

Chapter Five

Undeclared Nuclear Activities and the IAEA's "93+2" Programme

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This is a brief examination of the International Atomic Energy Agency's "93+2" programme for strengthening its comprehensive safeguards, with respect to declared nuclear activities.

The Problem and the Argument

The argument presented here is based on the following sets of considerations: first, the nature of the Agency's "93+2" programme; second, three types of threats which the Agency is being asked to deal with; and, third, the detection and deterrence functions of a verification system.

The IAEA created the "93+2" programme in the aftermath of the discovery of Iraq's nuclear weapons programme, as a response to the challenge posed by undeclared nuclear activities and to deal with resource pressures arising from the combination of increasing demands and constrained budgets. That programme consists of three parts, the first largely seeking more information from states about their nuclear activities, the second seeking broader access to locations, and the third, ways of optimizing the use of the current safeguards system. Since the third set of measures is driven primarily by cost considerations, it will be ignored here. The "93+2" programme has further divided these measures into two parts, the first consisting of those which, the Agency argues, can be implemented under existing authority in the INFCIRC/153 safeguards system, and the second consisting of measures requiring additional authority. Measures in Part 1 are now being implemented, but those in Part 2 are still the subject of consultations. The final shape of the "93+2" programme is therefore still unknown. For the purposes of this chapter, the Part 1 mea-

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asures will be taken as forming the *minimum case*, while a combination of Part 1 and at least some version of Part 2 measures will be taken as constituting the extended case.

In trying to strengthen its safeguards, the IAEA must deal with three types of threats. The first, the threat of *diversion of declared nuclear materials* to unknown or prohibited uses, has been the primary focus of the Agency's efforts in the past, and will continue as such in the future. Whatever else we might want the Agency to do, it *must* be able to perform this task adequately. The other two touch on the *completeness of declarations of nuclear activities and especially of nuclear materials*. Safeguards against diversion are relevant to these threats as such safeguards may detect the entry of undeclared nuclear material into a safeguarded stream or facility, or the unauthorized exit of nuclear material (whether or not safeguarded) from such a stream or facility, or may detect the suspicious use of such a facility. Such *in-situ* and boundary transgressions may indicate, by implication, the existence of other clandestine activities, whether on-site or at unknown sites. Other than in this connection, the role of safeguards against diversion will be ignored in this chapter.

The second type of threat arises from the possible co-location of undeclared activities on sites with declared activities. The issue here is not only the possibility of the diversion of declared nuclear materials, but also that prohibited activities involving undeclared and separate production streams may be benefitting from this co-location. The marginal costs and difficulties of such undeclared activities might be reduced by such co-location.

The third threat is from undeclared activities carried on at undeclared, separate sites. Here again, there may be some connection to activities (declared or undeclared) at known sites, but another possibility is the creation of a complete set of undeclared sites constituting a full, separate, and clandestine production stream.

Among the objectives of a verification system, two are of significance here. First, it seeks to detect non-compliance with obligations. Second, it seeks to deter non-compliance. Usually, the deterrent effect is *directly* associated with the possible negative consequences of detection. There is, however, also a relevant *indirect* effect. Although a proliferator might escape detection, the effort to do so may make a nuclear weapons production programme more expensive, more difficult in technical terms, and longer in duration. This might be of least a marginal discouragement to a state without a sufficiently strong motive for acquiring nuclear weapons, without requisite technical and production capabilities or hidden supply networks, and without strong finances.

This chapter will argue with respect to co-located activities that the minimum case will substantially strengthen the ability of the IAEA to detect them, and thus also to deter them directly, and that the extended case will have a secondary, though still significant, indirect deterrence effect. With respect to

undeclared separate sites, the minimum case will have significantly lower detection and direct deterrence effects but will have some indirect deterrence effect. The extended case will again increase the indirect deterrent effect, but may not greatly increase the detection and direct deterrence effects. For both threats, the extended case presents a problem of when the information demanded will be a significant benefit rather than adding substantially to management problems and ambiguity — that is, when the gains from increased information reach the point of diminishing returns.

The general conclusion argued here is that "93+2", in whatever version implemented, will be more effective for co-located activities than for undeclared, separate sites. To deal with the latter, the IAEA will continue to depend significantly on the ability of national or multilateral monitoring efforts for detection and direct deterrence, though the programme may add significantly to an indirect deterrent effect. This will have implications particularly for the information measures proposed in "93+2", but less for the access measures.

