

In this study the mathematical tools of Decision Theory and Game Theory have been applied to models representing

- states' decisions to comply with or violate the NPT, and, if violation is chosen, where to violate;
- the IAEA's decision of where and how much to inspect.

Important determinants of success in scheduling safeguards operations have been identified. The most important conclusions are outlined below.

4.1 The required size of the safeguards program depends on the interplay of political and technical parameters.

The *political* parameter that plays a major role in determining the necessary level of safeguards with respect to a particular state is termed *value ratio*. For states that are motivated to violate, but not at any cost, the value ratio measures the incentive to comply. It reflects the magnitude of the state's perceived decrease in value for a detected violation (in comparison to its value for compliance), relative to the magnitude of its perceived increase in value for an undetected violation (again in comparison to its value for compliance). For example, the value ratio is increased when the sanctions following detection of a violation are made more severe; it is decreased when the state comes to place a higher value on the prohibited weapons.

The *technical* parameter that plays an equal role in determining the success of safeguards is *inspection effectiveness*. Inspection effectiveness is measured by the reduction in the state's anticipated (expected) value were it to choose violation, in consequence of the possibility of detection in an inspection. It was noted that additional *inspection resources* increase inspection effectiveness, but generally at a decreasing rate. In other words, the conversion rate, called *inspection efficiency* is usually lower at higher levels of inspection resources.

The required levels of inspection resources vis-à-vis particular states, and thus the size of safeguards programs, are determined by some very simple comparisons. If inspection effectiveness exceeds a particular threshold depending on the value ratio, a state will be deterred from violating. If inspection effectiveness falls below this threshold, the state will choose to violate. The threshold increases as the value ratio decreases, i.e. as the incentive to comply decreases. The required level of inspection effectiveness thus determines the required level of inspection resources, for each particular state.