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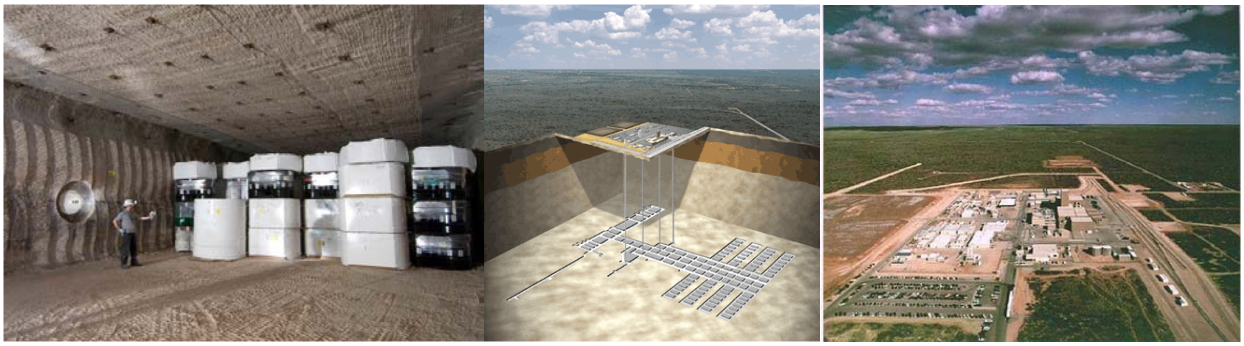

Application of Framework for Integrating Safety, Security, and Safeguards (3Ss) into Design of Used Nuclear Fuel Storage Facility

Rev. 0

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EXECUTIVE SUMMARY

Department of Energy's Office of Nuclear Energy, Fuel Cycle Research and Development develops options to the current commercial fuel cycle management strategy to enable the safe, secure, economic, and sustainable expansion of nuclear energy while minimizing proliferation risks by conducting research and development focused on used nuclear fuel recycling and waste management to meet U.S. needs. Used nuclear fuel is currently stored onsite in either wet pools or in dry storage systems, with disposal envisioned in interim storage facility and, ultimately, in a deep-mined geologic repository. The safe management and disposition of used nuclear fuel and/or nuclear waste is a fundamental aspect of any nuclear fuel cycle.

Integrating safety, security, and safeguards (3Ss) fully in the early stages of the design process for a new nuclear facility has the potential to effectively minimize safety, proliferation, and security risks. The 3Ss integration framework could become the new national and international norm and the standard process for designing future nuclear facilities.

The purpose of this report is to develop a framework for integrating the safety, security and safeguards concept into the design of Used Nuclear Fuel Storage Facility (UNFSF). The primary focus is on integration of safeguards and security into the UNFSF based on the existing Nuclear Regulatory Commission (NRC) approach to addressing the safety/security interface (10 CFR 73.58 and Regulatory Guide 5.73) for nuclear power plants.

The methodology used for adaptation of the NRC safety/security interface will be used as the basis for development of the safeguards /security interface and later will be used as the basis for development of safety and safeguards interface. Then this will complete the integration cycle of safety, security, and safeguards. The overall methodology for integration of 3Ss will be proposed, but only the integration of safeguards and security will be applied to the design of the UNFSF.

The framework for integration of safeguards and security into the UNFSF will include 1) identification of applicable regulatory requirements, 2) selection of a common system that share dual safeguard and security functions, 3) development of functional design criteria and design requirements for the selected system, 4) identification and integration of the dual safeguards and security design requirements, and 5) assessment of the integration and potential benefit.

APPLICATION OF FRAMEWORK FOR INTEGRATING SAFETY, SECURITY AND SAFEGUARDS (3SS) INTO DESIGN OF USED NUCLEAR FUEL STORAGE FACILITY

1 INTRODUCTION

Integration of safety, security, and safeguards (3Ss) into the design of new nuclear facility is a concept has been promoted by the International Atomic Energy Agency, the Department of Energy (DOE), and by some in nuclear industry.

A preliminary framework was developed that focuses on how the 3Ss can best be integrated at beginning of the facility design and extending into the facility operation. The integration framework uses a systems engineering approach to combine the results of the individual quantitative and qualitative 3Ss analyses to identify commonalities and differences, and to assess the synergy between the 3Ss elements and how best to integrate 3Ss elements into design. The overall overlaps and commonalities between safety, security, and safeguards are shown in Figure 1. Safety, Security, and Safeguards Interfaces.

The purpose of this task is to apply the concept of 3Ss integration to the design of the Used Nuclear Fuel Storage Facility (UNFSF). The focus of the work will be on integration of safeguards and security with minor emphasis on safety. The integration of Safeguards and Security into the UNFSF builds on the existing Nuclear Regulatory Commission (NRC) approach to addressing the Safety/Security interface 10 CFR 73.58 and implementing Regulatory Guide 5.73 (Ref. 1) for nuclear power plants.

The current threat environment requires that safeguards and security programs provide robust protection against the possibility of diversion or theft of material that could be used to fabricate an improvised nuclear device. Robust nuclear materials safeguards and security programs must consider the possibility of multiple perpetrators who are willing to sacrifice themselves in order to accomplish their goals.

Specifically, physical protection programs protect against external threats to facilities, while Safeguards/Material Control and Accounting (MC&A) programs protect against internal threats related to theft or diversion. As such, certain physical protection measures within facilities, such as using badge readers to restrict access to certain rooms, also reflect material control measures. Current MC&A regulations primarily focus on facility operations covering special nuclear material (SNM) in use or storage.

