INSAG-24

The Interface Between Safety and Security at Nuclear Power Plants

INSAG-24

A REPORT BY THE
INTERNATIONAL NUCLEAR SAFETY GROUP

INSAG

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THE INTERFACE BETWEEN SAFETY AND SECURITY AT NUCLEAR POWER PLANTS

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A report by the International Nuclear Safety Group

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INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2010

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The International Nuclear Safety Group (INSAG) is a group of experts with high professional competence in the field of nuclear safety working in regulatory organizations, research and academic institutions and the nuclear industry. INSAG is constituted under the auspices of the International Atomic Energy Agency (IAEA) with the objective of providing authoritative advice and guidance on nuclear safety approaches, policies and principles for nuclear installations (defined as nuclear power plants, fuel cycle facilities, research reactors and support facilities). In particular, INSAG provides recommendations and informed opinions on current and emerging nuclear safety issues, to the international nuclear community and public through the offices of the IAEA.

FOREWORD

by the Chairman of INSAG

The operation of nuclear power plants requires careful attention to safety, security and safeguards. Safety, of course, is aimed at preventing accidents; security is aimed at preventing intentional acts that might harm the nuclear power plant or result in the theft of nuclear materials; and safeguards are aimed at preventing the diversion of nuclear materials for nuclear weapons purposes. Although these activities have a different focus, they overlap with each other. Actions that are taken to further one activity can have implications for the others.

Concerns about a radioactive release have long provided the justification for a particular emphasis on safe operations at nuclear power plants. In the aftermath of the 9/11 attacks and subsequent terrorist activities around the globe, operators, regulators and international organizations have all given increased attention to ensuring adequate security at nuclear installations. Nuclear power plants have been a particular focus of this effort, given the awareness that the potential for a terrorist attack on a nuclear power plant might strike particular fear in the affected population.

Nuclear power plants benefit from a sophisticated and comprehensive safety regime that has been established over the years. Although security issues are now receiving increased attention, the security regime for nuclear power plants is far less developed than the safety regime. For example, the IAEA has developed a wide ranging set of requirements and guidance publications for safety, whereas its security related guidance is comparatively sparse. This report thus focuses on the interface between nuclear safety and security at nuclear power plants with the aim of ensuring that, as the security framework matures, safety and security obligations serve to reinforce each other. Measures related to non-proliferation (safeguards) also contribute to the overall goal of protecting public health and the environment, and need to be integrated, but they do not typically present similar interfaces with safety in the case of nuclear power plants and are not discussed in this publication.

This report was prepared by a task force composed of members of INSAG, with assistance from the members of the Advisory Group on Nuclear Security (AdSec). AdSec is a group of senior security experts who advise the Director General on the IAEA's activities related to preventing, detecting and responding to terrorist or other malicious acts involving nuclear and other radioactive material and associated facilities. We gratefully appreciate the views of AdSec and the contribution of AdSec's members to the preparation of this report. However, this report does not necessarily reflect the views of AdSec. The responsibility for this report rests with INSAG.

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1. INTRODUCTION

1. Recent terrorist events have served as a catalyst for the development of an array of new nuclear security arrangements. Although concern about malicious acts involving nuclear installations is not new, recent terrorist events have demonstrated that an attack on a nuclear facility might be attempted and that terrorists have formidable capabilities and dedication. This has led to an increased focus on defences against terrorists at nuclear facilities, as well as at other critical infrastructures.

2. The development of revised security arrangements arises at a time when the public expects high standards of nuclear safety and security to be met. The challenge in meeting these expectations is predicted to grow in light of the interest in the new construction of nuclear power plants both in countries with existing plants and in those embarking on a nuclear programme for the first time. INSAG seeks in this report to explore the special challenges associated with the expanded emphasis on nuclear security, with a focus on the relationship between safety and security at nuclear power plants.

3. Nuclear safety and nuclear security have a common purpose — the protection of people, society and the environment. In both cases, such protection is achieved by preventing a large release of radioactive material.[1] Many of the principles to ensure protection are common, although their implementation may differ. Moreover, many elements or actions serve to enhance both safety and security simultaneously. For example, the containment structure at a nuclear power plant serves to prevent a significant release of radioactive material to the environment in the event of an accident, while simultaneously providing a robust structure that protects the reactor from a terrorist assault. Similarly, controls to limit access to vital areas not only serve a safety function by preventing or limiting exposures of workers and controlling access for maintenance to qualified personnel, but also serve a security purpose by inhibiting unauthorized access by intruders. Such controls may be of particular importance in the security context

[1] The prevention of the diversion of nuclear material is also an element of the security regime and, of course, is the focus of the safeguards system. Concerns about diversion are a particular concern at fuel cycle facilities — particularly enrichment and reprocessing facilities, as well as the facilities at which weapons usable materials are stored. Nuclear power plants, with the exception of those facilities that use fresh mixed oxide fuel, do not present the same opportunities for diversion. Hence this publication focuses on the security and safety dimensions of the prevention of releases from nuclear power plants.

because the high radiation doses that might be encountered in a vital area may not be a significant deterrent given the apparent willingness of terrorists to forfeit their lives to achieve their objectives.

