Trust and Verify

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Plutonium smuggling

Although there have been many reported attempts to smuggle radioactive materials to the West and convince buyers that they were fissile, some 400 or so cases in the last three years in Germany alone, it was not until May this year that genuine weapon-grade material was found.

- On 10 May 6g of plutonium was found in a garage in Tengen-Weichs, a small town in south-western Germany. This material is reported to have been 99.7 per cent Pu-239, making it more pure than is considered weapon-grade. It is possible that the material had been artificial enriched in Pu-239. The material was discovered after the arrest of a man, Adolf Jăkle, on suspicion of currency fraud.
- On 13 June 0.8g of highly-enriched uranium (87.5%) was seized in Landshut.
- On 10 August 580g of mixed oxide (MOX) fuel was seized at Munich airport. The plutonium content in the fuel was 300-350g and that 87 per cent of the plutonium was Pu-239, making it close to weapon-grade, although it would still need to be chemically separated. This is a higher proportion of plutonium than is normally found in MOX fuel.
- On 12 August a miniscule amount of plutonium, roughly 0.05mg, was seized at Bremen station. The composition of this material is not known and may have come from many sources.

The source of the materials in each case is almost certainly Russia. Although some scientists have attempted to identify the source of the material by analysing its composition, this is hampered by the lack of precise knowledge of the different processes carried out at different Russian facilities.

Material accountancy and control

Part of the problem is the lack of control over nuclear materials in Russia.

Following the dissolution of the Soviet Union, the weakening of central authority in Russia and the its economic difficulties the traditional control systems, armed guards and fear of retribution by the state, no longer have the strength that they once had.

North Korea

A proposal was put to North Korea that converting their planned reactors to 'lightwater' systems would reduce the capability for production of plutonium, which would have security benefits for other states, and make them more efficient in producing usable power.

The work of converting the reactors would be carried out with outside financial and technical assistance, primarily from the US and the IAEA.

Defector's claims

On 26 July a South Korean announcement said that Kang Myong Do, son-in-law of the North's Prime Minister, Kang Song San, had defected, claiming that the North had already manufactured five nuclear weapons. A few days later the South Koreans acknowledged that Kang's claims were not correct.

The '5MW' reactor

A reader has pointed out that the rating often given to the '5MW' North Korean reactor is its electrical output rather than its thermal output which is somewhere in the region of 15MW.

There are two points for consideration. Firstly, the reactor's primary function is declared to be for research rather than power generation and research reactors are classified by their total, thermal output. Second, and more important, plutonium production in a reactor of this type is of the order of 1 gramme per day per megawatt (thermal) output and therefore the difference in rating is significant.

Pakistan and nuclear weapons

In late August, former Prime Minister of Pakistan, Nawaz Sharif, made the following statement at a political rally: 'I confirm that Pakistan possesses the atomic bomb'.

The statement was called 'irresponsible' by the current Prime Minister Benazir Bhutto who said that it was not true. It also provoked a strong reaction from India calling it a 'dangerous course'.

Nawaz claimed later that he had not made the statement in the heat of the moment but that he had made it in an attempt to stop the country's nuclear programme being cut back. Pakistan is under pressure from the US, which cut off aid in 1990, to demonstrate that it has no bomb programme.

UK and intangible technologies

On 19 July, Tim Boswell, British Parliamentary Under-Secretary of State for Further and Higher Education, announced that he was writing to the chairmen of the Committee of Vice-Chancellors and Principals (representing universities) and the Standing Conference on Principals (representing higher education colleges) with regard to 'careful consideration of applications from certain visiting

Editorial Comment

Material Accountancy in Russia

The smuggling of weapons-grade nuclear material from the former Soviet Union is a cause for concern but not panic. The news of recent weeks should be heeded as a warning.

The quantities of material so far discovered are far smaller than those required for even a single weapon. However, if measures to resolve this situation are not started soon, there will be a longer period for material to be smuggled.

The vast majority of the materials of concern are in Russia, most of the rest is in weapons in other states of the FSU which will eventually be moved to Russia.

