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The Functional Interactions Among Safety, Security, and Safeguards (3S) --- Conflicts and Synergies

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ABSTRACT

In the transport of radioactive materials, the need to address three disciplines related to nuclear power — safety, security, and safeguards (3S) — is vital. To meet the challenge of effectively and efficiently integrating the 3S as they apply to transport, a series of training modules addressing the interactions among safety, security, and safeguards were developed as part of the training on security during the transport of nuclear and other radioactive material held annually by Argonne National Laboratory, supported by the U.S. Department of Energy (DOE) Packaging Certification Program (PCP). All stakeholders — designers and operators, shippers and carriers of nuclear material, national and international authorities — can benefit from the savings gained by the integration of 3S. In particular, there could be cost savings for 16 ongoing DOE cleanup programs, which are projected to cost more than $400 billion. The first step in developing this integration is to examine where and how 3S requirements interface. We start by presenting an approach that defines the two needs for access that form the basis for conflicts and synergies in 3S — access to nuclear material and access to nuclear material information. We then apply this approach using Nuclear Regulatory Commission (NRC) regulation requirements 10CFR71, Packaging and Transportation of Radioactive Material. This paper then reviews and tabulates the potential for conflict and synergy for each requirement. The paper concludes with recommendations based on our findings.

INTRODUCTION

Transport of radioactive material is an integral part of both the commercial nuclear fuel cycle and nuclear defense activities. Globally, about 20 million consignments of radioactive material are transported each year on public roads, railways, and ships. Around 5% of these are nuclear fuel cycle related. [1] The total cumulative amount of used nuclear fuel that has been discharged worldwide is more than 400,000 tons heavy metal (t HM), of which more than 100,000 t HM have been reprocessed. Thus, about 300,000 t HM are stored at or away from reactors in wet and dry storage facilities, awaiting recycling or disposal in a repository. [2]

In the U.S. alone, more than 3 million packages of radioactive materials are shipped each year by road, rail, air, or water. [3] Transport of radioactive materials also is required for cleaning up U.S. nuclear defense sites, and the bill for the entire life cycle clean-up of those sites could be over $400 billion. [4] In 2019, the DOE reported that the Defense Environmental Cleanup will require more than $250 billion at the remaining 16 sites to complete its ongoing mission. [5] The National Nuclear Security Administration (NNSA) estimates that up to four future shipments per week to the Waste Isolation Pilot Plant in New Mexico will be made during the dilution and disposal of 34 metric tons of weapons-usable plutonium. [6]

Safety, security, and safeguards (3S) are required for nuclear materials at facility sites and during transportation. All stakeholders, including designers, operators, carriers, shippers, and government authorities, could potentially benefit from synergies in the integration of the three disciplines. One reason why integrating 3S is both a necessity and challenge is that when one of the three becomes a primary concern, the other two are affected and can produce new issues if conflicts are not addressed. The challenge has been characterized as demonstrating that “3S can provide more with less.” [7]

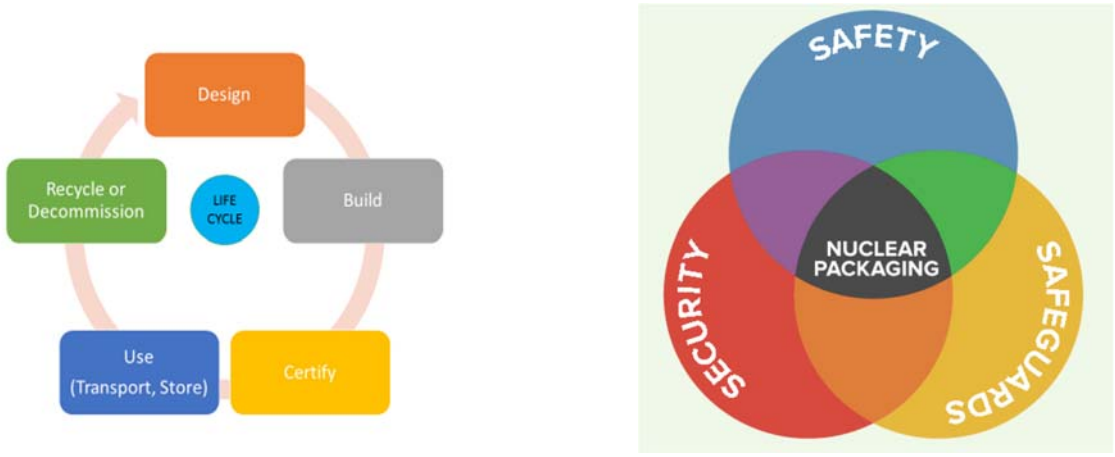
Historically, the emphasis has been on safety at facilities and during transport, and security has been given almost equal priority following the 11 September 2001 terrorist attacks in the U.S. [8] But nuclear safety cannot be isolated from nuclear