4. Nonetheless, there are also circumstances in which actions to serve one objective can be antagonistic to the achievement of the other. For example, the introduction of delay barriers for security reasons can limit rapid access to respond to a safety event or can limit emergency egress by plant personnel. Indeed, security considerations might serve to bar plant personnel from certain areas of the facility in the event of an attack that might need to be accessed for safety reasons. The establishment of fighting positions could adversely affect safety if the field of fire affects critical safety equipment or access to that equipment.

5. These facts highlight the importance of a coordinated approach to nuclear safety and security. This report is intended to discuss the need to approach safety and security in a fashion that they complement each other. The aim is to ensure that safety and security are dealt with together in a seamless and effective way.

2. PURPOSE AND SCOPE

6. The purpose of this report is to provide a better understanding of the interfaces between safety and security at nuclear power plants and to discuss the means to achieve both objectives in an optimal fashion. It provides information in a background chapter on the existing relevant documentation, discusses the expectations for administrative arrangements at different levels, surveys certain common principles, and suggests general solutions that can help ensure an integrated approach. Conclusions are drawn and high level recommendations are proposed with the goal of maximizing the protection of the public, property, society, and the environment through an improved and strengthened interface between safety and security.

7. The following definitions of nuclear safety and security are found in the IAEA Safety Glossary [1]:

— **(Nuclear) safety:** "The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards."
— **(Nuclear) security:** "The prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities."

8. The events taken into account differ in each sphere. Safety evaluations focus on risks arising from unintended events initiated by natural occurrences (such as earthquakes, tornadoes, or flooding), hardware failures, other internal events or interruptions (such as fire, pipe breakage, or loss of electric power supply), or human mistakes (such as the incorrect application of procedures, or incorrect alignment of circuits). In the case of security, the risks, or events, feared arise from malicious acts carried out with the intent to steal material or to cause damage. Security events are therefore based on 'intelligent' or 'deliberate' actions carried out purposely for theft or sabotage and with the intention to circumvent protective measures.

9. Safety and security share many common elements, and both serve to protect the plant with the ultimate aim of protecting people, society, and the environment. As noted above, the fundamental purpose of each is the same — the protection of people, society and the environment. The acceptable risk is presumptively the same whether the initiating cause is a safety or a security event. Moreover, the philosophy that is applied to achieve this fundamental objective is similar. Both safety and security typically follow the strategy of defence in depth — that is, the employment of layers of protection. The fundamental nature of the layers is similar. Priority is given to prevention. Second, abnormal situations need to be detected early and acted on promptly to avoid consequent damage. Mitigation is the third part of an effective strategy. Finally, extensive emergency planning should be in place in the event of the failure of prevention, protection and mitigation systems.

10. The steps taken to provide protection against malicious acts incorporate specific features to ensure physical protection, but also rely on provisions that may have been installed for safety reasons. For example, as noted above, nuclear plants are constructed with protective barriers of steel and reinforced concrete that serve both a security and a safety function.

11. Nonetheless, while there are many elements that are common to safety and security, there are also challenges related to differences in approach and culture between the two disciplines. As will be discussed further herein, some actions that are taken for security reasons, such as limitations on access or egress from a nuclear facility, may serve to inhibit safety or emergency response. Also, some areas may need to be dealt with differently in the two spheres, such as the management of information and the involvement of stakeholders.

12. Safety and security considerations impact nuclear facilities of all types, as well as the transport of nuclear material, the usage of nuclear material (medical, industrial and academic) and radioactive waste disposal. As noted above, this report focuses on nuclear power plants, although most of the statements presented also have a bearing on other nuclear installations.[2] Measures related to non-proliferation (safeguards) also contribute to the overall goal of protecting public health and the environment and need to be integrated, but they do not typically present similar interfaces with safety and are not discussed in this publication.[3] In addition, this report focuses on security activities at, or in the vicinity of, nuclear power plants that are under the control of the operating organization; other off-site security activities remain the exclusive province of the State and are not considered here.

