

These fundamental problems relating to both the effectiveness and the costs of IAEA's NPT safeguards operations are addressed in this report. The approach adopted here is based on an identification of the determinants of safeguards effectiveness and costs. With a more complete understanding of what levels of cost-effectiveness can potentially be achieved, the IAEA's safeguards programmes can be reassessed, and new routes to the solution of certain problems can be mapped out.

In fact, the problems faced by the IAEA in implementing an NPT safeguards programme are not qualitatively different from those faced by inspecting agencies under most arms-control regimes. In general, arms-control inspections are intended to deter and detect violations. Moreover, inspections are usually subject to quotas and inspecting agencies' budgets are almost always severely limited, so there is pressure to deter and detect with minimal inspection effort, i.e. minimal costs. Thus, although this study is specifically aimed at increasing the cost-effectiveness of IAEA safeguards programs for the NPT, many of the conclusions are also applicable in other arms-control contexts.

The objective of this report is thus to present an assessment of current and potential levels of cost-effectiveness of inspections of nuclear materials and activities, and to suggest avenues for improvement. A specific framework demonstrating what determines required levels of enforcement effectiveness is provided, and used to answer the following questions:

- *How should inspection resources for NPT safeguards be allocated over non-nuclear-weapon states to fulfill the IAEA's mandate?*
- *How should the IAEA's inspection effort be divided between the task of verification at declared sites and the task of detecting undeclared sites?*
- *How should the variable characteristics of states, and of declared and undeclared sites, affect the answers to the previous questions?*

The organization of this report is now summarized. In Section 2, the fundamental assumptions underlying the modelling and analysis to follow are discussed, and a framework is set out for determining the required level of effectiveness of an inspection program. Section 3 is divided into three subsections, each featuring a model (or group of models) that provides important information about safeguards operations: