this may not be the case in the future if present policies remain. As such plants and technologies spread, these loopholes or weaknesses in the safeguards regime will become extremely serious.

Lack of resources

The IAEA inspectorate is seriously under-resourced, so the actual number of inspections made each year can often be well below those indicated even by the minimal informal guidelines. Until 1992, IAEA budgets had been frozen for several years, in spite of increased demand and concerns about proliferation. For 1992/3, a small increase in real terms has been agreed, but in fact IAEA resources may actually decline substantially – the former states of the USSR have defaulted over the last two years and are unlikely to be able to meet their commitments this year. Such budgetary constraints are inexcusable given the relatively small sums of money involved and the importance of the NPT regime. They can partly be explained by the fact that the major donors believe that safeguards are mostly misdirected: Japan and Germany are not enthusiastic about budget increases when they know that even now, some 70% of the safeguards budget is allocated to inspections of themselves, Canada and Western Europe. Moreover, an informal guideline has been established to roughly balance the safeguards and technical assistance budgets: for every two dollars extra in IAEA budgets, about one will

be allocated to nuclear assistance programmes whose importance for third world development is not always clear.

Political will

Finally, there has been inadequate political will and institutional culture for implementing effective safeguards. Many in the IAEA inspectorate have tended to act as scientific or technical auditors or as experts in developing safeguards equipment for materials accountancy, and have lost sight of their key role as active investigators alert to possible non-compliance with NPT obligations. Moreover, the non-proliferation concerns have often been subordinated to states' broader foreign policy interests, with the implication that powerful states' intelligence investigations and pressures to ensure compliance with the NPT have been inadequately and inconsistently focused on countries with whom relations are already poor for other reasons.

6.3 Structure of the Verification Regime

The inadequacies of the existing safeguards system have prompted radical proposals for a wholesale re-organisation of the NPT verification regime. One class of proposals aim to transform the IAEA so that it focuses solely on verification functions, and does so with greater powers and investigative zeal. An alternative type of proposal aims to relieve the IAEA of prime responsibility for verifying the NPT, and transferring it to a permanent version of UNSCOM working directly under the UN Security Council.

There are valid arguments in favour of either of these approaches. The present full-scope safeguards system and the terms of the NPT reflect the economic expectations of nuclear technology and the political priorities and compromises of the late 1960s and early 1970s. If we were constructing the regime now, we would probably do it differently. The verification regime therefore needs major reshaping and reform to be most appropriate to challenges in the 1990s and beyond. However, this report argues that attempts to implement the radical proposals for restructuring outlined above risk being counterproductive.

Concerns of developing states

Fundamental renegotiation of the institutions and terms of an established regime is characteristically a difficult and controversial task. One of the great strengths of the existing nuclear non-proliferation regime is that it is based on an international treaty signed by the vast majority of states. In the medium term, non-proliferation cannot effectively be imposed by powerful or supplier states. Unless

the terms of the proposed reshaping of the regime take adequately into account the interests and fears of developing states, attempts at radical reform could in fact cause the regime to weaken and fragment. It is vital to avoid putting the success of the 1995 NPT Extension Conference at serious risk. If nuclear-weapon states and their allies try to override developing states concerns and impose a new verification regime largely directed at them, then many non-nuclear states may incline to decide in 1995 to make the removal of the discriminatory nature of the regime, in which some states are allowed to retain nuclear weapons, a condition for a second extension of the NPT. The Extension Conference could fail to achieve a long-term extension of the NPT.

If a very substantial strengthening of the verification regime is to be achieved with wide consent, it does not seem astute to link it with a removal of technical aid to developing states, as one type of radical proposal advocates. The realities of international negotiation are that many developing states will be seeking increased aid in exchange for 'concessions' to developed states concerns about verification of compliance. Explicit linkage between aid and improved verification seems a small price to pay if it can be used to strengthen the NPT regime. The fact that the IAEA is a potential source of technical aid as well as a verification agency provides an additional incentive for states to join and cooperate. Nevertheless, it would be appropriate to reform the type of aid available to broaden its scope beyond solely nuclear technologies and with explicit recognition that some nuclear technologies are inherently proliferatory and should be restricted.