Physical Protection and Safeguards/MC&A programs complement each other in safeguarding nuclear materials from unauthorized use or diversion by providing for a variety of measures to promptly identify and help withstand sabotage, theft, or diversion attempts. Safeguards/MC&A primarily focuses on detecting covert theft or diversion, especially by potential facility insiders, while physical protection focuses on areas such as penetration by an external threat.

Safeguards/MC&A and Physical Protection (security) programs at a given facility share certain risk considerations, such as relevant internal adversary aspects in safeguards threats and comparable SNM thresholds for triggering protective measures against theft or diversion commensurate with its strategic worth. In particular, these programs interface with each other in the areas of containment; surveillance, e.g., monitoring and detection; access control; and movement vantage points.

A sound Safeguards/MC&A program deters theft or diversion by using practices and procedures that enable early detection of unauthorized changes in the material inventory and that trigger an appropriate and timely response. Focusing on the interfaces and interactions between Safeguards/MC&A and Security will produce risk-informed programs, minimize redundancy, take credit for the synergistic relationship between the two programs, optimize actions to safeguard SNM, and minimize cost of protection and control of SNM materials throughout the life cycle of the facility.

2 FRAMEWORK FOR INTEGRATING SAFEGUARDS AND SECURITY

The framework is developed using NRC and DOE regulations, guidance and requirements for licensing of independent Spent Nuclear Fuel Storage Facility, such as 10 CFR 72 (Ref. 2), NUREG 1619 (Ref. 3), and DOE–NGSI-SBD-001 (Ref. 9). The framework is preliminary and additional development is required in the future to optimize and standardized the process.

The framework for integrating safeguards and security has two phases. The first phase is to identify and analyze the applicable regulations and regulatory guidance necessary for developing a framework for designing safeguards and security systems that will meet the regulatory objectives and functional performance. The second phase is to implement and integrate the regulatory framework for designing Safeguards/MC&A and security systems in the overall design and operation of the facility. The framework is complex and challenging and requires multi-disciplines expertise. The expertise may include, but is not limited to regulations, requirements, design process, analysis, procurement, construction, startup testing, operation, and maintenance.

2.1 DEVELOPMENT OF REGULATORY FRAMEWORK FOR DESIGNING SAFEGUARDS/MC&A AND SECURITY SYSTEMS

This first phase of the process consists of two steps. The first step is to develop the regulatory framework for designing Security systems and the second step is to develop the framework for designing Safeguards/MC&A system. Sections 2.1.1 and 2.1.2 describe the framework for design security and Safeguards/MC&A.

2.1.1 REGULATORY FRAMEWORK FOR DESIGNING SECURITY SYSTEMS

The first step is to develop the framework for designing a security system that meets NRC requirements 10 CFR 73, Physical Protection of Plants and Materials (Ref. 4). This framework consists of several elements that must be examined and assessed as related to the specific nuclear facility. Some of these elements are fixed and others continue to develop as the design evolves. Therefore, attention must be paid to the implementation, integration, and verification process during all the design phases and the subsequent construction, startup, maintenance, and operation. The process involves tasks such as

1) Identifying the site security characteristics;
2) Defining security system objectives, identifying the threats, selecting threat scenarios;
3) Identifying and using the right tools for analysis;
4) Designing a system with less reliance on operational program;
5) Identifying and designing the security systems;
6) Continuing assessment of the system design throughout the design phases; construction, testing and operation; and
7) Developing the programmatic and operating procedures.

The framework for designing a security system for nuclear facility is shown in Figure 2. Regulatory Framework for Designing Security Systems.

2.1.2 REGULATORY FRAMEWORK FOR DESIGNING SAFEGUARDS/MC&A SYSTEMS

The second step is to develop the framework for designing a Safeguards/MC&A system that meets the NRC requirements in 10 CFR 74, "Material Control and Accounting of Special Nuclear Materials" (Ref. 5). Similar to the framework for design security system, the Safeguards/MC&A system consists of several elements that must be addressed at the start of the design and throughout the design phases, construction, start up, and operation. The process involves tasks such as

1) Identifying the SNM form, enrichment, quantities, and process units;
2) Defining Safeguards/MC&A system objectives, identifying the threats, selecting threat scenarios;
3) Defining the Material Access Areas (MAAs), and Vital Areas (VAs);
4) Identifying and using the right tools for analysis;
5) Designing a system with less reliance on operational program;
6) Identifying and designing the Safeguards/MC&A systems;
7) Continuing assessment of the system design throughout the design phases; construction, testing and operation; and
8) Developing the programmatic and operating procedures.

The framework for designing a Safeguards/MC&A system that will meet 10 CFR 74, Material Control and Accounting is shown in Figure 3. Regulatory Framework for Designing Safeguard Systems.

2.2 FRAMEWORK FOR INTEGRATING SAFEGUARDS/MC&A AND SECURITY INTO DESIGN

The second phase of the process for integrating safeguards and security into the design is to translate and implement the regulatory frameworks for designing the safeguards and security systems into the overall design of the facility. The translation process includes identifying applicable rules, regulations, and guidance and developing the performance objectives, function design criteria, and design requirements for each system. The implementation process includes designing the systems to the identified requirements and verifying the design meets the regulatory goals and objectives.

The first step in this phase is to identify the safeguards and security regulations performance goals. The second step is to identify functional design criteria and develop specific design requirements from the applicable regulatory guides, guidance, codes, and standards. Once the design criteria and requirements are developed and documented based on applicable regulations and guidance, the functional design criteria and associated design requirements that serve dual safeguards and security functions are identified. A strategy for integration into the design is developed by multi-discipline team that includes (but is not limited to) security, safeguards, engineering, maintenance, and operation staff. The requirements may be integrated through combining, cross-referencing, coordination, tracking, and assessments. The integration strategy is verified throughout the design phases of the facility by assessment and independent review by subject matter experts in safeguards and security.