safeguards and nuclear security. [9] As more nuclear material has been put into use by more countries, safeguard requirements received greater attention.*

2S and 3S INTERNATIONAL GUIDANCE

While the three disciplines' principles, applications, and culture in the nuclear industry are well understood individually, the three have generally not been treated collectively. Many published papers address two of the 3S requirements as pairs: for example, safety and security, security and safeguards (material control and accounting, or MCA), and safeguards and safety. Some of these pair relationships lead to conflicts, and others lead to synergies. Integration of 3S leads to an infrastructure that provides the most effective and efficient design and operation for a nuclear facility's handling, transfer, and shipment of nuclear material.

Figure 1(a) depicts the life cycle for nuclear and other radioactive material packaging. Figure 1(b) depicts the separate aspects of safety, security, and safeguards, their "2S" paired interactions, and the 3S united in nuclear packaging.



(a) (b)

Figure 1. (a) Life cycle of packaging of nuclear and other radioactive material and (b) 3S, three 2S and 1S aspects of nuclear packaging

Figure 1(b) also illustrates that packaging is always required for nuclear and other radioactive material during its life cycle of storage, transportation, and disposal and that safety, security, and safeguards must be maintained at all times during the entire life cycle. Safety by design, security by design, and safeguards by design for nuclear packaging, when fully integrated, provide balance and strength to each of the three disciplines.

In a resolution at the International Atomic Energy Agency (IAEA) 2002 General Conference, the IAEA adopted an integrated approach that includes physical protection and material accounting for transport of radioactive material and nuclear material, and recommends that security system designers consult with safety experts. [10]

The most frequent approach for 3S interactions has been to address safety and security only, where security sometimes has included material control and accounting (MCA). At the 2018 IAEA General Conference, a resolution was passed that acknowledged the distinctions between safety and security, affirmed the importance of addressing their interfaces, and encouraged the IAEA to ensure the consistency of the terminology. [11]

* In this paper, the term "safeguards" refers to national systems for material control and accounting (MCA) of nuclear material, and "international safeguards" are based on the existence of national MCA systems.

It is also common to address the interactions between security and MCA, but not their interactions with safety. For example, for security purposes, detailed information about the transport of nuclear material should be protected as sensitive information until the movement is complete; however, this should not conflict with notification requirements for MCA. [12] Other 2S pairings can also exhibit gaps:

- Interactions between security and safety should address interactions with MCA. For example, it is recognized that nuclear security and safety considerations for transport of nuclear material should work in concert. In assessing the potential for sabotage, the safety features of the package and conveyance and the nuclear security measures to prevent unauthorized removal should work in concert. Facilities can benefit from a safety and security culture built and maintained for the management of safety-security interfaces. [13]

- Interactions between physical protection and MCA should address interactions with safety. An in-depth defense of materials should take into account the ability of the physical protection system and the MCA system to protect against both insider and external threats. These two disciplines together should also deter and detect the protracted theft of nuclear material by an insider. [14]

