International safeguards: An industry perspective

The civilian nuclear industry has long backed the need for an effective system of nuclear verification

by Gerald Clark

There was considerable relief among the Members of the Uranium Institute in May 1995 that the Conference in New York to discuss the extension of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) had agreed without a vote on permanent extension of the Treaty. The Institute had campaigned for this result. It was a matter of vital importance to its members that the international safeguards regime which had served the civil nuclear industry well for more than 25 years should be thus extended permanently. The terms which were agreed as the price of permanent extension were also fundamentally in the industry's long-term interests.

It is worth examining why this should have been so. Ever since US President Eisenhower launched the civil nuclear age with his Atoms for Peace speech at the United Nations in December 1953 the civil industry has been at pains to show that it is an independent endeavour, quite separate from and in no way linked to the ambitions of ministries of defence. For many years this was an exceedingly difficult, almost impossible task. The civil applications of nuclear energy had their origins in the Manhattan project culminating in the two atom bombs which brought the Second World War to an end, and for many decades after that nuclear rivalry between the superpowers inevitably was uppermost in the public mind. The horrors of a possible nuclear war, fortunately never realised, held a far stronger grip on the public imagination than the developments, however impressive, of the closely related civilian technology.

Nevertheless, as the civilian technology became more distinctive, and its objective, the economic safe and efficient generation of electricity, became an end in itself, it became easier to show that the putative linkage between the two was more imaginary than real. It was also possible to take internationally inspected measures to demonstrate that the work of the civil industry need have no connection with attempts, overt and clandestine, real and imagined, to embark on a nuclear weapons programme.

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The civil/military split

Historically none of the existing five acknowledged weapons States used a civilian programme of nuclear power generation as a stepping stone to their nuclear arms manufacture. Rather the reverse was true. Electricity was a by-product of the early plutonium producers, but once electricity generation became the primary aim, it was also seen that it should be pursued for its own sake, and weapons material production became the province of specially dedicated installations. One reason for this was the usual obsession with national security, but the need to discriminate between appropriate technologies became a more important reason. The retrieval of weapons grade plutonium is incompatible with maximising the output of electricity even from channel reactors. The natural or low-enriched uranium fuel of present day power reactors is unusable as bomb material. Enrichment to the required degree to deliver weapons grade highly enriched uranium involves taking the process much further, involving far more extensive cascades than would be found in a civilian plant.

In other words, for both technical and economic reasons, misuse of the civil technology for weapons production is not the best way to proceed, and in practice the weapons States and the "would be" weapons States have not gone down that route. The development of a civil nuclear power programme is neither a necessary nor a sufficient condition for the pursuit of a weapons programme. However, the civil indus-

try does make use of materials and technical skills which are commonly also used in nuclear weapons programmes. There is thus an onus on it to collaborate fully with any regulatory system which is designed to show that there has been no diversion of material away from legitimate civilian purposes.

It is implicit in the IAEA Statute that it should devise a safeguards system which does just that. The system developed naturally as the technology spread. The arrangements already established by EURATOM for its members were a model. The arrival of the NPT, which came into force in 1970, was the signal for a much more comprehensive system: that of full-scope safeguards, where a signatory country has to apply the Agency's safeguards system to all its nuclear materials. In the course of the next 25 years the value of the system gradually became apparent, not only to the arms-control community, but to the civil nuclear industry, which came to realise the value of the certificate of good conduct which its willing collaboration with the safeguards system provided.

It is easy to deduce from what has been said above that safeguards are more essential for ensuring non-diversion in some parts of the nuclear fuel cycle than in others. Mining, milling, processing and conversion, all of which take place with natural uranium only, are relatively innocuous. The material is far from usable directly in a weapon, and, were it to be diverted, the diverter would still face an enormous task to achieve his ends. It is much more important for the civil industry to be able to demonstrate that the materials arising from enrichment and from recycling are subject to safeguards, and that no diversion has taken place.

Forty years of success

The IAEA and the civil nuclear industry have together developed a safeguards system which has worked well for nearly 40 years. Diversion of material from the civil industry has not taken place. Even those examples which have been held to call the safeguards regime into question, and are the catalysts for current measures to extend the system, are not so much failures of the system but demonstrations that it has worked. Iraq realised that diversion from its existing civil programmes (all of which by 1991 were research reactors and not power generating reactors) would inevitably be detected, so went to very expensive lengths to start its weapons programme from scratch, quite separately from its civil research programme. The imbroglio over the Democratic People's Republic of Korea (DPRK) arose because the IAEA noticed that its rules for the implementation of an INFCIRC-153 type agreement were being flouted, and the DPRK refused to put its house ostensibly in order.

