



XA0103202

SECURITY STUDIES

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Security studies constitute one of the major tools for evaluating the provisions implemented at facilities to protect and control Nuclear Material against unauthorized removal. Operators use security studies to demonstrate that they are complying with objectives set by the Competent Authority to counter internal or external acts aimed at unauthorized removal of NM. The paper presents the context of security studies carried out in France.

The philosophy of these studies is based on a postulated unauthorized removal of NM and the study of the behavior of the systems implemented to control and protect NM in a facility

The potential unauthorized removal of NM usually may take place in two stages. The first stage involves the sequence leading to handling of the NM. It occurs inside the physical barriers of a facility and may include action involving the documents corresponding to Material Control and Accounting systems. At this stage it is possible to limit the risk of unauthorized removal of NM by means of detection capabilities of the MC&A systems. The second stage is more specific to theft and involves removing the NM out of the physical barriers of a facility in which they are being held, notably by affecting the Physical Protection System.

Operators have to study, from a quantity and time lapse point of view, the ability of the installed systems to detect unauthorized removal, as well as the possibility of tampering with the systems to mask unlawful operations. Operators have also to analyze the sequences during which NM are accessed, removed from their containment and further removed from the facility in which they are stored. At each stage in the process, the probability of detection and the time taken to carry out the above actions have to be estimated. Of course, these two types of studies complement each other.

Security studies have begun, in France, for more than fifteen years. Up to now more than fifty security studies are available in the field of PP and most of them have been revised at least once. They have been produced by the French Operators, assessed by the IPSN and approved by the French Competent Authority. They are mandatory as far as PP is concerned for NM held in category I facilities. To go ahead preliminary security studies in the field of MC&A have been performed by operators of two different types of facilities, the results of which are very encouraging.

In the field of PP, security studies are based on an analysis consisting in grouping together all the possible paths leading to NM in compliance with a set of threats. Diagrams could be used to show which actions have to be taken to successfully carry out the theft of NM. This may involve crossing zones or outwitting detection devices and overcoming obstacles. By following the diagrams mentioned above, the probability of undetected persons or nuclear materials as they progress in the facility is evaluated. The relevant criteria to assume that the theft has been detected is determined. Then the time elapsing between positive detection of the action and the removal of the NM from the facility is estimated. This estimate is based on documented data and/or the results of tests carried out in the facility or elsewhere. Critical paths are taken as being those along which nuclear materials can be removed from the facility in the shortest time after detection. Special care is taken when analyzing these paths.

In the field of MC&A, when unauthorized removal or dysfunction occurs, a discrepancy appears between the physical reality of NM and the way in which it is represented in the MC&A systems. In the case of these studies, an assumption is made that such a discrepancy exists in compliance with a set of threats. Then, the purpose of the security study is to analyse the way in which the discrepancy is revealed in connection with a discovery threshold amount, if any. It should be noted that possible detection of the discrepancy by the physical protection system is not covered by such studies, since this type of detection gives no information on either the effectiveness or the reliability of the MC&A systems.

A critical scenario is defined as one which leads to discrepancies involving substantial amounts of NM or for which the detection delay is long. Special care is taken when analysing these scenarios. For critical scenarios, sensitivity analysis could be made to determine the smallest quantity of NM the disappearance of which could be detected or the criteria leading to the detection of the disappearance in the control system or in the accounting system.

The threats taken into account are identified with reference to the design basis threat specified by the competent authority. Both internal and external threats are taken in account. Internal threats are defined as attempts by insiders to steal quantities of nuclear material, either once or on several occasions; accumulating these quantities leads to a significant quantity of NM. External threats are defined as attempts by groups of aggressors to steal significant amounts of nuclear material. Two hypotheses are taken into account to test the ability of the physical protection system to counter threats of this type. The first is based on a small group of aggressors with limited resources and the second involves a larger team with more sophisticated resources.

Of course security studies have to be carried out in compliance with the corresponding confidentiality rules. In addition, such studies have to be regularly updated, notably if significant modifications are made in the MC&A or PP systems.

It is important that security studies are available in the facilities for competent personnel, as it gives the rationale behind control and protection of NM. In particular, it could be used, in a performance-based approach, to support analysis reports or to illustrate that the required level of security has been reached.