"93+2"

The information-related measures of the "93+2"¹ programme consist of an expanded declaration by states, rights of environmental sampling,² and improvements in the Agency's information analysis methods.³ Proposals within these last two categories largely fall within existing Agency rights, but the information measures may go substantially beyond them. In the case of environmental sampling, this includes for ad hoc inspections at locations where initial reports indicate nuclear material is present, routine inspections at strategic points, special inspections, and design verification visits. It is assumed here that environmental sampling would be undertaken on a local basis only, not through long-range or wide-area methods.⁴ The projected improvements in information analysis include the development and use of a computerized proliferation pathway analysis and database, and the right to use information drawn from open literature, information arising within the IAEA (including inspection reports), environmental monitoring, information received from states under safeguards, and information received from other states.

The expanded declaration includes measures under existing authority (Part 1) and measures requiring additional authority (Part 2). Part 1 measures include information on State Systems of Accounting and Control, past nuclear

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1. The primary source used here for the "93+2" programme is IAEA, *GC(39)/17*, 22 August 1995.
 2. See Office of Technology Assessment, U.S. Congress, *Environmental Monitoring for Nuclear Safeguards*, OTA-BP-ISS-168 (Washington, D.C.: U.S. Government Printing Office, September 1995).
 3. Mark H. Killinger, "Improving IAEA Safeguards through Enhanced Information Analysis," *The Nonproliferation Review* Vol. 3, No. 1 (Fall 1995), 43-48.
 4. This does not exclude local atmospheric, vegetation, or water sampling.

activities, information routinely provided under the current safeguards, descriptions of the nuclear fuel cycle and of other activities involving nuclear material, of nuclear research and development activities involving nuclear material, some information regarding buildings on relevant sites, and the early provision of design information. Part 2 proposals cover additional information on locations which are nuclear-related but where nuclear material may not be present, other operational activities, uranium and thorium deposits, the domestic manufacture of relevant equipment and materials, certain currently voluntarily-reported information, and information on plans for the nuclear fuel cycle and planned research and development activities.

The access proposals cover broadened inspection access and non-notice or unannounced inspections. Under Part 1, the Agency claims rights of access beyond strategic locations during design verification visits and ad hoc inspections. Under Part 2, it seeks to extend routine inspection access beyond strategic points and to gain access to other locations identified in the expanded declaration. It would also like voluntary access to other locations which might interest it. Under Part 1, it claims no-notice inspection rights at strategic points in routine inspections. Under Part 2, it seeks to extend these rights to other locations on-site with nuclear facilities, and to gain no-notice rights at other locations identified in the expanded declaration.

Co-located Activities

Co-located undeclared activities are carried on at the same general site as declared activities which are subject to safeguards. The benefits of co-location also leave such activities vulnerable to detection, through proximity as well as through other means. The primary site defences of undeclared co-location are: first, a proper balance between getting the benefits of co-location and controlling the threat of discovery created by any impingement of the co-located activities on declared activities, or on indicators which may be observable through safeguards techniques applied to declared activities at the shared sites; and, second, restricted access by inspections and limitations on inspection techniques. As for off-site threats, these are matters for the control of general information about state activity.

The Minimum Case

Co-located activities could be fairly vulnerable under the minimum case, if the Agency pushes its rights. If they impinge on the safeguarded stream of nuclear material, they might be detected through existing materials accounting and supplementary techniques of containment and surveillance. Even if they avoid this, there are other threats. In establishing the character of a site where safeguards are applied and of the activities to be safeguarded on that site, the Agency's design verification and ad hoc inspection rights, strengthened by the use of environmental sampling, could be vigorously applied. After the initial inspections, re-verification visits might also be employed.

Even during routine inspections, restricted to strategic points, environmental sampling could be effective if sampling points were in areas common to or vented into from both undeclared and declared activities, and if the undeclared activities left traces incompatible with those of the declared activities. Restricting undeclared activities to those which would not show up readily in the design and ad hoc visits or in environmental sampling might considerably restrict the activities that could be co-located.

The information proposals of the minimum case would also have an effect, assuming an adequate analytical process. Reports of unusual shipments of equipment and materials, given the declared character of safeguarded activities at a site, could lead to requests for clarifications. Open literature sources, export reports, and reports from other states would be compared to information submitted by the verified state to check for consistency. Information from the verified state could also be checked for internal consistency. Observations by suitably trained inspectors could also be exploited. The information requested from the verified state and routinely provided by exporters of nuclear goods and services would have to be carefully structured, of course. Open literature and occasional reports from member states would be more opportunistic and varied, rather than continuous and standardized in format and content. This variability would limit their usefulness, but these sources could also act as "wild cards" which could not be easily predicted even by a proliferator knowledgeable about and seeking to circumvent the Agency's analytical methods and data sources.

At least three basic issues arise about the analysis of information and its results. First, would the information gathered and the analytical routines used be able to lead to reasonably convincing, even if still uncertain, conclusions, or would much either be lost in an unfavourable signal-noise ratio or be very readily explained? Second, how willing would the Agency be to push for clarifications based on such results, and how easily would it be satisfied by an explanation? Third, how willing would states be to tolerate requests for clarifications based on such results, given the ambiguity that might be involved and that at least some states so questioned would be engaged in innocuous activities?