The civil industry had thus come by 1995 to have a lot at stake in the continued health of the international safeguards system. Nuclear power generation is a very long-term business. The existence of a long lasting, preferably permanent, system of international regulation and control has become a necessary condition for the continued existence of a healthy trade in civil nuclear materials and technology. The general acceptance of the IAEA system of safeguards and related measures of materials accountancy and other forms of control is of great benefit to companies and countries involved in the civil nuclear trade. There are now general rules of practice. Much of the trade is mundane and normal. The shipment for which special arrangements have to be made is the exception not the norm. The designers of the Treaty presumably had this in mind in drafting its Article IV. From an industrial perspective, the Treaty has worked. Nuclear power generation has spread from the handful of countries which were pioneers in the 1950s and early 1960s to 30 countries, and nuclear electricity is now 17% of the world's supply.

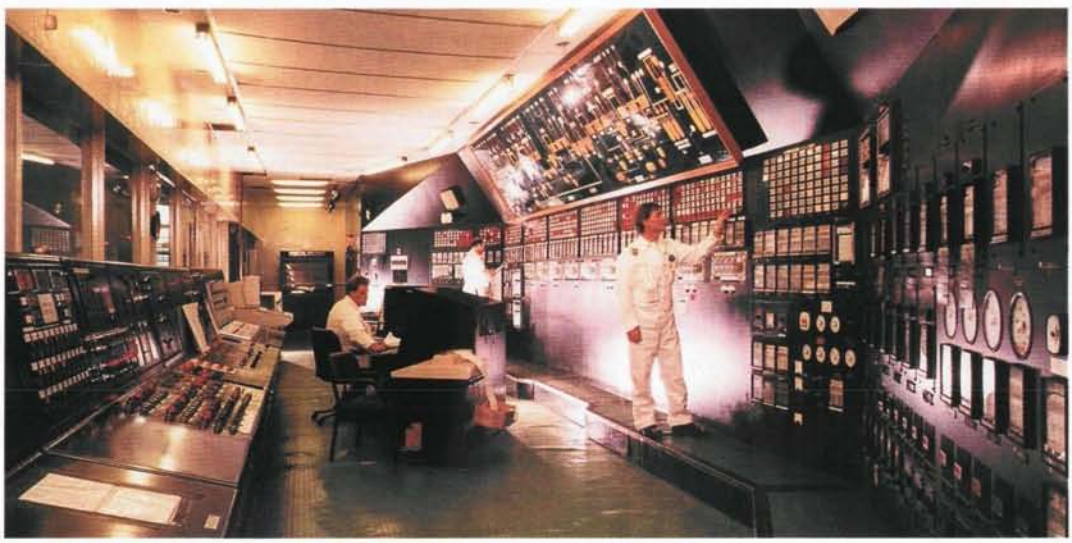
The spread of nuclear technology has not been confined to nuclear power generation. Much of the world relies to a far greater extent than most people realise on the medical, industrial and agricultural applications of radioisotope technology. While some may think that this is relatively small beer, an interesting paper by the American Nuclear Society has demonstrated that in the United States the industries which rely on these technologies are about four and a half times as large as the power-based nuclear industry. Since 1980 the IAEA has processed over $500 million worth of technical assistance in these technologies. None of it would have been possible without the international safeguards system.

Universal application

After 25 years of operation the application of the NPT has become almost universal. Compared with the early years when there were many important countries which were not members of the Treaty, and other regulatory arrange-

ments for the civil nuclear trade were still in widespread use, the present membership of the Treaty has expanded to 184, with very few exceptions remaining outside its ambit. It has therefore become the main regulatory system, with most other arrangements dependent upon it. Even if some of the NPT's achievement of virtually global coverage is of very recent date, the accreditation of members in the last five years is as important for the regulation of the civil trade as for arms control.

