

SAFEGUARDS SEALS REFERENCE GUIDE



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PREFACE

This guide is a revision of the Safeguards Seal Reference Manual, issued by the Office of Safeguards and Security, Assistant Secretary for Defense Programs, U.S. Department of Energy (September 1995). The guide addresses the use of seals in the control and accountability of nuclear materials. This guide is intended to assist DOE Field Element and contractor personnel in implementation of seals programs at their facilities. This guide does not establish or originate policy.

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CHAPTER 1

INTRODUCTION

This guide is a revision of the 1995 *Safeguards Seal Reference Guide*. It provides general guidance for developing a safeguards seals program to meet a specific need as well as guidance for the selection and use of safeguards seals at Department of Energy (DOE) facilities.

The development of a seals program must consider site-specific differences, concerns, and environmental conditions which dictate the type of safeguards seals and the detailed procedures for their use. Users should refer to this guide when preparing: (1) a seals program implementation plan, and (2) administrative procedures to meet the needs of each organization. Its purpose is to provide a framework for an effective seals program.

1.1 Role of Seals

The role of a safeguards seal is to alert authorities to tampering with or opening of a container, package, door, or other object to which a seal has been affixed. Seals can be used in several areas of safeguards and security operations. The guidance in this document is limited to seals used for the control and accountability of nuclear materials. It is important to note that seals are ineffective without a material surveillance program.

1.2 Seal Characteristics

Seals have been used for centuries to authenticate or to verify the integrity of physical objects and containers. In the nuclear industry safeguards seals are used for the same purpose. These devices have been called tamper-indicating devices (TIDs), safeguards seals, or seals. These three terms are used interchangeably in this guide. Effective seals have the following characteristics:

- **Seals** are not intended as deterrents to an adversary willing to risk detection.
- Once violated, a seal is difficult to repair without leaving telltale signs of tampering.
- Seals have unique identification characteristics.

1.3 Seals Usage in MC&A

DOE nuclear materials are either in item or bulk form. Seals are used in the management, control, and accountability of nuclear material items. Seals allow for more cost-effective control and accountability of items.

Providing effective safeguards for an item is usually much easier than safeguarding bulk materials since the item is or is not in its authorized location. Once an item is created, it needs monitoring to assure that its integrity is not violated (theft or diversion of all or part of material in the item). An intact seal (see paragraph 6.1) in conjunction with a material surveillance program allows the custodian to verify the integrity of an item and its assigned weight values. If a TID is violated a verification measurement is required to detect possible loss of material. Confirmation of measurement accuracy is no longer certain when TIDs indicate the possibility of tampering. A violated seal signals facility

personnel to begin investigative and corrective actions. Automation of seals information pertaining to bar code labels, part numbers, nomenclature, serial numbers, dates, and part classifications may be considered to enhance efficiency and effectiveness of the seal program.

Seals aid in safeguards and security alarm assessments and response determination. An intact seal may suggest that a false alarm has occurred and/or material containment has not been violated. Conversely, discovery of a violated seal provides an indication of possible theft or diversion of nuclear material and should result in additional material verification activities as well as appropriate investigation and reporting. Verification measures should include at a minimum re-measurement of the items with violated TIDs and may need to include re-measurement of other parts of the nuclear material inventory as well. The assumption to be made when finding a broken seal is that potential tampering may have occurred. It is important that prompt action be taken to determine whether or not tampering did occur.

Seals also act as a psychological deterrent in that potential violators are made aware that safeguards and security measures are in effect. The psychological role of seals is enhanced by vigorous, comprehensive, and documented investigation of all anomalies involving seals, even if they are found to be accidental.

1.4 Seals as a Part of Safeguards and Security Systems

Safeguards and security systems, in general, consist of multiple elements that do not provide sufficient protection when used alone. Thoughtful selection and integration of such elements can, however, result in a system that will provide a high level of confidence that the desired level of effectiveness will be achieved. The effective integration of multiple system elements also ensures the system is not degraded if any single element fails to function as intended. Seals are an excellent example of elements that are important to an integrated system, but their contributions and limitations must be understood if they are to be used effectively.

Specific seals usages can usually be categorized as MC&A or physical security. The seal program controlled and used by physical security (i.e., pro-force, security guards, etc.) is not discussed in this document. The following are some specific contributions that seals can make to an MC&A program:

- indication that container contents have not been altered since the seal was applied
- reduction in the frequency of time-consuming nuclear material verification measurements
- simplification of inspection and inventory operations
- support of special nuclear material (SNM) assessments and audits

1.5 Using Seals Effectively

Seals can be a highly reliable and cost-effective safeguards element. However, for most seals to be considered reliable for materials control purposes, they must be used with an effective material surveillance program. Additionally, the containers in which the SNM is located must be such that removal of material from a container by means that do

not violate the integrity of the TID, such as cutting a hole in the container, could easily be detected during a visual inspection. For items located in areas without an effective materials surveillance program, the safeguards effectiveness of the seals should be considered to be minimal.

A comprehensive seals program for nuclear materials can result in efficient inventory-taking and reduced personnel radiation exposure. No measurements are required for items with intact seals. Seals can provide a quick and easy means of obtaining a reasonably good verification of item integrity.

In many cases, applying a seal can provide a quick and relatively inexpensive method of increasing the effectiveness of a safeguards system element against a specific type of insider threat. Indiscriminate and uncontrolled use of seals can, however, reduce safeguards and operational effectiveness by giving a false sense of security. Seals programs should be considered for the following:

- items in long-term storage
- off-site shipments and transfers between material balance areas (MBAs)
- waste containers
- items or containers in process or working vaults if it would save on manpower or cost of performing inventories
- reducing radiation exposure

In deciding whether or not to use seals, factors such as cost, radiation exposure, potential improvement in protection, operational impacts, and procedural or hardware alternatives should be considered. The same factors may also be used in deciding what types of seals to use. (See Chapter 3 for guidance on selecting the proper seal.)