The Extended Case

In the extended case, pressure on co-located activities would be increased even more. Routine access at safeguarded facilities would be extended beyond strategic points, and access would also be permitted (even if only occasionally invoked) at the additional locations listed in the expanded declaration. An expansion in the access for no-notice inspections would also occur. If environmental sampling is possible as part of such inspections, then the range of known/declared locations potentially subject to this technique, and thus where co-located activities could be vulnerable, would also be extended. Improved

inspector training for readily observable indicators of undisclosed activities would also be a factor at this extended set of locations.

Outside of the expanded set of locations, the same information conditions and problems for general information demands would apply as in the minimum case, but over a larger set of locations, activities, and data. This might increase the problem of ambiguity, perhaps to a very considerable degree. Unless such information could be connected to specific sites where safeguarded activities were already going on, it would seem more applicable to the generic problem of detecting undeclared activities, rather than to the specific problem of dealing with co-located undeclared activities.

Undeclared, Separate Sites

We will assume that, once a site is subjected to inspection, the combination of on-site inspection techniques (including environmental sampling) and remote surveillance techniques employed in support both before and during inspection will be sufficient to characterize the site and activities at it.⁵ Environmental sampling, for example, could be helpful in reconstructing the history of a site, thus reducing the ability of a state to use delays to hide or remove evidence. This leaves detection, location, and access as the chief problems to be overcome. If the advantages of delaying access to a specified site can be overcome, through remote surveillance or environmental sampling, access becomes less of a difficulty. Even if access is denied, remote surveillance can continue, and the denial of access itself may strengthen suspicion. Location is a significant problem because it forms the basis both for a specific access request (and possibly, therefore, for a definite discovery of a breach of obligations) and also because often a peculiar site must be spotted before activity at it will be noticed and arouse concern. In other cases, however, one may detect traces of an activity without being able to specify a precise location. Such detection might be sufficient to justify a request for clarification, and this may eventually lead to a site being named and inspected.

Increased pressure on co-located activities, whether in the minimum or the extended case, will discourage some proliferators and drive others to the more costly and difficult strategy of developing undeclared activities at separate locations. As the area of activities rendered potentially visible is increased, they will be forced to head for the remaining cover. The key questions are how much cover remains, how difficult it is to penetrate it, and how far it can be pushed back from a direct production stream (thus increasing costs, difficulty, and time even if concealment can be maintained).

5. This introduces an issue of larger significance: the cooperation between the IAEA and states which might be able to deploy such technologies in support of its inspection activities or, more generally, in support of its information-gathering and analysis capabilities.

The Minimum Case

Assuming that a full, separate clandestine production stream is the issue, the minimum case gives less leverage on this than on co-located undeclared activities. The exercise of Agency rights at known sites might uncover *in-situ* and boundary transgressions that indicate incomplete separation, but this is excluded in the case of the fully separate clandestine production stream. Ad hoc inspections might put pressure on such sites, if these rights give potential access throughout a state, but the effect of design verification rights would be limited by an absence of information linking a site to nuclear material which should be declared. Once such information was received, design verification rights would present a basis for requesting access.

The major source of pressure on separate undeclared activities, under the assumption of effective inspection noted above, is likely to come from the information available to the Agency and analyzed by it. Again, consistency checks will be the key tool. Equipment and material unusual for a given purpose, or unusual for a given destination (if supposedly for non-nuclear use), may give some leverage.

However, there are countermeasures available to a proliferator, affecting both information directly available to the IAEA and that which might be obtained by individual states and provided to the Agency.⁶ Efforts may be made to disguise foreign acquisitions, to exploit the weaknesses of nuclear suppliers' export controls, and to replace reliance on imports with satisfactory indigenously-produced items, even if these are cruder or less capable. Dual-use and general purpose equipment and materials, unless subject to their own verification systems, may be used rather than tell-tale specialized items procured from abroad. A proliferator with a long time-horizon and ample resources may start its acquisition activities at some removes from a direct production stream, building up the domestic means of production and obscuring this in more general economic, industrial, and scientific activity.

In the minimum case, therefore, the gains against co-located activity are significant because they push the proliferator farther away, possibly creating an indirect deterrence effect. However, while improved information analysis methods may allow better use of information already available to the Agency, it also may have an indirect rather than a strong direct effect.