Involvement of UN Security Council

The second type of radical proposal referred to above would be widely regarded with suspicion by non-nuclear weapon states. Transferring authority for NPT verification from the IAEA Board of Governors to the UN Security Council would involve a transfer from an institution in which non-nuclear states are powerful and well-represented to one in which the nuclear-weapon states are entirely dominant. Many developing states would be particularly suspicious that the NPT verification regime was being co-opted by the United States and its allies as an instrument to pursue their great power interests. A more limited proposal that the UN Security Council takes over only the special inspection regime, leaving routine safeguards in IAEA hands, would not substantially reduce such concerns: the use of such intrusive inspections at undeclared facilities as a coercive instrument is what some states particularly fear.

Such a transfer of authority for NPT verification to the UN Security Council would not necessarily strengthen the regime in practice: it would leave the entire safeguards system vulnerable to veto by one or more P5 members. Nevertheless, there is a good case for much closer involvement of the UN Security Council in

the implementation of the NPT verification system. The UN Security Council is the only body in a position to enforce the regime, and close cooperation between the P5 and the IAEA Secretariat can reinforce the Agency's authority and improve its access to intelligence information.

7 Proposals For Action

The overall approach

The approach recommended in this report is to aim for substantial reform and an overall strengthening of the existing NPT verification structures, creating an enhanced full-scope safeguards system and an effective special inspection regime operated by the IAEA, bolstered by strengthened export controls, close links with the Security Council, and effective communication between national intelligence services and the IAEA.

Some tend to argue that there are no serious weaknesses in the safeguards regime as it relates to declared sites, and that attention should focus on developing a special inspections regime directed at undeclared activities. Saddam Hussein, for example, chose largely to establish a parallel covert nuclear programme rather than to divert substantial quantities of safeguarded nuclear material. However, special inspections are no panacea for the weaknesses of the existing NPT verification system. In practice they can only operate effectively in conjunction with an enhanced safeguards system relating to declared facilities and a strengthening of the other elements of the NPT verification system listed above.

Some important aspects of the regime require renegotiation, particularly in relation to the recognition that the spread of certain fissile and other materials and sensitive technologies is inherently proliferatory and should be restricted.

To facilitate agreement for such reforms, nuclear weapons states should be more willing to be subject to safeguards and restrictions themselves. However, until the 1995 NPT Extension Conference at least, the fundamental terms and institutions of the NPT regime should not be radically challenged.

Safeguards at declared sites

- As of October 1992, the most substantial measure undertaken to strengthen safeguards has been the requirement that preliminary information on new nuclear facilities or modifications to existing facilities must be provided to the IAEA as soon as a decision to authorise construction has been made. This information must then be periodically updated during construction.

- This reform will enable the IAEA inspectorate thoroughly to monitor construction of nuclear facilities from an early stage and will facilitate the timely use of diplomatic pressures or export controls if necessary. It will expand the 'routine' safeguards system to cover nuclear facilities even if nuclear materials have yet to be introduced.

- This reform should be implemented rigorously, and failure to comply should be reported as a serious breach of safeguards.

- Apart from this, all that has been achieved in relation to declared sites is agreement to establish a voluntary reporting system for exports, imports and production of nuclear and nuclear related materials that are not reported under existing safeguards agreements.

Priorities for further strengthening

- The establishment of improved transparency and a universal system of reporting imports, exports, and production of all nuclear materials including ore concentrates and also of sensitive non-nuclear materials and equipment particularly relevant to nuclear weapons programmes.

- Increasing the capacity for frequent inspections at declared facilities, particularly in states with relatively small nuclear programmes where, for example, a significant quantity of fissile material might be divided between two or more sites. This requires establishing flexibility in the frequency, intensity and timing of inspections by removing many of the restrictions on inspections that have been imposed by states through facility arrangements, visa restrictions and such like.

- The Board of Governors should insist that states accept all inspectors approved by the Board and allocated by the Secretariat (except perhaps in the case of certain 'sensitive' facilities for which special arrangements can be agreed) and either waive visa requirements for them or issue long-term multiple re-entry permits.

- Changes are also required in the guidelines for inspections. Most immediately, a reduction by some 50% of the amounts of fissile material deemed to constitute a 'significant quantity' is recommended.

- A change of inspection guidelines is necessary so that they become less 'facility-oriented' and more directed towards monitoring states' overall nuclear-related programmes.

Undeclared facilities

- In relation to undeclared sites, the Board of Governors' confirmation that the IAEA had the right to conduct special inspections is welcome but it failed to resolve several key disputes about the scope and character of such rights and the procedures according to which they might be exercised.

- An effective NPT verification regime must include real and usable provision for special inspections at undeclared facilities. 'Managed access' procedures, such as those developed in the Chemical Weapons Convention, could help protect commercially and militarily sensitive information.