When building the capacity for nuclear security, there will be direct interfaces with nuclear safety and nuclear safeguards (MCA). In 2S interactions, basic capabilities may be the same: for example, using equipment to detect and identify nuclear and other radioactive material. Based on education and experience, multiple professional competencies may be maintained by staff. It is most effective and efficient if the management system, procedures, and personnel take maximum advantage of shared capabilities, equipment, and resources and work together to achieve goals. [15]

Recently, an IEAE publication addressed interactions between nuclear material control (MCA) and nuclear security (2S) in production, processing, use, storage and movement (although nuclear material control should continue during off-site movement of nuclear material). Using the appropriate administrative and technical measures ensures that nuclear material is not misused or removed without proper authorization. Control of nuclear material should be coordinated among all organizational units involved. Physical protection measures and MCA measures should be coordinated and should complement each other, and the same technical measures may serve both disciplines. The operator should assess and manage the interfaces to prevent adverse effects, and activities should be mutually supportive, to the extent possible. [16]

The IAEA Safety Standards Series has addressed both safety and security by noting that safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety, and safety measures do not compromise security.[17, 18] The Standards Series extended this approach to 3S interactions in "Principal Technical Requirement No. 8, Interfaces of Safety with Security and Safeguards," which states that 3S measures should be designed and implemented in an integrated manner so they do not compromise one another. [19]

The IAEA Nuclear Security Series also notes that for new nuclear facilities, site selection and design should take physical protection into account as early as possible and address the interface between physical protection, safety, and material accountancy and control to avoid conflicts and to ensure that all three elements support each other. More specifically, the safety features of the design of the transport package, container, and conveyance should be taken into account when deciding what additional physical protection measures are needed to protect the material against sabotage. [20] Subsequent reports in this series further note the importance of addressing all 3S disciplines. [21, 22, 23]

There are interfaces among safety, security, and safeguards, including MCA, which should be coordinated during each phase of development of a nuclear power program, taking into account related requirements for each. In particular, the management system has a key role to play in reinforcing the interfaces and taking into account their commonalities and

differences. For new facility site selection and design, 3S interfaces should be considered as early as possible to avoid any conflicts and to ensure complementarity. Consignors and carriers should develop an integrated transport security plan. [24] Safety in the transport of radioactive material relies primarily on the performance of packages. It is the consignor's responsibility to ensure the appropriate selection of the packaging and the mode of transport.

Although focused on safety, some IAEA standards recognize the importance of integrating 3S disciplines at the national authority level. [25, 26] U.S. NRC regulations 10CFR73.55 and 10CFR73.58 address the safety and security (2S) interface at nuclear power plants, including a review of the security program with an audit of the effectiveness of safety and security interface activities. For the transport of spent nuclear fuel, 10CFR73.38(b) sets a performance objective for personnel that they do not constitute an unreasonable risk to public health and safety or the common defense and security. Regulation 73.38(c)(ii) also addresses safety and security. When potential conflicts are identified, the licensee must communicate them to appropriate licensee personnel and take compensatory actions to maintain safety and security. [27]

In addition, the U.S. NRC provides guidance for managing the safety-security interface (2S) by nuclear power plant licensees, an important element for achieving the objectives of both safety and security. The licensee should address activities including the handling, storage and preparation for transport of spent nuclear fuel that could compete or conflict. Procedures should be reviewed and should provide a means for resolving conflicting or competing safety and security interests. The licensee should also provide training to managers involved in the process of facilitating the interface between safety and security. [28]

Recognizing the need to achieve a better understanding of the interactions and interfaces among all 3S disciplines related to nuclear power, Argonne National Laboratory has developed a training series on Nuclear and Other Radioactive Materials Transport Security, which includes a module on how to address the interactions of safety, security, and safeguards requirements. [29, 30]

3S OBJECTIVES AND RISKS

A new paradigm is needed that takes into account potential conflicts and synergies, starting with a reconciliation of the threats and objectives for the three disciplines. Totally independent 3S systems are likely to introduce conflicts and duplication. It is important that the objectives for the 3S systems are compatible and mutually supportive. However, before defining an approach or methodology for analyzing 3S interrelationships, it is helpful to identify a working definition of the corresponding threats and objectives.