The next step is to feed both the specific and shared security and safeguards requirements into the conceptual design. Analysis methods for safeguards and security, such as vulnerability analysis, treat analysis, probability risk assessment, acquisition strategy, and acquisition path analysis/diversion path analysis are conducted; and the results are incorporated into the design. Some of these analyses may generate new design requirements or require a revision of the design requirements. Some trade studies may be conducted during conceptual design phase as a result of the safeguards and security analyses. These studies are fed into the preliminary design. Additional studies or analyses may be performed to formulate the design. This is an iterative process throughout the design phases.

An early stage preliminary performance assessment should be conducted on the preliminary design using the top-down approach to trace the functional design criteria and design requirements through the security and safeguards systems design and ensure they are properly implemented. The findings of this assessment should be addressed. As the design moves into the final phase, there may be the potential for additional analysis, trade studies, and /or revision of existing analyses and trade studies.

This part of the iterative process during the design is necessary to optimize and harmonize the final design. The final step is to conduct a final performance assurance assessment that may use both top-down and bottom-up approaches to trace and verify that the functional design criteria and requirements are fully incorporated into the design. This step ensures that the design meets the performance goal of the regulations so that it can be licensed by the regulatory agency. The process for integration is shown in Figure 4. Framework for Integrating Safeguards into Design of Nuclear Facility.

3 APPLICATION OF FRAMEWORK FOR INTEGRATING SAFEGUARDS AND SECURITY INTO THE DESIGN OF THE UNFSF

The scope of the application is to 1) develop the performance goals, functional design criteria, and design requirements for a system that has dual safeguards and security function and identify the specific requirements for that system and address the early integration process of these requirements; 2) identify methods and trades studies; 3) describe the performance assessment process; and 4) highlight the benefits of integration at the early stage of the design.

3.1 SAFEGUARDS AND SECURITY RULES AND REGULATIONS

The applicable Safeguards and Security rules are

- Code of Federal Regulation, 10 CFR 73, Physical Protection of Plants and Materials and
- Code of Federal Regulation, 10 CFR 74, Material Control and Accounting of Special Nuclear Materials.

3.1.1 PHYSICAL PROTECTION OF PLANTS AND MATERIALS, (10 CFR PART 73) PERFORMANCE GOAL/OBJECTIVE

The performance goal/objective of the physical security rule is to analyze and establish the security design features that provide minimal reliance on operational program to protect against the design basis threats of theft or diversion of strategic special nuclear materials and radiological sabotage at an early stage.

3.1.2 MATERIAL CONTROL AND ACCOUNTING OF SPECIAL NUCLEAR MATERIALS (10 CFR PART 74) PERFORMANCE GOAL/OBJECTIVE

The performance goal/objective of the Safeguards/MC&A rules is to analyze and establish, at early stage, safeguard features that provide minimal reliance on operational programs to deter, prevent, detect loss or theft or sabotage, or unlawful diversion or unauthorized production of special nuclear materials.

3.2 SELECTION OF A SYSTEM WITH DUAL SAFEGUARDS AND SECURITY FUNCTION

The applicable regulatory guides applicable to the design, licensing, and operation of an Independent Spent Fuel Storage Installation were identified (Ref. 6). These guides were assessed in order to define the functional design criteria and design requirements for safeguards and security systems and to facilitate the selection of a facility system that has dual safeguards and security functions. Based on the review of the guidance documents, Exit and Entry Control System for Protected Areas, (PAs), VAs, and MAAs was selected. The system shares safeguards and security function.

3.3 DEVELOPMENT OF DESIGN CRITERIA AND REQUIREMENTS

NRC Regulatory Guide 5.53, Applicability of Existing Regulatory Guides to the Design and Operation of an Independent Spent Fuel Storage Installation (Ref. 6), identifies the applicable regulatory guides for safeguards and security for an Independent Spent Fuel Storage Facility. In addition, NRC Regulatory Guide 3.24, Guidance on the License Application, Siting, Design and Plant Protection for Independent Spent Fuel Storage Installation, provides design requirements for design of security systems.

Regulatory Guide 5.53 identifies the following regulatory guides as applicable to the Access Control System:

- Regulatory Guide 5.27, Special Nuclear Material Doorway Monitors, which lists the typical design requirements for SNM detection systems (Ref. 7)
- Regulatory Guide 5.7, Entry/Exit Control for Protected Areas, Vital Areas, and Material Access Areas, which lists the typical design requirements for metal/ explosive detection system (Ref. 8)

The performance objective of controlling the access to PAs, VAs, and MAAs is to prevent introduction of firearms, explosive, or incendiary devices that could be used to commit radioactive sabotage (security goal), or aid in the theft or diversion of SNM (safeguards goal). The Access Control system serves both functions.

The Access Control System is provided specifically to meet the requirements of 10 CFR 73.45(b), which requires specific entry and exit techniques to achieve the capability to detect, assess, and communicate attempt at unauthorized removal of SNM. The system consists of two separate systems: radiation detection and metal and explosive detection system.