The problem can only be tackled by the Russians — to demand that Russian materials be placed under international control without similar concessions by other nuclear-weapon states is a political non-starter.

At the core of the problem is the lack of a stringent accountancy system for military-cycle materials in Russia. Such a system may be established by providing Western funds to pay Russian technicians and clerks that are already involved in the military nuclear programme to carry out the work.

There are four important elements in such a system:

- An inventory must be made of military cycle materials, especially the weapons-grade materials, produced by the former Soviet Union; this may be calculated from plant operating records. It is unlikely that the Russian authorities know how much material was produced in total, but this is not surprising as the United States is still 'finding' material it produced but had not been inventoried centrally.
- An inventory must be made of all material currently in weapons, being used in facilities and in storage. This must then be matched against the production inventory and discrepancies, many of which will be legitimate such as scraps and material trapped in filters, accounted for.
- A system of accountancy for material movements between facilities and use of materials in chemical and physical processes must be established. The system will have to account for movements such as material removed from weapons being dismantled and material being moved from dismantling facilities to storage areas.
- A system of auditing needs to be set up to ensure that errors in accountancy are picked up at an early stage. The verification of the accountancy system would mean that attempted diversions of material are detected with greater speed and confidence.

Although the system may be established with Western aid, the results of the inventory should not be given to Western governments unless they also provide such information. To demand that this should happen from the start would only place further obstacles before the system's establishment.

Western assistance for the creation of such a system will have two clear benefits. First, by ensuring that material is accounted for, the likelihood of theft is reduced. Secondly, by providing personnel with incomes, the economic incentives for theft are reduced.

If a fissile materials cut-off is negotiated in Geneva, a materials accountancy system will have to be established for material declared under it. Rather than waiting for such a convention to be completed, it would be far more sensible to start work on materials accountancy now.

Intangible Technologies

'Intangible technologies' — the information carried around in people's heads — are becoming the latest export control demon. What seems at first glance to be a sensible method of controlling technologies could become one of the greatest negative influences on the international non-proliferation norms.

The issue of transfer of high technologies and the possible uses of them for military purposes has another side — the issue of transfer of high technologies for peaceful economic and social development. This is the argument surrounding Article IV of the NPT and the discussion of verification measures for the Biological and Toxin Weapons Convention (BWC) this month.

Why could measures against intangible technologies be so negative? Let us take an example. If you are to develop biological weapons you have to understand how diseases spread; this tells you how much agent is needed for a particular method of dispersal. However, this information is precisely what is required by developing states in their attempts to bring many diseases under control.

There are many instances where leading technologies being studied may be used in some way to develop weapons, but in very few cases is this the likely intent.

The North, quite understandably, wishes to take measures to prevent new states acquiring weapons of mass destruction. Indeed, it is in their best interests to do so. However, this requires political co-operation between states and such co-operation requires trade-offs. The *quid pro quo* in most cases is technological co-operation.

It would be foolish to suggest that the information contained in people's heads was not of proliferation concern; and, in a few specific cases, students may have to have their studies curtailed. However, the suggested controls are too wide and are likely to do grave harm to international relations.

A general prohibition on students from certain states, which is what the proposed provisions will soon effectively become, indicates a lack of trust. Verification regimes are difficult, if not impossible, to establish unless some trust is shown.

In addition, the timing of the recent announcement, and the subsequent indications of the involvement of the security services (notwithstanding their errors in identifying Iraqi students during the Gulf War) may hinder progress at the BWC special conference.

researchers from overseas ... in certain fields of scientific research'.