[2] The chief security concern at a nuclear power plant is sabotage that could result in a large radioactive release. Theft of nuclear materials is not a major security concern at a nuclear power plant, except at those facilities using fresh mixed oxide fuel (MOX) (because of its plutonium content). Other types of nuclear facilities, such as those that store weapons usable nuclear materials, may appropriately have a security system that focuses on the prevention of the theft of materials; the danger of sabotage may be of secondary concern. Although the objective of the security system may differ from one type of nuclear facility to another, the considerations discussed in this report relating to the need for a coordinated approach apply universally.

[3] Safeguards measures seek to identify and restrict the diversion of nuclear material for weapons use by a State actor. Measures that are installed for safeguards reasons — seals, surveillance systems, etc. — may assist in detecting theft, but do not necessarily entail measures directly intended to prevent theft.

3. BACKGROUND

3.1. GENERAL CONFERENCE RESOLUTIONS

13. More than 130 IAEA Member States and over 1400 delegates attended the IAEA's 52nd General Conference in 2008, at which two resolutions on measures to further strengthen the IAEA programmes in nuclear safety and nuclear security were adopted.

GC(52)/RES/9, on measures to strengthen international cooperation in nuclear, radiation, transport and waste safety:

> "[A]cknowledges that safety measures and security measures have in common the aim of protecting human life and health and the environment, calls upon the Secretariat to enhance its efforts to ensure coordination of its nuclear safety and security activities, and encourages Member States to work actively to ensure that neither safety nor security is compromised;".

GC(52)/RES/10, on measures to protect against nuclear terrorism:

> "[W]elcomes the Nuclear Security Report 2008 submitted by the Director General in document GC(52)/12 on measures to improve nuclear security and protect against nuclear terrorism, produced in response to resolution GC(51)/RES/12, commends the Director General and the Secretariat for the implementation of the Nuclear Security Plan for 2006–2009, and looks forward to their continued efforts, in particular in the development of the forthcoming Nuclear Security Plan for 2010–2013."

3.2. GLOBAL NUCLEAR SAFETY REGIME AND GLOBAL NUCLEAR SECURITY REGIME

14. The global nuclear safety regime is made up of a complex web of relationships that serve to enhance safety. This regime is described in INSAG-21 [2]. The safety regime is founded on a variety of international legal instruments, including conventions and codes of conduct and the IAEA safety standards, supplemented by IAEA safety services and support programmes, and a global network of experts. The safety support network can provide assistance at a national, regional or global level on matters relating to nuclear infrastructure, regulation, enforcement, research, operations and education.

15. The global nuclear security regime is not as mature as the safety regime. It comprises international legal instruments, including conventions and codes of conduct and the IAEA Nuclear Security Series publications, supplemented by IAEA security services. The IAEA published security related recommendations in 1972 in The Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225), which has since been revised several times. Many bilateral nuclear cooperation agreements and the Convention for the Suppression of Acts of Nuclear Terrorism require States to take these recommendations into account when adopting measures to protect nuclear material. IAEA security guidance has been developed but is somewhat less comprehensive and mature than the counterpart safety standards.

16. The following international instruments are relevant to both nuclear safety and nuclear security:

— Convention on Early Notification of a Nuclear Accident;
— Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [3];
— Code of Conduct on the Safety and Security of Radioactive Sources [4].

17. The following international instruments relate to nuclear safety:

— Convention on Nuclear Safety [5];
— Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [6];
— Code of Conduct on the Safety of Research Reactors [7].

18. The following international instruments are related to nuclear security:

— Convention on the Physical Protection of Nuclear Material (CPPNM) [8];
— Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) [9];
— International Convention for the Suppression of Acts of Nuclear Terrorism [10];
— United Nations Security Council Resolution 1540 [11];
— United Nations Security Council Resolution 1373 [12].

3.3. SAFETY AND SECURITY IN PREVIOUS INSAG REPORTS

19. INSAG-12 [13] states in paragraph 242 that the design and operation of nuclear power plants should provide adequate measures to protect the plant from damage and to prevent the unauthorized release of radioactive material arising from unauthorized acts by individuals or groups, including trespass, unauthorized diversion or removal of nuclear material, or sabotage of the plant. In addition, paragraphs 243 and 244 state that physical protection measures should be coordinated with nuclear safety programmes to ensure that physical protection does not jeopardize nuclear safety. For example, physical protection measures should not jeopardize nuclear safety under emergency conditions.

20. INSAG-5 [14] (page 45) states that the review of vulnerability of the plant to violent attack should be part of the design process.