3.3.1 FUNCTIONAL DESIGN CRITERIA FOR THE ACCESS CONTROL SYSTEM

References 7 and 8 identify the functional design criteria that are applicable to the Access Control System:

- Exit searches, which are conducted to ensure that concealed SNM is not removed from MAAs, should use both SNM detection equipment and metal detection equipment to provide greater confidence that either shielded or unshielded SNM material could be detected.
- SNM doorway monitors should be used in conjunction with a metal detector and should be installed in passageways in such manner that objects cannot be passed over, around, or under the detection area.
- Doorway monitors should be used in locations of minimum background and minimum background fluctuation. If circumstances dictate use of a doorway monitor in an area of high background, sufficient shielding should be provided to maintain necessary sensitivity.

- Entry searches should use equipment to perform the search function, such as metal or explosive detectors, which are the preferred methods because they minimize the imposition of hands on or strip searches.
- Entry and exit traffic should be separated by physical barriers and employee and visitors traffic should be processed separately.
- Personnel entering into PAs, VAs, and MAAs should be searched for firearms, explosive, or incendiary devices by using both a firearms and explosives detectors.
- The opening to the PA should be controlled by an individual isolated within a bullet–resistant structure. The structure shall meet the UL Level IV standards. The opening to the PA is controlled by central alarm station or secondary alarm station operator (or both).
- Unmanned exit and entry doors to PAs, VAs, and MAAs should be alarmed and annunciated in the both the Central Alarms Station (CAS), and the Security Alarms Station (SAS).
- Entry/exit control points should be provided with one or more duress alarms that annunciate in both the SAS and CAS. Such alarms should be placed in concealed locations that can generally be reached by attendant security personnel and activated in unobtrusive manner.
- Failure of detection equipment should not be allowed to comprise the effectiveness of entry/exit search.
- Without comprising safety practices and considerations, measures should be established to protect against the possibility of an emergency evacuation being used to remove SNM from the facility or to gain access to the facility. Such measures should be part of the facility's contingency plan.

3.3.2 DESIGN REQUIREMENT FOR THE RADIATION DETECTION SYSTEM (SNM DOORWAY MONITORS)

SNM doorway monitors provide an efficient, sensitive, and reasonably unobtrusive means of searching individuals existing from MAAs for concealed SNM. With proper installation and operation, gram quantities or less of SNM can be detected with a high level of reliability while maintaining a low false alarm rate.

The doorway monitors are composed of a detector units, associated electronics, and alarm logic. The detector units are sensitive to radiations emanate from SNM and respond to these radiations (usually gamma rays) by generating current pulses. These pulses are amplified, filtered, and fed to alarm logic, which interprets the number (or rate) of pulses in some period of time, for example, one second. The alarm logic may be either a digital or analog system; in either case, if the number (or rate) of pulses exceeds a set level, an alarm condition ensues. Typically the detector of a doorway monitors are Na-I scintillators or solid liquid scintillators.

Detectors are normally arranged such that a detection area is defined by a plane perpendicular to the line of passage of individuals through the doorway monitor. Various arrangements of detectors are possible; however, specific placement of detectors is usually dictated by the need to eliminate dead spots.

Reference 7, Regulatory Guide 5.27, Special Nuclear Material Doorway Monitors, lists the typical design requirements for SNM detection systems. These requirements may include but are not limited to the following:

- A doorway monitor used to detect plutonium should be capable of detecting a minimum of 0.5 gram of Pu-239 encased in a minimum of 3 mm of brass at a 90% confidence limit. The false alarm rate should be less than 0.1%.
- A doorway monitor used to detect U-233 should be capable of detecting within 4 hours of removal of all decay products a minimum of 1 gram of U-233 containing between 7 and 10 pmm of U-232 encased in a minimum of 3 mm of brass at 90% confidence limit. The false alarm rate should be less than 0.1%.
- A doorway monitor used to detect U-235 should be capable of detecting a minimum of 3 grams of U-235 contained in uranium enriched to 20% or more in U-235 isotope encased in a minimum of 3 mm of brass at a 50% confidence limit. The false alarm rate should be less than 0.1%.
- The detector elements should be designed and positioned so that detection sensitivity is as uniform as possible over the detection area; in no case should there be any areas where SNM cannot be detected.
- Power, sensitivity, and other controls of the doorway monitor should be tamper-safe when the unattended.
- Signal lines connecting alarm relays to the alarm monitor should be supervised.
- Doorway monitors that may require an individual to occupy the detection area for a specific time, longer than a normal pace would provide, should be provided with a treadle pad and a “clock” device to assure that the detection area is occupied for the requisite time. An aural and visual indication should be given if an individual being searched does not occupy the area sufficiently long.
- If doorway monitor is attended during use, it does not need to be equipped with automatic background updating system, although such capability is preferred.
- Prior to each use of a doorway monitor that is not equipped with automatic background updating system, a measurement of background should be taken, and the alarm threshold should be set to the proper value for measured background. During use, the background should be checked and the alarm threshold reset at least each 15 minutes.
- When an individual is in the detection area, an alarm should sound if the activity in the detection area exceeds the alarm threshold *T*, as such a situation would indicate the presence of SNM.