The information gathered by such visiting students is known in the export control field as 'intangible technologies'. The idea of stricter controls in this area was first proposed by the British Government in March 1993 (see *Trust & Verify*, No. 36, March/April 1993)

The operative paragraphs of the letters sent to the chairmen are as follows:

> As you know, the Government attaches great importance to preventing the transfer of technology related to the development of mass destruction [*sic*]. We have discussed the Government's concern that UK higher education should not be exploited by visiting researchers from overseas as a means of acquiring knowledge of these technologies. I know that higher education institutions share this concern, and I am glad that we have been able to reach agreement on arrangements to help UK universities to ensure that, in the course of their role in developing and disseminating knowledge, they do not unwittingly contribute to the proliferation of these weapons.
>
> We are agreed that, in the case of visiting researchers at postgraduate and postdoctoral levels who might pose a proliferation risk, universities will need to consider carefully whether their applications should be accepted. We both recognise the potential long-term implications of accepting applicants from countries of proliferation concern if their field of research is likely to be of use in the development or manufacture of weapons of mass destruction.
>
> To help universities to assess the risk, the Government will provide information and guidance. Because the focus of proliferation concern naturally shifts from time to time, Foreign and Commonwealth Office will keep the universities up-to-date, through the CVCP, with the current list of countries and technologies where a proliferation risk arises. I hope that university staff involved in considering applications from researchers will take account of this information when reaching their decisions. The Government will be able to offer more detailed guidance in cases or areas where universities express specific concern.
>
> The prevention of proliferation is a shared objective of the developed nations. We are currently discussing with other like-minded countries, particularly within the various export control regimes, the arrangements that they too have in hand, in accordance with their own legislation, for ensuring that the global mobility of researchers in higher education cannot become an avenue for proliferation.

In early September, it became clear that the security services, and in particular MI5, would become directly involved in the monitoring of intangible technologies and the provision of advice to academic organisations.

Reactor-grade plutonium test

On 27 June the United States Department of Energy (DoE) announced that a nuclear test that they had carried out in 1962 using reactor-grade plutonium had used material obtained from the United Kingdom. The announced yield was 'less than 20 kilotons'. The existence of this test had first been revealed in July 1977, although the source of the material had not.

The factsheets issued by the DoE on that day included the following statements:

> The release of additional information was deemed important to enhance public awareness of nuclear proliferation issues associated with reactor-grade

Nuclear materials — some definitions

Two of the major stories in this edition of *Trust & Verify* — the plutonium smuggling and the 1962 US test using British materials — revolve around characteristics of the materials involved.
The use of some terms has led to confusion.

The descriptions of the physical properties of nuclear material relate to the proportions of fissile atoms it contains. In uranium it is the isotope U-235; in plutonium, the fissile isotope is Pu-239, but the material is normally defined in terms of the isotope Pu-240 which reduces the material's usefulness for weapon engineering. For a definition of isotope, see the glossary in *Verification Report 1992*.

Reactor-grade

For plutonium, it used to be that any material in which the proportion of Pu-240 was greater than 7% of the whole was considered reactor-grade. This was the definition in use at the time of the 1962 test. In the early 1970s the new term *fuel-grade* was used to define plutonium in which the proportion of Pu-240 was between 7% and 19% of the whole. Reactor-grade material was then defined as having more than 19% Pu-240.

Reactor-grade uranium is material in which the proportion of U-235 has been raised to a few per cent (low-enriched uranium).
The reason the term reactor-grade is not often used for uranium is that some reactors are designed to operate on natural uranium (0.7% U-235) and a few reactors require uranium of a much higher level of enrichment.

Weapon-grade

For plutonium, weapon-grade material is defined as plutonium in which the proportion of Pu-240 is less than 7%.

For uranium, weapon-grade material is generally considered to be greater than 93% U-235. This is also known as highly-enriched uranium (HEU).

Weapon-usable

Weapon-usable describes any material that may be used to make a weapon, even though it may not be an ideal material and complicate the weapon design.

The term is often used far too loosely, and has been used, for political purposes, to describe material that no designer would ever choose to make a weapon with.

Military versus civil

The distinction between 'civil' and 'military' nuclear materials relates to their source and how they are used, rather than any property of the material itself. In some circles, military materials are known simply as 'non-civil'.

In the nuclear-weapon states, military materials are those that are not covered by international safeguards agreements. The description 'military' does not make any judgement about the fissile content of the material. In fact much of the military material produced in the UK was not 'weapon-grade' and has been voluntarily been relabelled as 'civil' and placed under safeguards.

plutonium that can be separated during reprocessing of spent commercial reactor fuel.