21. Although previous INSAG reports have touched on security, this publication constitutes the first focused INSAG analysis of the relationship between safety and security.

4. RESPONSIBILITIES FOR SAFETY AND SECURITY

22. Both safety and security are built on a legal and regulatory framework. That framework should define the responsibilities of several organizations: the State, the regulatory authority or authorities, and the operating organizations.

4.1. RESPONSIBILITY OF THE STATE

23. The State must set up an appropriate legislative and regulatory framework to ensure control of nuclear power plants, as well as of the transport and uses of nuclear material that present a radiological risk and thus require safety and security provisions.

24. The State must designate a regulatory authority or authorities in both the safety and security fields and provide the regulator(s) with the authority, competence and the financial and human resources necessary to accomplish their tasks. Moreover, they should be independent from nuclear operators and other

government entities responsible for promoting nuclear power or the use of radioactive material.

25. The State must verify that the responsibilities in safety and security are well defined and are satisfied.

26. The State must also define rules for confidentiality and information protection in the security area and carry out checks to ensure the trustworthiness of personnel.

27. Although the operator has the principal responsibility for safety, the operator cannot alone ensure protection of a site or an installation against terrorist threats. The State plays a critical role in ensuring adequate protection. The State is directly involved in the assessment of the risk and nature of a potential terrorist attack. (The State presumptively has access to intelligence information about threats that is unavailable to the operators.) Of course, the risk of a terrorist event may vary over time, requiring the State to ensure that the security measures are suited to the threat situation. To address this, the State typically defines a design basis threat that must be met by the operator, with guidance as to how to adjust the defensive capability to account for the threat situation. In addition, the State must be prepared to augment the defensive capability of the operator in the event of an attack and, if necessary, to execute an operation to seize back control over the plant. If the threat is a theft of material, the State must participate in national and international programmes to prevent the theft, or to recover stolen material.

4.2. RESPONSIBILITY OF THE REGULATORY AUTHORITIES

28. The regulator (or regulators) must define the requirements to be satisfied by the operator for both safety and security. The regulator must also set up and implement a licensing system and an inspection and enforcement system. The regulator must ensure that an adequate emergency response system is in place, including various off-site elements that are not the responsibility of the operator. In both the safety and security fields the regulator must also observe international commitments.

29. Because of the close relationship between safety and security, many countries see advantages in having a single regulator responsible for both. This authority may, in turn, be dependent on other government entities for assistance on security matters. That is, a regulator with responsibility for safety and security might be dependent on intelligence information from a specialized agency or

agencies. It may also turn to police or military entities for fighting capability to augment the operator's security forces. In the event that the security regulator is separate from the safety authority, it is essential to have a consultation and coordination mechanism between the two regulators to ensure that regulatory requirements are compatible and serve optimally to advance both safety and security.

4.3. RESPONSIBILITY OF OPERATORS

30. The operating organization has the prime responsibility for the safety and security of the nuclear power plant, although in the case of security, the operator's responsibility may be limited to defence against a design basis threat. This allocation of responsibility reflects the reality that operating staff are in the best position to identify the risks arising at the nuclear power plant and to ensure compliance with regulatory requirements. In this context, the operators must:

- Design, implement and maintain technical solutions and other arrangements to satisfy regulatory requirements related to both safety and security;
- Ensure first level control;
- Verify the skills and appropriate training of personnel;
- Inform the regulatory authorities of any event likely to affect the safety or security of the nuclear power plant and, as appropriate, request support;
- Maintain coordination with State organizations that are involved in safety or security; and
- Implement a quality assurance system in both the safety and security fields.

31. Operators should have a centralized information system and a centralized command centre for directing operations during a safety or security event.

5. COMMON BASIC PRINCIPLES

5.1. LEADERSHIP AND MANAGEMENT

32. Leadership in safety and security matters has to be demonstrated at the highest levels in an organization and must be achieved in both areas by means of

an effective management system. In order to ensure the proper balance between safety and security and to ensure coordinated action in the event of an emergency, the ultimate responsibility at the site for both safety and security should be attained by means of a single, unified management structure in the operating organization.

33. A culture of safety and security that governs the attitudes and behaviour of individuals should be integrated in the management system. Safety culture and security culture are based on similar principles. Safety culture is defined in the IAEA Safety Glossary [1] as the assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance. Security culture has the same definition except for a focus on security issues.