The world political climate has completely changed compared with the 1960s when the Treaty was negotiated. The existence of the Treaty has contributed to that change. Countries have gradually become comfortable with the regulatory regime it imposes. The change in climate is perhaps best demonstrated by the contrast between governmental attitudes to the safeguards system in the early years and now. When the Treaty was under negotiation, the proposal for international inspection of areas of activity so close to vital national security interests was an unprecedented intrusion into national sovereignty. This could clearly be seen in the minimalist view of international inspection in support of the safeguards regime which animated the drafting of Article III of the Treaty, and



Today's commercial nuclear industry provides about 17% of the world's electricity. *Above:* Inside the control room at Sellafield's reprocessing plant in the UK. Left: Takahama nuclear plant in Japan. *(Credits: BNFL, JAIF)*

the related "INFCIRC 153" type agreements on the application of safeguards.

Whereas safeguards were originally seen as very intrusive, to the extent that some important States hesitated long before joining the Treaty, there is now strong pressure to extend the system. While there may be differences about the scope of measures to strengthen the system, the principle that it should be strengthened is almost universally accepted. This presents no problems of principle to the civil nuclear industry as it has every interest in the wide acceptance of a well respected and effective regulatory regime. The civil industry is well aware that, if the Treaty had not existed the spread of the benefits of civil nuclear energy would not have been as widespread as they are. But obviously we want to ensure that the implementation of any such "improvements" does not raise serious obstacles to the legitimate trade permitted under the Treaty.

I have so far set out the general arguments why the civil nuclear trade supported the permanent extension of the international safeguards system enshrined in the NPT. Above all, its application over the first 25 years of the Treaty has demonstrated that the expansion of the civil nuclear industry across the world has not led, and does not need to lead, to proliferation of nuclear weapons. (In the 1960s it was widely assumed that by now there would be 20-30 nuclear weapons States. There are still only five declared weapons States, and fewer "threshold" States.) The Treaty has achieved what it set out to achieve in this regard.

Costs and benefits

But it is not without cost to nuclear operators. It is often forgotten in the hurly-burly of diplomatic in-fighting that the system is not an abstract construct but has to be implemented meticulously and constantly, not so much by the inspectors of EURATOM or the IAEA, as by the industrial enterprises which they inspect.

The safeguards requirements stemming from the facility attachments required as an integral part of the INFCIRC 153-type agreements which the Treaty enjoins upon its signatories clearly vary from installation to installation. Little has hitherto been published concerning the costs which the nuclear industry has to bear in order to comply with these requirements. The Uranium Institute did some work on the subject when preparing briefings for the delegates to the NPT Extension Conference, and the figures which follow are based on that work. Our estimates are inevitably very broad, as there are a number of factors, some of which balance each other out, which are very difficult to quantify. These costs arise both in the construction of installations and in operating them.

We estimate that for a new nuclear power station the increase in capital cost, attributable to measures which make it possible to demonstrate that safeguards requirements are being met, lies in the range 0.1- 0.2% of the total cost of the station. This implies a total capital cost of between $2 million and $4 million for a nuclear power station costing $2 billion. For nuclear facilities in which plutonium is being processed, such as reprocessing plants and MOX fuel-fabrication plants, the costs of safeguards equipment are an order of magnitude higher, and lie in the range 1-2%. Thus the additional capital cost in the case of a reprocessing plant costing $4 billion would be from $40 million to $80 million. For a MOX fabrication plant costing $400 million, the extra capital cost would be from $4 million to $8 million.

We estimate that the effect on operating costs of the aggregated effort, and associated expenditure of the industrial enterprises in countries which are party to safeguards, is comparable to the safeguards-related expenditures of the inspecting organisations, the IAEA and EURATOM. In other words, the industry's collective annual operational costs worldwide, ascribable to safeguards-related activities, are of the order of $100 million.

The industry has come to see that this is a price well worth paying for an effective Non-Proliferation regime as it carries with it the associated bonus of a smooth flow of trade in nuclear technologies round the world. It is not surprising that the permanent extension of the NPT was regarded by the Uranium Institute's members as a triumph of good sense. They were not in the least dismayed by the fact that the concessions its supporters had to make in order to achieve it on something akin to a consensus basis included negotiations towards a Comprehensive Test Ban Treaty, preliminary moves towards a fissile materials cut-off agreement, and of most relevance to the civil industry, the IAEA's plans for strengthening safeguards, "the 93+2 Programme". The industry has kept a close watch on these developments, and while it accepts that a strengthening of the system is desirable, it is concerned that the resultant arrangements should be in accord with the principles of good materials accountancy, and should not bear unduly on countries with a good record of compliance. ❐