The United States maintains an extensive nuclear test data base and predictive capabilities. This information, combined with the results of this low yield test, reveals that weapons can be constructed with reactor-grade plutonium.

Following the US announcement, Jonathan Aitken, Minister of State for Defence Procurement (shortly before he was promoted to a Cabinet post), stated in a Parliamentary Written Answer:

> My Department was consulted about the announcement [of the test]. We agreed to this information being released.
>
> ... The 1962 test confirmed the technical feasibility of constructing a nuclear explosive device using reactor-grade plutonium. ... There are, though, significant technical difficulties which would complicate the manufacture and storage of any weapon based on reactor-grade plutonium.

Lord Henley, a new defence minister after the reshuffle stated in the House of Lords on 26 July:

> As a nuclear weapon state, the UK maintains military reactors outside safeguards for the production of nuclear material for defence purposes. The plutonium used in the 1962 test was produced in these military reactors and was sent to the US under the terms of the 1958 Mutual Defence Agreement. It is not our practice to give details of the nuclear materials given to the US under these arrangements.

Materials

The 1962 test raises more questions than answers. It seems highly unlikely that the full story has yet been told as the information released so far is contradictory.

In the late 1950s and early 1960s the British military nuclear programme was desperately short of weapon-grade material — the 1957 fire had put the original Windscale piles out of operation and the Magnox programme was behind schedule. Things had become so desperate that in 1958 the British Government, against public opposition, had proposed adapting civil Magnox stations to produce weapon-grade plutonium to be then used by the military, although this was never carried out.

Reactor-grade plutonium is produced when the fuel rods have been extensively irradiated. For example it is known that fuel rods would remain in the civil Magnox reactors for five to twelve years, depending on their position in the reactor and on the reactor itself. To produce weapons-grade plutonium, the fuel rods must be irradiated for a much shorter time. It is practically inconceivable that the military Magnox reactors, the first of which became operational in 1956, would be run on a longer cycle.

However, the British Government have stated categorically that the plutonium was obtained from 'the military reactors at Calder Hall and Chapelcross' and, other than small research reactors, there was no other source at that time for such material.

VERTIC project news

ACRONYM reports

The ACRONYM Consortium, of which VERTIC is a part, have produced two further reports on the test ban negotiations at the Conference on Disarmament in Geneva. *A Comprehensive Test Ban: Setback for an early treaty* was published in July and covers the second session of negotiations. *A Comprehensive Test Ban: Disappointing progress* will be published in early September and will cover the thirdd session of negotiations.

Test ban papers

VERTIC is currently preparing a series of three papers on the theme 'Test Ban Verification Matters' to tie in with issues of concern at Geneva. The papers will be published in the coming weeks.

The three papers will cover entry into force; the use of satellite images; and hydroacoustic testing.

VERTIC seminar

VERTIC will be hosting a discussion meeting on the theme 'Copts, Islamists and the future of the Egyptian state' on Wednesday 28 September at 11.30 am at Carrara House (see address below).

The discussion will be introduced by Dennis Sammut of VERTIC who has recently returned from an extensive visit to Egypt.

Trust & Verify is edited and produced by Richard Guthrie with additional reporting by VERTIC staff and consultants.

Trust & Verify

Trust & Verify is produced by VERTIC 10 times a year. Anyone wishing to comment on its contents should contact the VERTIC office.

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What is VERTIC?

VERTIC is an independent organization aiming to research and provide information on the role of verification technology and methods in present and future arms control and environmental agreements.

VERTIC co-ordinates six working groups comprising 21 UK consultants and 11 overseas advisors.

VERTIC is the major source of information on verification for scientists, policy makers and the press.

VERTIC is funded primarily by grants from foundations and trusts and its independence is monitored by an Oversight and Advisory Committee.

Other publications

In addition to *Trust & Verify*, VERTIC publishes the *Verification* (formerly *Verification Report*) series of yearbooks and a variety of research reports each year. Details of VERTIC publications are available on request.

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