34. Nonetheless, there are some elements that are unique to each culture. For example, one difference between the two cultures relates to the way information is handled. In the security field, the sharing of information should typically be restricted to a small and select group of individuals in order to prevent sensitive information related to protective measures or facility weaknesses from falling into the hands of adversaries. Further, it is also important to take measures to ensure that the knowledge of malicious acts does not encourage similar events. The general rule in the safety area, by contrast, is to pursue transparency. For example, it may be particularly important to share feedback on experience, and thereby to prevent occurrences of incidents or accidents at one nuclear power plant from being repeated at others, as described in INSAG-23 [15]. As a result of these differences, there is a need for management to put in place systems to ensure substantial transparency with regard to most safety related information, while ensuring confidentiality with regard to most security information.

35. Management care is necessary because departures from the general rules about public disclosure may occasionally be necessary. It may be necessary and appropriate to reveal some generalized security information in order to ensure an adequately informed public. Moreover, it may be necessary in some cases to withhold safety information that might reveal a vulnerability which a terrorist could exploit. For example, probabilistic safety analyses might serve to identify a path to produce significant damage that could be exploited by a terrorist and thus such detailed information should be protected.

36. Management should also seek the promotion of both safety and security culture. These cultures often involve individuals of diverse backgrounds and experiences. That is, security personnel, unlike safety personnel, often have

military or police backgrounds. Since culture is an attribute of both organizations and individuals, it is important to provide both safety and security staff with an appreciation of the importance of each area, while emphasizing the importance of cooperation and balance to achieve optimized protection. Due recognition of the difference in backgrounds should be a consideration in these efforts.

37. In this connection, management has the responsibility to make adequate arrangements to ensure the competency and integrity of staff whose actions could affect either safety or security. This obligation is particularly noteworthy because of the special security challenge that can be presented by insider assistance to terrorists.

5.2. OPTIMIZATION OF PROTECTION

38. The principle of optimization of protection, applicable to both safety and security, is based on the idea that radiation risks must be kept as low as reasonably achievable, taking social and economic factors into account. All risks, including those resulting from malicious acts, must be assessed and re-assessed using a graded approach. The graded approach consists of analysing the risk with a view to defining measures that are appropriate and proportional.

39. The identification of risks resulting from natural events, equipment failures, or human errors relies on deterministic methods (expert judgment and feedback from operating experience), often complemented by probabilistic methods. (It is common to have one or more probabilistic safety assessments of a nuclear power plant, for example.) The identification of risks in the security domain is customarily deterministic because it is difficult to apply probabilistic techniques. Regardless of the methodology, however, the risks must be identified and assessed, both in the design phase of the nuclear power plant and during its lifetime. Moreover, these risks should be re-assessed periodically to reflect the evolution of technology, possible changes in threats and any associated modifications of safety and/or security requirements.

5.3. PREVENTION OF SAFETY OR SECURITY EVENTS

40. Defence in depth for the safety of nuclear power plants is described in INSAG-10 [16]. It states:

> "All safety activities, whether organizational, behavioural or equipment related, are subject to layers of overlapping provisions so that if a failure should occur it would be compensated for or corrected without causing harm to individuals or the public at large."

Defence in depth is a fundamental concept that is applied by nuclear safety experts in design and operation. Defence in depth for security is discussed in the Amendment to the CPPNM [9], and outlined in INFCIRC/225. In the security context, defence in depth involves the establishment of a series of protection layers around potential targets for sabotage or theft. This approach takes into account the robustness of systems, structures and components (SSCs) by designing protection systems against adversary capabilities, considers accident management measures and containment systems, and endeavors to protect the function of these SSCs through physical protection measures. Systems for continuous monitoring and early alerts of a possible attempt to circumvent or cause the failure of a protection layer are an integrated part of prevention.

41. Safety specialists, in close cooperation with security specialists, should evaluate the consequences of malicious acts, in the context of the State's design basis threat, and identify the minimum complement of equipment, systems or devices that should be protected. Measures that have been designed into the facility for safety purposes should be taken into account for this purpose.

42. The first line of defence for security consists of deterrence steps that serve to discourage an aggressor from attempting an attack. For example, deterrence could include prevention of access to information required for an attack, highlighting the criminal penalties applicable to a potential aggressor, and/or establishing monitoring and collection systems for intelligence that allow the early interception of aggressors.

43. The second line of defence is to implement a security plan that prevents an aggressor from succeeding in an attack or, at the least, delays the aggressor for a sufficient period as to allow external support from police forces to arrive. As noted above, this second line of defence has several layers. The security plan typically entails a comprehensive strategy for the defence of the facility from an attack at the level of the design basis threat. Defence against threats beyond the design basis involve extensive coordination between the facility personnel and off-site reinforcements.