- If the door monitor is unattended, an automatic background update system should be incorporated into the doorway monitor electronics and alarm logic. The second circuitry should be located in the central alarm station or other monitoring point.
- Door interlocks and closed-circuit TV in combination with beam breaks, motion detectors, and /or treadle pads should be used to
    - Indicate to the person staffing the central alarm station that an individual has entered the secure access passage way and/or is approaching the doorway monitor,
    - Allow observation of the individual approach the doorway monitor.
    - Preclude a slow approach to the sensitive area of the doorway monitor and activate the electronics and alarm logic when the individual is within the detection area, and
    - Initiate operation of the doorway monitor.
- An alarm should sound in the central alarm station if, when occupied, the radiation activity in the detection area exceeds the internally set threshold level (the mean background plus some multiple times the square root of the mean background), as such a situation would indicate the presence of SNM upon the individual being checked.
- For both attended and unattended doorway monitors, the doorway monitor should be equipped with a high background alarm that will sound if the measurement of background exceeds the appropriate maximum permissible background level. The doorway monitor should not be used during periods of high background. Other monitored exits should be used.
- Doorway monitors should be tested by passing an appropriate source of the amount and isotope specified through the doorway monitor no less frequently than once per day. In addition, a functional performance test should be carried out at least once per week.
- Doorway monitors should be calibrated with a source of the amount, configuration, and variety of SNM to be detected (e.g., 0.5 gram of Pu in 3 mm of brass).

3.3.3 DESIGN REQUIREMENTS FOR METAL AND EXPLOSIVE DETECTORS

Reference 8, Regulatory Guide 5.7, Entry/Exit Control for Protected Areas, Vital Areas, and Material Access Areas, lists the typical design requirements for metal/ explosive detection system. These requirements may include but not limited to the following:

- Firearm detectors, whether handheld or portal, should be capable of detecting with least an 85% effective detection rate.
- The false alarm rate should not exceed 10% when the detector sensitivity is adjusted to this detection level.
- The detector should be adjusted to discriminate between typical firearm and non-firearm masses of metal.
- Explosive detector, whether handheld or portal variety, should be capable of detecting at dynamite, TNT, and similar nitrogen–containing compounds in a minimum amount of 200 grams least a 90% effective detection rate.

- Explosive detectors false alarm rate should not exceed 1% when the detector sensitivity is adjusted to this detection level.
- Annunciation of metal and explosive detection should be both aural and visual.
- Firearms, explosive, and nonferrous metal detectors should undergo detection rate and operational testing. Detection rate testing should be conducted quarterly to determine whether the detector is operating in compliance with the appropriate performance criterion. Operational testing should be conducted daily, preferably at the beginning of each shift, to ensure that the detector is operating and the detection rate has not decreased to below the performance criterion.

3.3.4 FUNCTIONAL DESIGN CRITERIA WITH DUAL SAFEGUARDS AND SECURITY FUNCTIONS

The following functional design criteria have a dual safeguards and security functions that must be incorporated into the design of UNFSF:

- Exit searches that are conducted to ensure that concealed SNM is not removed from MAAs should use both SNM detection equipment and metal detection equipment to provide greater confidence that either shielded or unshielded SNM material could be detected.
- SNM doorway monitors should be used in conjunction with a metal detector and should be installed in passageways in such manner that objects cannot be passed over, around, or under the detection area.

3.3.5 INTEGRATION OF SAFEGUARDS AND SECURITY INTO ACCESS CONTROL SYSTEM DESIGN

The design criteria and requirements are the basis for the conceptual, preliminary, and final design. Integrating overlapping requirements in the early design can identify the synergy and common functions that serve both safeguards and security performance objectives. The integration facilitates the optimization of the facility layout for various process and operational areas, for example, where to locate the explosive and metal detectors at the facility relative to radiation monitors, and to whether have the radiation monitors attended or unattended and its impact on operation. This will determine the number of detectors and their strategic location at the facility and the required staffing. The trade-off studies will determine best and most cost-effective options for metal and explosive detectors, while still meeting the performance goals for both safeguards and security for access control. For example, the options may include but are not limited to

- Number of detectors;
- Location of detectors;
- Staffing requirements;
- Operation process;

- Risks associated with design options;
- Reliability and effectiveness of the system;
- The likelihood of meeting the performance goals of the applicable regulations; and
- The cost associated with the design, procurement, construction, testing, operation, and maintenance of these detectors during the life cycle of the facility.

4 SUMMARY AND CONCLUSION

In the case of the UNFSF, integrating safeguard and security into the early design has very limited benefits, because the requirements for safeguards are mainly focused on item control, surveillance, detection and monitoring, and records control. The security/ safeguards interfaces and overlaps are in the areas of access control and detection surveillance and monitoring. These areas are well established and understood for a UNFSF. The features are used extensively and successfully at existing nuclear facilities and are technically achievable with minimum risk. However, for other nuclear facilities, such as the pyro-processing or reprocessing facilities, integration will provide substantial benefits in licensing, design, procurement, testing, operation, and maintenance of the facilities. The cost benefits can be substantial throughout the life cycle of the facility.

5 ACRONYMS AND ABBREVIATIONS

3Ss	Safety, Security, and Safeguards
CAS	Central Alarms Station
DOE	Department of Energy
MAA	Material Access Areas
MC&A	Material Control and Accounting
NRC	Nuclear Regulatory Commission
PA	Protected Area
SAS	Security Alarms Station
SNM	Special Nuclear Material
UNFSF	Used Nuclear Fuel Storage Facility
VA	Vital Areas

6 REFERENCES

1. NRC Regulatory Guide 5.74, Managing the Safety and Security Interface, June 2009.

2. 10 CFR 72, Licensing Requirements for Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste and Reactor –Related Greater Than Class C Waste.

3. NUREG -1619 Standard Review Plan for Physical Protection for the Independent Storage of Spent Fuel and High- Level Radioactive Waste.

4. 10 CFR 73, Physical Protection of Plant and Materials.

5. 10 CFR 74, Material Control and Accounting of Special Nuclear Materials.

6. NRC Regulatory Guide 5.53, Applicability of Existing Regulatory Guides to the Design and Operation of an Independent Spent Fuel Storage Installation, July 1982.