6. For brief accounts of Iraqi methods, see David A. Kay, "Iraqi Inspections: Lessons Learned," *Eye on Supply* No. 8 (Winter 1993), 88-98; David A. Kay, "Deception and Denial Practices of WMD Proliferators: Iraq and Beyond," *The Washington Quarterly* Vol. 18, No. 1 (Winter 1995), 85-105; and Harald Müller et al., "From Black Sheep to White Angel? The New German Export Control Policy," PRIF Reports No. 32 (Frankfurt: Peace Research Institute Frankfurt, January 1994), 5-10. See also Joel Ullom, "Enriched Uranium versus Plutonium: Proliferant Preferences in the Choice of Fissile Material," *The Nonproliferation Review* Vol. 2, No. 1 (Fall 1994), 1-15, esp. 13.

An exception to this may arise from open literature and from non-routine reports from states. Here, of course, other problems of supply and assessment, including credibility and bias in the information received, will apply. In some cases, states may be reluctant to share information with the IAEA; in others, they may be only too willing to share — about certain states. A strong independent information analysis process will cope with some of these difficulties. The more general problem, however, will remain, finding reasonably strong indicators which may then help piece together still other information to suggest a pattern which should be clarified.

The Extended Case

The extended case will further expand the range of locations and the amount of other activity which is to be made available to the Agency. This will create further opportunities for consistency checks and for pushing undeclared activities away from established facilities, and thus will increase the indirect deterrent effect for those states which still might wish to proliferate. Again, however, the key questions will be how much cover remains, whether it can be penetrated, and how far it is from a direct production stream. The extended case may reduce cover, but the problems of information and the countermeasures available to a proliferator will remain.

Under the extended case, the expanded information required beyond the additional locations would be subject to the same countermeasures by proliferating states. Merely expanding these information requirements will not, of itself, necessarily give much additional leverage unless the basic problems of acquisition and analysis are properly handled. Information of uranium and thorium, and on domestic manufacturing capability, could be of value — particularly the former, as it could help establish a nuclear materials flow to be subjected to diversion safeguards. In the case of equipment and other materials, however, dual-use and general-purpose items, or obsolete or unusual but still workable production approaches could still be exploited. Unless one knew what was being made and/or being shipped where, one might ask what real gain would arise from simply knowing, in general, what a state *claimed* it could produce. Information about future nuclear fuel cycle plans and nuclear activities could be combined with import and other information for consistency checking, but here also a state could simply make claims tailored to obscure undeclared activities or to provide superficially satisfactory explanations for indicators generated by these.

Again, open literature reports and non-routine reports from other states — information sources not affected by the extended case — may be important sources of information, once countermeasures by proliferators are factored into consideration. It is true that these will also be subject to countermeasures, however, and will also have problems of credibility, ambiguity, bias, and their inherent occasional nature.

Implications

Both the minimum and the extended cases will increase pressure substantially on co-located activities, having both an increased chance of detection and thus a strong direct deterrence effect, and some indirect deterrence effect by reducing the range of activities which might be co-located with an acceptable risk of detection. Access and improved on-site techniques are the primary direct threat to such activities. More general information-gathering and analysis may further increase the pressure, if the information is linked to specific sites and indicates with acceptable, if not complete, assurance activities incompatible with both the declared activities on those sites and a state's non-proliferation obligations.

This may be enough to discourage some proliferators. However, others will simply move their activities away from locations subject to inspection. For such undeclared sites, the minimum case may give some leverage, particularly based on open literature and non-routine reports from other states once proliferator countermeasures are factored in. The extended case will give some more leverage, primarily by expanding the set of locations to which access is available. Its information component beyond this list of additional locations, however, may offer little gain beyond the minimum case. A key issue for this contention is precisely how much the additional information will complicate or penetrate proliferator countermeasures.

With respect to undeclared activities considered in general, then, access to locations and improved on-site inspection techniques create the greatest pressure, which is why co-located undeclared activities are particularly threatened by "93+2" regardless of the case used, and by the extended case even more than in the minimum case. The expanded set of locations sought under Part 2 has a significant effect on both co-located and separate undeclared activities because it is tied to access and improved techniques of on-site inspection. Information requirements outside of the expanded list of locations may give more leverage on undeclared separate activities, but the possible gains from these are linked also to significant problems. The usefulness of such expanded information requirements is linked to both the countermeasures available to proliferating states and the analytical capabilities of the Agency's information systems.

The argument of this chapter also suggests that a key distinction must be drawn between the information normally and routinely available to the IAEA and that which comes to it from open literature and from the non-routine reports of states. If we assume that proliferators will take steps to confound the known and predictable information-gathering and analysis methods of the IAEA (though these may still complicate their operations), the greatest danger of detection and location of undeclared, separate activities will come from these less routinized sources. The main hope for detection and location, and thus also for both direct and indirect deterrence effects, will then come from improvements in the ability of states in particular, acting alone or in concert,

to detect such activities through their own means, and their willingness to pass along convincing evidence of such activities to the Agency for its follow-up. The IAEA's "93+2" measures will have a beneficial effect in pushing undeclared separate activities further into the shadows, but the Agency can only do so much by itself.