5.4. EMERGENCY PREPAREDNESS AND RESPONSE

44. Operators as well as State authorities are required to develop plans to limit the consequences of a radiological accident. Such plans should encompass both safety and security events.

45. The management of a crisis resulting from a terrorist act may demand the involvement of a greater number of State bodies than one arising from a safety event. In addition to services to minimize the consequences of the event, the response to a terrorist event may involve law enforcement agencies, bomb disposal services and judicial authorities (even if the latter may intervene to a lesser degree during a crisis).

46. Security plans for a nuclear power plant should encompass not only the prevention of malicious acts, but also the specification of effective response measures (so-called contingency plans), including, for example, securing a site. There is an obvious need to ensure that the security plan is compatible with and complementary to the safety plan. Therefore, it is necessary to ensure that coordination is organized among both safety and security responders as part of overall emergency planning.

47. Emergency management may present some very unique problems in the case of a terrorist attack. Safety measures on-site under the operator's responsibility will need to be taken to minimize or mitigate potential consequences. Security measures, which may include the introduction of response forces by the State, will focus on the neutralization of the adversaries, thereby preventing further damage and protecting emergency personnel. These actions must be coordinated.

48. It is thus necessary to carry out joint exercises in order to permit the coordination of safety and security organizations. For example, an exercise scenario may simulate a group of aggressors who enter the nuclear power plant and endeavour to trigger an accident. In the first stage, crisis management will focus on security effects, but very quickly it will be necessary to consider potential safety problems arising from the attack. Special care should be taken to verify that the activities of the security forces do not jeopardize safety and that security is not needlessly jeopardized during implementation of safety measures.

49. The operating organization has the prime responsibility for the safety and security of the nuclear power plant. The management authority for both safety and security should be centralized in the operator's organization so as to ensure

appropriate coordination. As noted above, it may be the case that some on-site actions must be undertaken at times by State response forces. In general, no on-site action should be taken by security forces or any other external organization without first closely consulting the operator and taking into account the advice provided on the safety risks that must be avoided in any proposed action. Situations that might require instantaneous response actions without the opportunity for consultation should be identified in advance, to the extent practicable, and emergency procedures put in place to guide such actions.

6. SAFETY AND SECURITY DURING THE LIFETIME OF A NUCLEAR POWER PLANT

6.1. THE VARIOUS LIFETIME PHASES

50. There are different challenges that arise in the various phases of a plant's lifetime.

Siting

51. The site should be assessed for safety purposes by considering the frequency and severity of various external natural and human induced events that could affect the safety of the nuclear power plant. The foreseeable evolution of factors in the region that may have a bearing on safety must be evaluated for a time period that encompasses the projected lifetime of the nuclear power plant.

52. The site is assessed for security purposes by considering the vulnerability to assault of the site. For certain types of threat, the location and layout of the plant site may limit the likelihood that particular on-site areas will be affected. Of course, site conditions that may benefit adversaries also need to be taken into careful consideration, such as the proximity of nuclear power plants to public transport infrastructure (roads, railways and airports) or to industry and populated areas. Other factors might include consideration of whether some areas within a country are more prone to terrorist activities or unrest than others or whether a given site is near the border with an unfriendly country or a country where terrorist activities are frequent.

53. The final selection of a site for a nuclear power plant should take into account both safety and security assessments.

Design

54. Nuclear power plants are designed by applying the defence in depth principle for both safety and security. Certain design criteria imposed for safety purposes may serve to reinforce security. As an example, the single failure criterion applied to safety systems requires the nuclear power plant to be designed with a sufficient level of redundancy and/or diversification to ensure that safety functions are maintained. That is, the criterion demands that safety be maintained even if one set of equipment in the system fails. This design feature is helpful for security purposes as well; the application of this criterion means that aggressors must compromise several targets in the nuclear power plant in order to cause a radiological release.

55. Other examples of synergy between safety and security are:

— The use of passive systems to avoid human errors may make it more difficult for potential aggressors to tamper with these systems;
— The introduction of robustness against human errors serves to increase protection against an insider threat and, of course, measures to ensure insider protection serve to reduce human errors as well;
— Doors or barriers can serve both safety and security. Doors or barriers have a safety function by serving as a radiation barrier. They can serve a security purpose by delaying or preventing unauthorized access.

56. Moreover, safety specialists can usefully help security specialists to identify sensitive targets because of their knowledge of the potential consequences of the failure of equipment important to safety and control.