7. NRC Regulatory Guide 5.27, Special Nuclear Material Doorway Monitors.

8. NRC Regulatory Guide 5.7, Entry/Exits for Protected Areas, Vital Areas and Material Access Areas, Revision 1, May 1980.

9. Guidance for Independent Spent Fuel Dry Storage Installations, Safeguards by Design Facility Guidance Series (NGSI-SBD-001) NIS office of Nuclear Safeguards and Security, May 2012.

7 FIGURES

1. Safety, Security, and Safeguards Interfaces
2. Regulatory Framework for Designing Security System (10 CFR 73)
3. Regulatory Framework for Designing Safeguards System (10 CFR 74)
4. Framework for Integration of Safeguards and Security into Design of Nuclear Facility

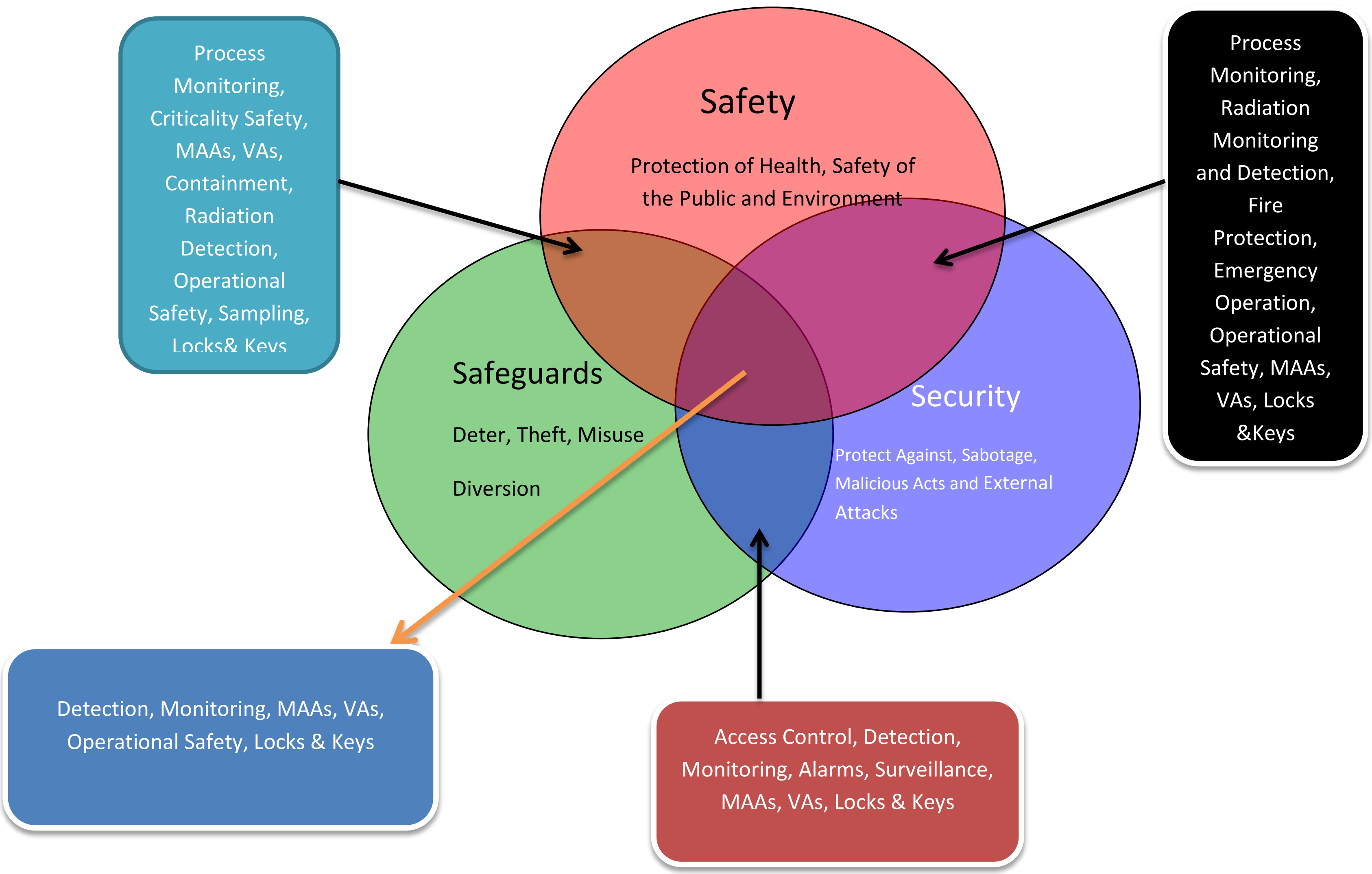