The three main aspects of nuclear law for 3S are as follows: [31]

- Safety: Unintended conditions or events leading to radioactive releases from authorized use
- Security: Intentional misuse of nuclear or other radioactive materials
- Safeguards: Activities that could lead to the acquisition of nuclear weapons

The three aspects independently address the following three corresponding risks:

- Safety risk: Accident due to system failure, human error, or natural disaster
- Security risk: Terrorism due to sabotage, external attack, or inside malicious act
- Safeguards risk: Diversion or misuse of nuclear material for non-peaceful purpose

Based on those risks, the following become objectives:

- Safety: Protect people and the environment from radiation
- Security: Protect nuclear and other radioactive materials and facilities from malevolent people
- Safeguards: Protect people and environment from malevolent people

Collectively, the overall objective is protection of human life, health and the environment. Each of the 3S must be designed and implemented in an integrated manner so that the collective and individual objectives are harmonized.

A SYSTEMATIC METHODOLOGY FOR DETERMINING 3S INTERACTIONS

Given the three threats, corresponding objectives, and collective overall objective, identifying conflicts and synergies while integrating 3S to obtain the benefits of nuclear energy has proven to be a complex undertaking. A set of basic principles and a systematic methodology, or framework, helps address the issues.

This approach was originally presented using international safeguards requirements INFCIRC/153 and INFCIRC/540 to compare to safety and security requirements. [32] The approach presented here uses the safety requirements of 10CFR71 to compare to security and safeguards (MCA) requirements.

We start with two principles regarding why and how conflicts and synergies may occur based on the need for two types of access:

1. *Access to nuclear material information*: All three disciplines (safety, security, and safeguards) require access to nuclear material information at various times. Sharing this information to the extent possible (rather than collecting and compartmentalizing it) can lead to synergies that result in greater effectiveness and efficiency for each discipline. At the same time, however, access to certain information (particularly that related to physical security and information security) is restricted. Conflicts can occur over sharing information due to its sensitivity, particularly that related to physical security and quantity, type, location, and transport of nuclear material.

2. *Access to nuclear material*: All three disciplines also require access to nuclear material at various times. Synergies can occur when access to nuclear material for purposes of measurement or inspection (for example, for safety and safeguards) is shared. On the other hand, conflicts can occur when safety and security disciplines restrict or control physical access to nuclear material, but a safeguards discipline requires access to nuclear material for verification.

APPLICATION OF THE METHODOLOGY TO NATIONAL REQUIREMENTS 10CFR71

Table 1 shows the results of applying these two principles to the set of requirements in 10CFR71, using the methodology to generate a table that helps identify potential conflicts (C) and synergies (S) among the 3S for each requirement. Table 1 helps provide insight on where conflicts need to be avoided and where synergies can be taken advantage of under 10CFR71. This insight then can be applied to the transport of a package of nuclear material to identify specific conflicts and synergies. Some requirements entail only a minor 3S consideration (denoted by NA for "non-applicable"). The more specific a requirement is, the clearer the degree of conflict or synergy. A key factor for each 3S discipline is the technology (equipment or procedures) used for purposes of safety, security, or safeguards. A good example is the smart drum technology developed by Argonne for the DOE Packaging Certification Program for radioactive and other hazardous materials. [33]

Determining the potential for conflicts and synergies at this level has a subjective element, which makes it all the more important that experts in each of the 3S disciplines apply this methodology jointly. Note that a similar table could be generated starting with other national regulations, such as for U.S. Dept. of Transportation regulations, or with international requirements and recommendations, such as IAEA SSR-6 for safety recommendations, INFCIRC/225 for physical protection recommendations, or INFCIRC/153 for international safeguards requirements.