- A widely acceptable special inspection regime cannot be directly modelled on UN Security Council Resolutions 687 and 707 aimed at Iraq. States are not going to allow inspectors to roam around their country in a broad search for possible hidden nuclear material or facilities. Moreover, many states will object to short-notice inspections at undeclared sites. In practice, the UN Security Council will not enforce such a system except in special circumstances.

- The statement by the UN Security Council that proliferation of weapons of mass destruction poses a threat to peace and security is an important advance, but the relationship between P5 states and the IAEA in terms of intelligence provision and cooperation remains unclear.

- The IAEA Secretariat needs to have effective access to information from national intelligence services and other outside bodies if they are to be able to implement a special inspection regime. Inspectors need to know where to look.

- This will require the establishment of a special group of IAEA advisors to the Director-General composed of a few officials trusted by the relevant intelligence organisations. Perhaps the best approach would be to establish a permanent version of the team set up in relation to special inspections of Iraq, though political sensitivities may mean that this has to be developed informally. Information provided to the IAEA on possible clandestine activities would be evaluated by this unit and would not be available to other IAEA officials or member states.

Special inspections

- The decision as to whether there are sufficient grounds for suspicion to warrant a special inspection should in the first instance be the responsibility of the IAEA Director General.

- If the state concerned refuses to agree to such an inspection, the matter would be referred to the Board of Governors. However, in general the Board should not become involved with the details of the case. If the state cannot be persuaded to accept the requested inspection within a few days, the matter should be referred to the UN Security Council as a matter of course.

- The UN Security Council must therefore play an important role if the special inspection regime is to be effective.

- However, it is important to realise that such an inspection regime will have limitations. The Security Council will normally be prone to the same tendencies to procrastinate as other international bodies. Short notice inspections will not normally be possible if the suspected state is unwilling to cooperate.

- The Director General must be cautious in initiating special inspections for such states. Information is inevitably ambiguous, and states wishing to undermine special inspection procedures can cause embarrassment by provoking unwarranted or misdirected inspections. Nevertheless, special inspection procedures could be an important element in a strengthened verification regime, especially if the Director General exercises good judgement and succeeds in making such inspections seem somewhat routine.

Establish an 'enhanced' full-scope safeguards system

- The IAEA should aim to establish special agreements with states to adhere to an 'enhanced' full-scope safeguards regime.

- States would be asked to participate in the reporting system outlined above, accept obligations to design nuclear-related facilities in consultation with the IAEA to ensure that they are highly amenable to effective safeguards, and agree to accept short-notice or challenge inspections at declared sites subject to few restrictions.

- It is probably impossible rapidly to achieve agreement with all IAEA states to accept such enhanced full-scope safeguards. So initially only a fraction of states under full-scope safeguards might join. However, the objective would be gradually to extend membership.

- One incentive to join the enhanced full-scope safeguards regime would be that the increased confidence that members were fully complying with their NPT obligations would allow the IAEA to reduce the average number of inspections to which they were subjected. States like Japan and Canada could find such an arrangement particularly attractive.

- The IAEA could then further refocus its safeguarding resources towards states that remain in the 'old' full-scope safeguards regime.

- Export control regimes to limit trade in nuclear and dual-technologies should insist on membership of the *enhanced* full-scope safeguards regime *before* authorising sales of sensitive equipment or materials.

Increasing and refocusing safeguards resources

- The IAEA safeguards budget needs to be increased substantially in real terms. It was inadequate even before 1990. Now shortage of resources threatens to weaken the safeguards system very substantially: the demands upon it are unprecedented and due to increase rapidly, while the money available to IAEA safeguards may actually be less in 1993 than in 1990 because several of the states of the former Soviet Union will be unable to pay their dues in full.

- The block on IAEA budget increases can partly be explained by major donors' criticisms of the way in which IAEA safeguards resources are allocated. The new partnership arrangement with EURATOM should allow the IAEA to divert the large fraction of its resources presently devoted to safeguards in Western Europe for use in areas of the world for which concerns about possible proliferation are greater.

- Partnership arrangements between the IAEA and regional safeguards organisations need to be agreed and designed with caution. A model agreement appropriate for EURATOM — an established and reliable organisation with which the IAEA has a long relationship and which serves a region of low military tension — may not be appropriate for other regions.

- The recent IAEA agreement with the Argentina-Brazil Agency for Accounting and Control of Nuclear Materials (ABACC) is welcome as part of the process of bringing these two Latin American states within full-scope safeguards. However ABACC is as yet inadequately developed, and there are particular verification concerns for transitional states such as Argentina and Brazil.