Figure 1. Safety, Security, and Safeguards Interfaces

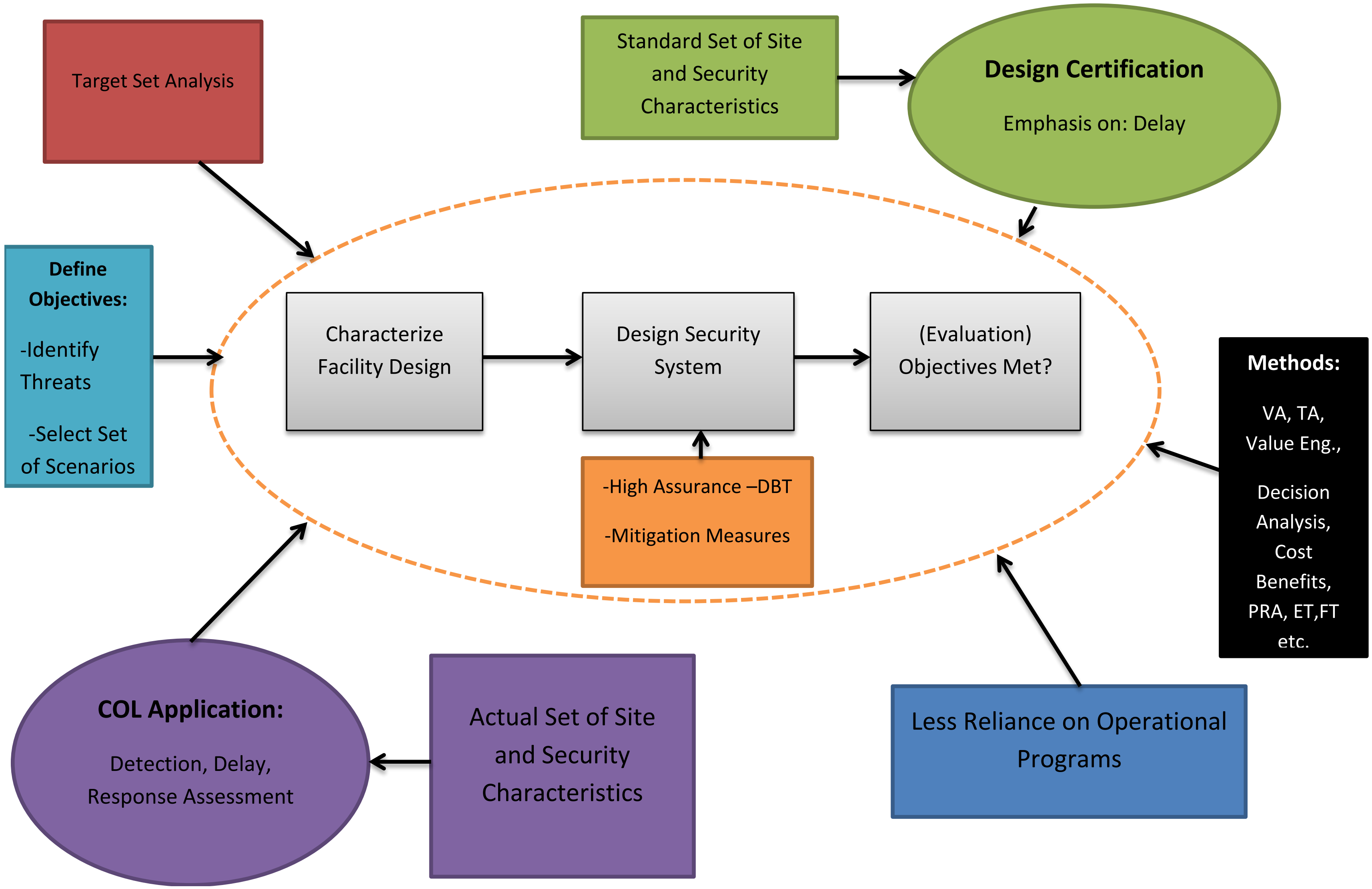

Figure 2. Regulatory Framework for Designing Security Systems

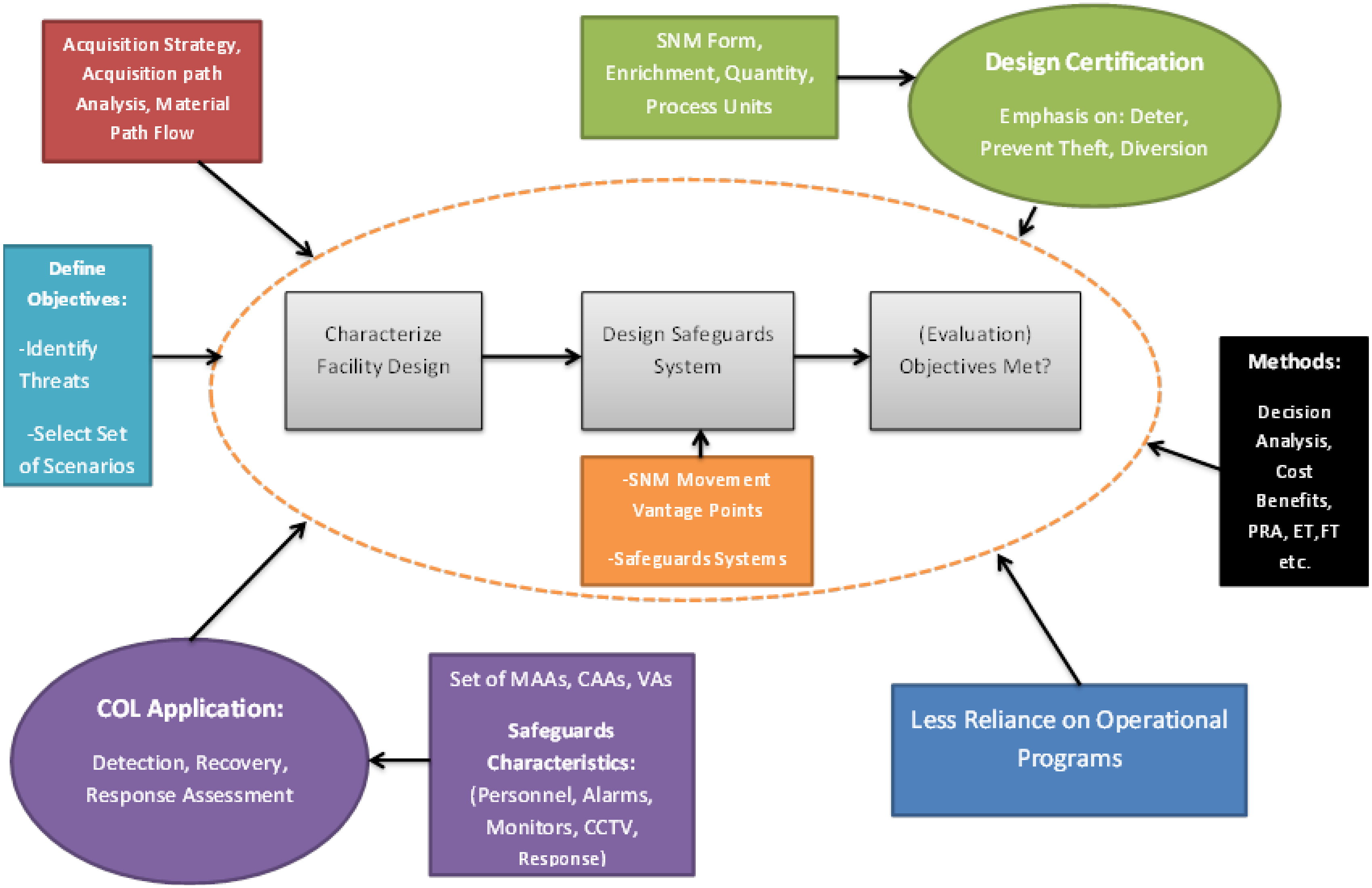

Figure 3. Regulatory Framework for Designing Safeguard Systems

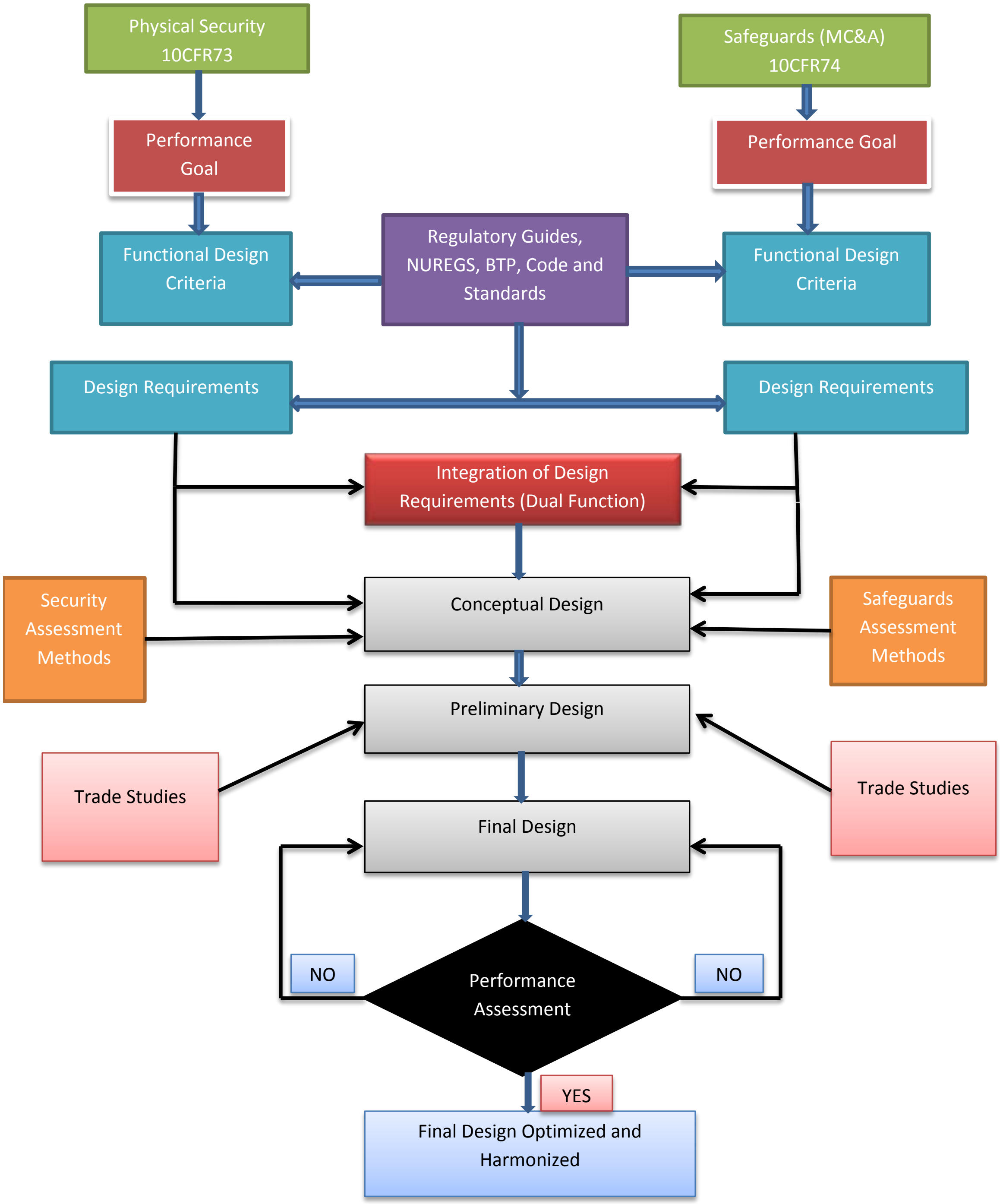

Figure 4. Framework for Integrating Safeguards into Design of Nuclear Facility