Table 1. Interactions for Potential 3S Conflicts (C) and Synergies (S) under NRC 10 CFR 71, Packaging and Transportation of Radioactive Material

Safety Requirements	Security	Safeguards	Comment
Subpart A — General Provisions			
71.0 Purpose and Scope			
(a) Establishes requirements, procedures, and standards	S/C	S/C	Applies to packaging, preparation and transport
(b) Applies to other CFR Parts	S/C	S/C	Other CFR requirements
(c) Applies to any licensee	S/C	S/C	For any external transfer
(d) Exemptions, application and compliance	S/C	S/C	Refers to sections below
(e) Applies for certificate of compliance	S/C	S/C	For external transfer
(f) Applies for certificate of compliance	S/C	S/C	For external transfer
(g) Notice to all persons	S/C	S/C	Enforcement action for violation
71.1 (a) Communications	C	C	Communication guidance
71.1 (b) Records	S/C	S/C	Licensee records
71.2 Interpretations	NA	NA	NRC interpretations
71.3 Requirement for license	NA	NA	NRC authorization
71.4 Definitions	NA	NA	NRC definitions
71.5 Transportation of licensed material	S/C	S/C	Comply with DOT regs
71.6 Information collection requirements: OMB	NA	NA	OMB approval
71.7 Completeness and accuracy of information	S	S	Licensee information
71.8 Deliberate misconduct	NA	NA	Personal behavior
71.9 Employee protection	NA	NA	Licensee discrimination
71.10 Public inspection of application	C	C	Information. available to public
71.11 Protection of safeguards information	C	C	Licensee protect information
Subpart B — Exemptions			
71.12 Specific exemptions	NA	NA	NRC grants exemptions
71.13 Exemption of physicians	NA	NA	Physicians are exempt
71.14 Exemption for low-level materials	S	S	Licensee exemption
71.15 Exemption from classification as fissile material	S	S	Licensee exemption
Subpart C — General Licenses			
71.17 General License: NRC-approved package	NA	NA	General license conditions
71.19 Previously approved package	NA	NA	NRC approvals
71.20 General license: DOT specification container	NA	NA	See DOT requirements and Subparts A, G, H specifics
71.21 General license: Use of foreign approved package	NA	NA	See DOT requirements and Subparts A, G, H specifics
71.22 General license: Fissile material	NA	NA	See DOT requirements and Subparts E, F, H specifics
71.23 General license: Plutonium-beryllium special form material	NA	NA	See DOT requirements and Subpart H specifics
Subpart D — Application for Package Approval			
71.31 Contents of application	S/C	S	Package description, QA, evaluation, and standards. Sensitive?
71.33 Package description	S/C	S	Detailed information. Sensitive?
71.35 Package evaluation	S/C	S	Detailed information. Sensitive? See Subparts E and F
71.37 Quality assurance	S	S	See Subpart H
71.38 Renewal of a certificate of compliance	NA	NA	Application guidance