- The IAEA must reserve and regularly implement the right to conduct its own inspections and otherwise verify compliance with non-proliferation obligations. Such partnership arrangements should not become a vehicle for informal or formal constraints on independent IAEA inspections.

Reforming IAEA culture

- The non-investigative culture within the IAEA inspectorate needs to be changed: it is currently over-focused on the technical challenges of materials accountancy in advanced member states. The IAEA should operate more explicitly as an organisation tasked with the overall verification of the NPT, implying a requirement to develop expertise in a range of areas relevant to nuclear weapons programmes, and not just in nuclear materials and nuclear engineering.

- Thus inspectors need to be well-informed about the proliferation risks relating to each member state, using information from outside sources as well as from the

state concerned and the inspectorate itself. A system of 'country officers' needs to be fully established, tasked with analysing all nuclear activities in the assigned country. Site inspectors should be encouraged to be alert to unusual or suspicious circumstances and to report these and follow them up.

- However, the present inadequacies of the IAEA culture cannot fully be explained by inadequacies in the inspectorate or secretariat. It is mainly a consequence of constraints imposed by major states – initially in the 1960s and early 1970s by the USA and its allies to accommodate Germany and Japan and more recently by developing states. To change the way IAEA inspectors operate, the Director-General, backed by the Board of Governors, must endorse and consistently back a more intrusive and investigative approach.

Increased acceptance by nuclear weapon states of safeguards on civil facilities

- Nuclear weapons states should agree to accept 'enhanced full-scope safeguards' on all their civil nuclear facilities. This would make it easier to persuade non-nuclear weapons states to accept a strengthened safeguards system and also indicate sensitivity to the discriminatory nature of the NPT.

'Ex-threshold' or 'transitional' states

- Verifying 'ex-threshold' or 'transitional' states, such as Brazil, South Africa or North Korea, poses particular challenges. Pre-eminent amongst these are the problems of establishing their initial inventories of fissile materials.

- After years of unsafeguarded activities, it is extremely hard to ensure that fissile materials have not been hidden. For example, 'ad-hoc' initial inspections at declared and undeclared sites have been extensively used in South Africa in an attempt to validate initial data, but they cannot provide reliable reassurance. Moreover, such states will typically retain expertise and infrastructure relevant to a nuclear weapon programmes. Powerful groups inside such states may continue to harbour nuclear ambitions.

- These additional proliferation risks posed by ex-nuclear weapon programme states should be recognised. Confidence in compliance would develop over time if they were particularly encourage to join the enhanced safeguards regime recommended above, and also to accept within agreed constraints, special inspections at undeclared sites. They may be more inclined to do so if the same enhanced regime is also accepted by developed non-nuclear-weapon-states such as Japan, Sweden and EC countries, which also have the technical capacity to

establish a nuclear weapons programme relatively rapidly, raising possible similar concerns.

Closing loopholes

- Provisions in the NPT and IAEA INFCIRC/153[86] for states to withdraw fissile materials from safeguards for use in 'non-proscribed' military activities (such as nuclear reactors or nuclear propulsion systems) provide dangerous loopholes in the NPT verification system that could weaken the regime in the future if not tackled now.

- A full safeguards regime should be designed and imposed for such fissile materials at all times except when they are contained in the reactor on board naval vessels.

- The use of HEU and separated plutonium for civil purposes should be highly restricted, and it should be phased out from use in 'non-proscribed' military activities. Low-enriched uranium is sufficient for use as fuels in all categories of reactor.

- Existing stockpiles of HEU (whether civil or released through nuclear disarmament) should be diluted with natural or depleted uranium.

- Stockpiles of separated plutonium are growing alarmingly, particularly in Japan, France, Russia and the UK. The economic case for fast-breeder programmes has collapsed and MOX-fuel reactors are also uneconomic compared to existing uranium fuel reactors. Separated plutonium poses a very high proliferation risk.

- Plutonium stockpiles should be mixed with high level radioactive waste to reduce the risk of accident or theft, and then placed under safeguards. Burning the plutonium as MOX fuel would also reduce proliferation risks, but this approach is likely to be more expensive and protracted.

- So long as separated plutonium stockpiles exist, they should also be placed under an IAEA international plutonium storage system along the lines identified in IAEA studies in the late 1970s.