57. Design features that are introduced to serve safety purposes can at times be antagonistic to the achievement of security purposes, and vice versa. The introduction of delay barriers for security purposes might, for example, prevent access by the fire brigade or off-site firefighters, or might block evacuation routes. Designs to channel attackers into a field of fire by weapons could limit accessibility more generally for safety personnel. Heavy bunkering for security reasons may limit access for routine maintenance or surveillance.

58. These considerations reinforce the need to evaluate the relationship between safety and security and to ensure that safety and security experts work together in the development and evaluation of a design.

Construction

59. Careful oversight must be exercised during initial construction. Such scrutiny serves to ensure that the plant is constructed as designed, thereby serving both safety and security purposes. This scrutiny should prevent the inadvertent or intentional introduction of weaknesses that could result in a radiological release during operation. Such oversight can present a major challenge because of the large number and diversity of workers entering the site during a construction period.

Operation and decommissioning

60. Operation must be conducted in a fashion that ensures that both safety and security functions are accomplished. The obligation to ensure safety and security extends over the lifetime of the facility — from construction, through the decades of operation, and during the decommissioning period for as long as used fuel remains at the site. The safety obligation continues until all radiological hazards have been addressed.

61. Special obligations may arise during periods in which extensive plant modifications are under way. During such activities, many contractors may need to enter the vital area of the plant, resulting in the need for appropriate access controls for both safety and security purposes. Care must be taken to prevent the inadvertent or intentional introduction of vulnerabilities. At a time when many operating plants are moving from analog to digital instrumentation and control, protection of the facility from bugs in the software or from hackers and malicious intruders requires special attention.

6.2. ACTIVITIES OF SPECIAL SIGNIFICANCE

62. There are activities undertaken during the plant's lifetime that warrant special consideration.

Maintenance, surveillance and inspections

63. The availability of safety and security systems must be permanently ensured. Maintenance operations as well as surveillance and inspections should be carried out on a regular basis and compensatory measures put in place whenever a safety or security capability is rendered unavailable. Again, coordination of safety and security capabilities is necessary so that compensatory measures do not undermine the necessary balance between safety and security. For example, the shutting off of electric power to an area in order to conduct maintenance should be undertaken with full awareness of the possible compromising of surveillance systems that serve security purposes and the need to introduce compensatory security measures.

64. It is common at many plants to undertake many maintenance and surveillance activities during refuelling. This inevitably leads to large peaks in demand for supplementary human resources, which are in general provided by external organizations. This leads to the need for additional access and control measures to ensure security.

Feedback from operating experience

65. Events concerning equipment failures, identified anomalies, human errors and sabotage attempts must be recorded and evaluated appropriately. The information gained from identified incidents in the nuclear power plant or in others of similar design or operation makes it possible to improve its safety or its security. It is customary and appropriate for the operator's safety personnel to share safety information widely. Such exchange of information is much more limited in the security domain and usually only involves to individuals on a need to know basis. At times a safety event may reveal a security vulnerability and, in such a case, controls on the sharing of information may be necessary.

Access and control measures

66. Access and control measures are relevant both for safety and security. For safety, such controls can prevent unexpected radiation exposure or ensure that access to vital equipment is limited to appropriate personnel, thereby avoiding errors. Such controls also can advance security through reducing risks of theft, by preventing unauthorized penetration by adversaries, and by excluding weapons or explosive materials from the plant. Moreover, access control records can also be used to confirm that all workers have been safely evacuated from a plant in the event of an emergency.

67. Access controls can create conflicts between safety and security. This is typically the case with access and egress of personnel during emergencies. Rapid access is necessary for safety purposes to respond to events in a timely manner and rapid egress may be necessary to protect the health of workers. But the provision of means for rapid access or egress can create a vulnerability that could be exploited by a terrorist adversary.

68. Consequently, the operating rules and procedures must take into account the respective safety or security considerations and provisions implemented must reflect an appropriate balance between safety and security objectives. In many cases, these conflicts can be solved with specific solutions defined by close cooperation between safety and security specialists. When conflict is unavoidable, the matter should be considered from both safety and security perspectives and resolved based on the philosophy of minimizing the overall risk to the public.

Management system

69. Activities related to both safety and security of a nuclear power plant are managed by a quality management system. In particular, the commitment to the implementation of a quality management system applies in an equivalent manner to both the safety and security fields. However, certain activities may have particular relevance in connection with one or the other objective. For example, the management of classified information is particularly relevant for security. On the other hand, the obligation of transparency on safety matters should be taken into account in the quality management system so as to facilitate improvement in safety and to reassure the public.