Safety Requirements	Security	Safeguards	Comment
71.39 Requirement of additional information	S/C	S/C	Added information. Sensitive?
Subpart E --- Package Approval Standards			
71.41 Demonstration of compliance	S	NA	Sensitive information?
71.43 General standards for all packages	S/C	S/C	Sensitive information?
71.45 Lifting and tie-down standards for all packages	S/C	C	Sensitive information?
71.47 External radiation standards for all packages	S	S	Sensitive information?
71.51 Additional requirements for Type B packages	S/C	S/C	Design and construct Sensitive information?
71.55 General requirements for fissile material packages	S/C	S/C	Design and construct Sensitive information?
71.59 Standards for arrays of fissile material packages	NA	NA	Calculational
71.61 Special requirements for Type B packages containing more than 10^5 A_2	NA	NA	Calculational
71.63 Special requirements for plutonium shipments	NA	NA	Shipping conditions (solid form)
71.64 Special requirements for plutonium air shipments	S	S	Design and construct criteria
71.65 Additional requirements	NA	NA	NRC responsibility
Subpart F --- Package, Special Form, and LSA-III Tests			
71.70 Incorporation by reference	NA	NA	Referenced standards
71.71 Normal conditions of transport	NA	NA	Tests
71.73 Hypothetical accident conditions	NA	NA	Tests
71.74 Accident conditions for air transport of plutonium	NA	NA	Tests
71.75 Qualification of special form radioactive material	NA	NA	Special form and tests
71.77 Qualification of LSA-III material	NA	NA	Tests
Subpart G --- Operating Controls and Procedures			
71.81 Applicability of operating controls and procedures	NA	NA	See Subparts A, G, H
71.83 Assumptions as to unknown properties	NA	NA	Assumptions
71.85 Preliminary determinations	S	S	Packaging review
71.87 Routine determinations	S	S	Packaging review
71.88 Air transport of plutonium	NA	NA	Restrictions
71.89 Opening instructions	C	C	Instructions Sensitive information?
71.91 Records	S	S	Shipment records
71.93 Inspection and tests	S	S	NRC inspections and tests
71.95 Reports	S	S	Licensee reports to NRC Sensitive information?
71.97 Advance notification of shipment of irradiated reactor fuel and nuclear waste	S	S	Notification by licensee Sensitive information?
71.99 Violations	NA	NA	NRC action
71.100 Criminal penalties	NA	NA	Atomic Energy Act
Subpart H --- Quality Assurance			
71.101 Quality assurance requirements	S	S	QA and QC for packages Sensitive information?
71.103 Quality assurance organization	S	S	Licensee QA organization Sensitive information?
71.105 Quality assurance program	S	S	Licensee QA program Sensitive information?
71.106 Changes to quality assurance program	S	S	Changes to QA program
71.107 Package design control	S	S	Package design interfaces
71.109 Procurement document control	S	S	Contractor QA
71.111 Instructions, procedures, and drawings	S	S	Document quality

Safety Requirements	Security	Safeguards	Comment
71.113 Document control	S	S	Document control
71.115 Control of purchased material, equipment, and services	S	S	Contractor QC
71.117 Identification and control of materials, parts, and components	S	S	Licensee QC
71.119 Control of special processes	S	S	Licensee QC
71.121 Internal inspection	S	S	Licensee QC inspections
71.123 Test control	S	S	Licensee test program
71.125 Control of measuring and test equipment	S	S	Licensee controls
71.127 Handling, storage, and shipping control	S	S	Licensee controls
71.129 Inspection, test, and operating status	S	S	Licensee controls
71.131 Nonconforming materials, parts, or components	S	S	Licensee controls
71.133 Corrective action	S	S	Licensee actions
71.135 Quality assurance records	S	S	Licensee records
71.137 Audits	S	S	Licensee QA audits
Appendix A to Part 71 --- Determination of A_1 and A_2			
Calculations and Tables	NA	NA	Calculational

PRACTICAL EXAMPLE OF APPLICATION FOR NUCLEAR MATERIAL PACKAGE TRANSPORT

This example consists of a package containing spent nuclear fuel that is loaded onto a trailer for road transport in the U.S. This package is subject to NRC regulation 10CFR71 and related DOT regulations, and the NRC has issued a Certificate of Compliance for the safety aspects of the package. This package must be secure from theft and sabotage, and the declared material in the package must be accounted for at all times. The package is designed with safety systems and barriers to routinely provide safe transport and storage incidental to transport and to prevent or reduce effects should an accident occur. Consequently, the design must take into account materials, structure, thermal, containment, radiation shielding, criticality, operation, acceptance test and maintenance and quality assurance, and satisfy the regulatory safety requirements during normal conditions of transport and hypothetical accident conditions prescribed in 10CFR71. Design documents include specifications, drawings, procedures, and instructions for the fabrication, maintenance and use of the package.

Below are some 3S opportunities for synergies and conflict risks for this example. We use the baseline U.S. national requirement 10CFR71 that applies to the transportation cask and the U.S. Department of Transportation requirements that apply to the transport vehicle.