- Reprocessing and enrichment technologies should explicitly be recognised as inherently proliferatory and difficult to safeguard. At present these technologies are mainly based in nuclear-weapon states or their close allies. In time, they will spread around the world unless they become restricted and existing plant is grad-

---

86. See footnote 4

ually phased out. Recently enhanced export controls on nuclear and dual technologies are a welcome step to limit such a spread. However, for long-term effectiveness, such controls must be legitimised by restrictions being accepted by the supplier states themselves (both nuclear *and* non-nuclear weapon states).

7.1 Strengthening long-term commitment to the NPT after the Cold War

If implemented, the combination of the measures recommended above would immeasurably strengthen the NPT verification regime. However, it is important to place the verification issue into context. The strengthening of states' political commitment to the NPT regime is the key objective, and this requires more than confidence in compliance.

Recently, the NPT has been greatly politically strengthened by events outlined in this report, such as France and China becoming parties to the treaty and decisions in Brazil, Argentina and South Africa effectively to join (or rejoin) the regime. However, the absence of India, Pakistan an Israel from the regime, linked with the regional tensions in the Middle East and South Asia, continues to threaten its long-term survival. There is also the risk that instability or confrontation in Central Asia or the North Asia-Pacific region could increase incentives for nuclear proliferation. Perhaps most worrying of all is the continuing ambiguity of Ukrainian policy towards nuclear weapons, in which the possibility of confrontation with Russia and the lifetime habits of its ex-Soviet governing elite are probably key factors.

The end of the cold war offers unprecedented opportunities for consistent and determined action by the members of the UN Security Council (P5) and their allies to reinforce the NPT regime and to facilitate and guarantee the development of effective regional security regimes in the above regions of tension. Progress is being made along these lines, but there is a danger of P5 complacency. The traditional desire of great powers in a multipolar world to pursue their national interests and to 'pick and choose' their foreign entanglements remains powerful today.

This tendency must be decisively overcome. The long-term survival of the NPT regime depends at least on the development of an international order which reliably addresses the core security concerns of all states capable of developing or acquiring nuclear weapons – an increasingly large group as technology spreads and plutonium and HEU stockpiles remain high. The strong NPT regime must be perceived by all such states to be in their security interests. Thankfully, this already perceived to be the case by most non-nuclear-weapon states, including most such 'transitional' or advanced civil nuclear states.

However, it is vital that such states perceive absolutely no threat from the nuclear arsenals of the nuclear-weapon states. It is easy for policy-makers i the P5 to persuade themselves that this is already the case, but in fact it is not reliably so. The discriminatory aspect of the NPT regime is often noted, but increasingly treated by the P5 as if it were a ritual incantation of little real significance. It must be accepted that there is little prospect that the nuclear weapon-states will abandon their nuclear weapons in the foreseeable future, and there are profound questions about whether (now that nuclear weapons technology has been developed) it is possible to achieve complete nuclear disarmament. However, it is possible to envisage a world in which the only role for P5 nuclear weapons is as an existential deterrent in the service of the UN Security Council and global security interests. Progress towards this is now a priority.

In this context, multilateral nuclear arms control amongst the P5 is of real importance to the NPT. Recent progress towards a Comprehensive Test Ban Treaty (CTBT), particularly in the form of unilateral moratoria by France, the United States and Russia, is thus an important development, particularly in the historical symbolic importance of a CTBT in NPT Review Conferences. However, now that hopes are raised, it would be doubly damaging if the unilateral process was not soon consolidated in a treaty. Progress in other areas of multilateral nuclear arms control would also be an important indicator that nuclear weapon states were moving in the direction outlined above. These include a fissile material production ban, a broadening of the ABM treaty regime, and nuclear transparency measures between the P5.

Finally, the increasingly universal character of the NPT regime is a real source of strength to it. Thus the concerns of less developed and reliably non-nuclear NPT members should be taken into account so as to gain their strong and consistent support for strengthening the regime. The NPT is unambiguously in their military security interests. However, these states characteristically also have intense economic security concerns. Technology transfer issues are important to them. The strengthening of dual-technology export control regimes by supplier states (and restrictions on exports of reprocessing and other nuclear technologies advocated here) need to be offset by well-funded arrangements for transferring technologies appropriate to sustainable development. Strengthening he NPT so that it survives and develops in the long term cannot come cheaply. Compared, however, to the costs of the nuclear weapon and missile defence systems of the P5, it is good value indeed.

VERIFICATION MATTERS
No 5

VERIFICATION TECHNOLOGY INFORMATION CENTRE
CARRARA HOUSE 20 EMBANKMENT PLACE
LONDON WC2N 6NN
Tel +44 171 925 0867 Fax +44 171 925 0861

VERTIC