70. It may also be found to be necessary to establish performance indicators for safety and security. It is necessary that the management of the operating organization be capable of measuring the status of safety or security of a nuclear power plant and to define progress or slippage in the achievement of either objective.

7. CONCLUSIONS

71. Safety and security serve a common objective — the protection of the public and the environment — and typically reflect a common philosophy of defence in depth. Indeed, many features of plant design or operation serve to enhance both safety and security. But at times actions undertaken to advance one purpose could adversely affect the other. This means that decisions at a nuclear power plant regarding safety or security require an integrated management approach that ensures the consultation of experts in each discipline on a continuous basis. The implementation of changes should be supported by effective procedures to ensure such consultation. Safety and security issues should be evaluated on mutually supporting and reinforcing terms.

72. With respect to the degree to which nuclear safety and nuclear security are to be integrated, special attention is needed in relation to:

— Differences in the State's involvement: the State is directly involved in identifying a threat and may need to provide support in response to a terrorist act, but has no similar role in connection with a safety incident.
— Security information must often be kept confidential, whereas safety is generally advanced by openness and transparency.
— Security personnel typically have a military or police background, whereas general plant staff are more typical of the general population, albeit with an emphasis on engineering or expertise in the maintenance or operation of machinery.

73. Achieving both safety and security in a nuclear power plant requires good communication among individuals with different objectives and backgrounds. Management needs to promote both a safety and a security culture that serves to ensure that both objectives receive appropriate attention. Management emphasis on coordination is essential. The objective is to ensure that safety and security co-exist with each other and mutually enhance each other.

74. Efforts to coordinate these two regimes are beneficial to both. Bridging the gap between the international conventions and standards/guidance is extremely important in this effort.

8. RECOMMENDATIONS

AT THE INTERNATIONAL LEVEL

(1) Efforts should be undertaken to promote coordination between safety and security at nuclear installations by:
   — Organizing meetings, events, seminars with both safety and security agencies and experts and including the participation of the industry from an early stage.
   — Developing documents such as security guides and safety standards that are consistent and complementary. Such development would benefit by involving safety experts in the production of security documents and vice versa, and also by industry involvement.
   — Developing combined assistance programmes and review and training missions, and providing them to specialists of each discipline in joint sessions to improve integration.

(2) States considering nuclear power for the first time should be made aware that both safety and security must be addressed and that the interface between the two should be coordinated.

AT THE STATE LEVEL

(3) The State and its regulatory authorities should ensure that security regulations do not compromise safety and that safety regulations do not compromise security. This is achieved in many countries by having a single regulatory agency responsible for both sets of requirements, thereby helping to ensure compatibility and coordination. However, if the safety and security authorities are not integrated in a single agency, consultation and coordination mechanisms are needed between the responsible authorities.

(4) The State needs to make sure that the responsibilities of the operating organization and other State bodies are well defined in relation to both safety and security.

(5) The regulatory authorities should develop ways to promote safety and security cultures, taking into account their similarities and differences.

(6) Regulatory authorities in different States should exchange good practices as well as information related to incidents or accidents, keeping in mind the need to protect certain types of information.

(7) Means should be pursued to ensure adequate communication with the public on safety and security issues. This includes efforts to educate the public on nuclear safety and nuclear security matters.

AT THE LEVEL OF THE OPERATING ORGANIZATION

(8) The management of the operating organization must take prime responsibility for safety and security.

(9) Safety and security should be coordinated from the conceptual stages of development, through infrastructure building siting, design, operation and decommissioning. All systems and procedures should be examined with an eye to both safety and security with the aim of ensuring that an optimal balance is achieved. An effective change control process should be put in place to ensure that any proposed changes of design, layout or procedures are thoroughly evaluated to verify that they do not jeopardize safety or security.

(10) The operating provisions should take into account the respective safety or security requirements and ensure that their implementation satisfies both objectives. Requirements should be managed through close cooperation between safety and security specialists with the objective of minimizing the overall risk to the public.

EMERGENCY RESPONSE BY THE OPERATOR, THE REGULATOR AND THE STATE

(11) Although the State may have a special role in the context of security, the achievement of both safety and security inside a nuclear facility remains the prime responsibility of the operator. To ensure that emergency decisions reflect an awareness of both security and safety considerations, the operator should centralize decision making in a single management chain.

(12) Emergency preparedness and response plans in the fields of safety and security need to be well coordinated with all relevant entities, and they should be complementary and coherent.

(13) Joint exercises should be organized and conducted to confirm the coordination among all organizations involved.

(14) Any on-site actions by outside security forces should be coordinated with the operator so as to ensure that safety considerations are appropriately evaluated.

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