- Application for license — Where licensing regulations require submittal of information to the national authority for all 3S disciplines, there may be duplication of submitted information. This is a 3S synergy opportunity to share information and avoid duplication of effort.
- Information — Availability, integrity, and confidentiality of information are important to each of the 3S. Protection of certain proprietary, security, and safeguards information is necessary. Access to certain information can lead to conflicts for safeguards and security purposes. Where possible, information that is not sensitive can be shared for 3S synergy to avoid duplication of data.
- Package design — Robust design, testing, and manufacture can synergistically support 3S with shared access to the information. To avoid conflicts, design for safety and security to control access to the packaged material must also provide for access for safeguards. Conflicts can occur if any of the 3S disciplines are not considered or they are considered late in the design and manufacture. Where design information is needed for each of the 3S disciplines, synergies may be realized by sharing information to avoid duplication of effort, records, and reports.

- Design changes — The potential for 3S conflict is high if design changes are made with only one discipline in mind. Joint review of design changes for 3S can be synergistic.
- Certificate of Compliance — Certain design information is relevant to all 3S and to gain synergies may be shared rather than duplicated for the individual disciplines.
- Transport vehicle — The type of transport vehicle is more relevant to safety and security conflicts and synergies than to safeguards.
- Package tie-downs — Tie-downs during transport can be synergistic for safety and security. Conflict with safeguards is not an issue, since accountability is done at time of shipment and receipt of the package, and access for safeguards is not required during transport.
- Loading/unloading of the package — There may be conflict where safeguards require access for material shipment or receipt accountability at the time of loading and unloading, but security and safety conditions and procedures limit access then.
- Inspection — Safety and security may conflict with safeguards where access to packaged material is needed. Joint inspection of a package and its contents, joint use of surveillance and seals, and information sharing can be 3S synergetic by reducing multiple independent accesses and duplication of information such as material type, amount, and location.
- Unattended monitoring — Continuous monitoring during storage and transport, to maintain continuity of knowledge of the material or package integrity, can be 3S synergetic when information and use of surveillance and seals equipment are shared to reduce redundancies.
- Seals — Joint use of seals for ensuring the integrity of the contents of a package can be 3S synergetic.
- Records — Records for packages, nuclear material, and inspections can be 3S synergetic where the information is shared and not independently duplicated.
- Reports — Reports on package condition and adherence to the Certificate of Compliance can be 3S synergetic when the information for the package and contents is shared.
- Advance notification — Advance notification can be 3S synergetic when information is shared, but placarding for safety may conflict with security.
- Transportation security plan — The transportation security plan can benefit from a joint 3S review, for example, with respect to design and handling procedures to identify potential 3S conflicts and beneficial synergies.
- Accident/emergency response — In the event of an accident during transport, all 3S disciplines come into play for the emergency response team. A safe, secure design synergistically helps reduce potential damage to the package and helps preserve the integrity of material and data for safeguard purposes. Access may be controlled synergistically for safety and security jointly. There can be 3S synergy in sharing information about material status during the emergency. For any event, there needs to be assurance that there are no 3S conflicts.
- Training — Training is essential for each of the 3S disciplines. Cross training in 3S can be synergetic when 3S disciplines are jointly addressed rather than separated by discipline, which can lead to conflicts.
- Quality assurance program — QA procedures and quality control for design, manufacture, handling, shipping, storing, and inspection are 3S synergistically beneficial.

CONCLUSIONS AND RECOMMENDATIONS

1. The 3S approach is valuable for meeting the combined objectives for safety, security, and safeguards.
2. The methodology presented in this paper is most effectively applied early in the planning, siting and design phases for sites and packages, but also is effectively applied during operation or use when new requirements, amendments, or guidance — whether for safety, security, or safeguards — are issued.
3. The benefits of the 3S approach apply to all stakeholders, including designers and operators, carriers and shippers of nuclear materials, and government entities.
4. Retrofitting and modifications can be avoided by jointly and systematically addressing the 3S disciplines.

5. Certain functions must remain independent and non-conflicting, but where possible benefits from synergies can be gained where access to material and access to information can be shared.
6. Training and demonstration of the 3S approach, such as the ANL Transport Security training course, helps identify 3S conflicts and synergies.

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