Seals programs should

- be cost-effective (capital and manpower)
- be capable of indicating violations of the container and tampering with safeguards devices
- be designed to minimize impact to facility operations

Essential to maintaining the effectiveness of any seals program is a continuing internal review and assessment process. The program may include both scheduled and unscheduled assessments of the program. All assessments should be documented, identifying deficiencies and corrective actions taken to address them.

In summary, a seals program can be an effective safeguards system element when used in conjunction with other safeguards and security system elements.

1.6 Seals Limitations

In general, seals currently in use and integrated into safeguards systems are not expected to provide the following:

- alarms which will initiate a timely response to a violated seal
- protection against overt actions (i.e., seals are not meant to physically delay or restrain violations)
- protection against covert actions without an adequate seal control program (i.e., seals are designed to leave non-erasable, unambiguous evidence of tampering or unauthorized access or entry.)
- Assurance of 100% effectiveness

1.7 System Interfaces

Integrated systems for safeguarding SNM may have a number of system elements such as inventories, re-measurement of randomly selected items, portal monitors, ¹two-person concept, motion detectors, and balanced magnetic switches on doors. Seals are one component of an integrated safeguards and security system whose design is based on a defense-in depth² strategy; an inappropriately high reliance should not be placed on them. Overall effectiveness of a safeguards and security system depends on the interface between various elements of the system. Elements that most commonly interface with seals programs are the following:

- **Material Databases.** All MC&A programs must have a database that includes details regarding nuclear material inventories. If seals data is incorporated into these databases, timely audit goals can be achieved. Bar-coded seals may also provide a convenient and efficient way to relate sealed items to inventory. (Use of bar-coded seals would not, however, eliminate the need to check item and location numbers during physical inventories.)
- **Inspection/Verification Procedures.** Specific examination procedures for seals should be included in both operational and safeguards and security procedures.
- **Operational Procedures.** Material handling procedures may include guidance on when, where, and how to apply seals as well as what types of seals to apply. Similar information should be given for removal and disposal of seals as well as for the accountability of the seals. Often procedures for application and removal of seals are written as operational procedures. These procedures should be closely integrated with the MC&A Plan and related safeguards procedures. Additionally, information about the seals which is recorded as part of the procedure, such as seal

¹ Reference defines two-person concept as two trained individuals (authorized by the NMC&A Department) be in close visual contact when a TID is applied, removed, or destroyed to ensure the integrity of the sealed item and that TIDs are properly accounted for.

² Reference defines defense-in-depth as “the use of multiple, independent protection elements combined in a layered manner so that system capabilities do not depend on a single component to maintain effective protection against defined threats.”

number and item to which the seal is applied, may be included in the nuclear materials database.

- **Physical Boundaries.** The physical boundary of the container, storage location, building, etc. should be at least as difficult to defeat or bypass as the seal used to detect tampering.
- **Management.** The assignment of personnel responsibilities rests with management. Each facility should have a documented program, administered by the materials control and accountability organization, for control of tamper-indicating devices and to assure that tamper-indicating devices are used to the extent possible to detect violations of container integrity. It is likely that responsibilities for various parts of the seals program will be shared with operations personnel. For this reason, all seals personnel must be periodically trained in seal procedures for the site. Thus, it is usually necessary that the efforts of all of the groups that have been assigned responsibilities be integrated into safeguards operations and planning and that the integrated effort be reflected in documented plans and procedures.

CHAPTER 2 IMPLEMENTING A SEALS PROGRAM

This Chapter, used in conjunction with Chapter 4, will provide the framework around which an effective seals control system can be built.

2.1 Personnel Organization

A critical step in developing a seals program is organizing the personnel. Examples of personnel positions directly or indirectly involved in the seals program should be identified in the MC&A Plan and/or the Site Safeguards and Security Plan. Identification of the organizational structure aids in the effective control of seals.

2.2 Task Assignment

Five key tasks need to be performed in any seals program. Personnel performing these tasks are the following:

- Vendor. The manufacturer and/or distributor from whom the seals are purchased.
- Buyer. The person(s) or operating group within the purchasing organization responsible for purchasing and receiving seals.
- Seal Administration. The person(s) or operating group at the facility, normally part of the MC&A Department, responsible for maintaining the seal supply and the associated records concerning the receipt, inspection, and distribution of seals.
- Seal Custodian. The person(s) in the operating area responsible for receipt, inspection, and distribution of the seals for use in their specific area.
- Seal User. The person(s) trained in the correct procedures for application, removal, inspection, verification, witnessing and destruction of seals (utilizing the two-person concept as it applies to TID functions) as well as documentation of their use.

Depending on the size and complexity of the organization, some overlap may occur among the functional areas listed above. The key areas to be kept separate are the control of records (the seal administrator) and the application of seals (the seal users). Once these components of the seals program have been identified within the organization, procedures can be developed to control the flow of seals hardware and program data between them.

2.3 The Seals Program

Seals programs should be structured to provide: (1) a reasonable level of confidence in the program, and (2) integration with other safeguards elements to assure that the compromise of a seal is not a catastrophic event.

There is little value in considering the seal by itself. The complete program within which the seal is used must be established in order for a seal to provide effective protection. Each feature provides a part of the protection required. Accordingly, the seal user and the seal program developer must understand the other elements in the overall system and utilize the appropriate approach to give the needed level of protection.

Seals programs generally consist of a seals program plan; the seals themselves; required TID forms; the containers or objects to be protected; and the procedures, techniques, training requirements and modules and devices necessary for their effective use.

2.4 Seals Program Documentation

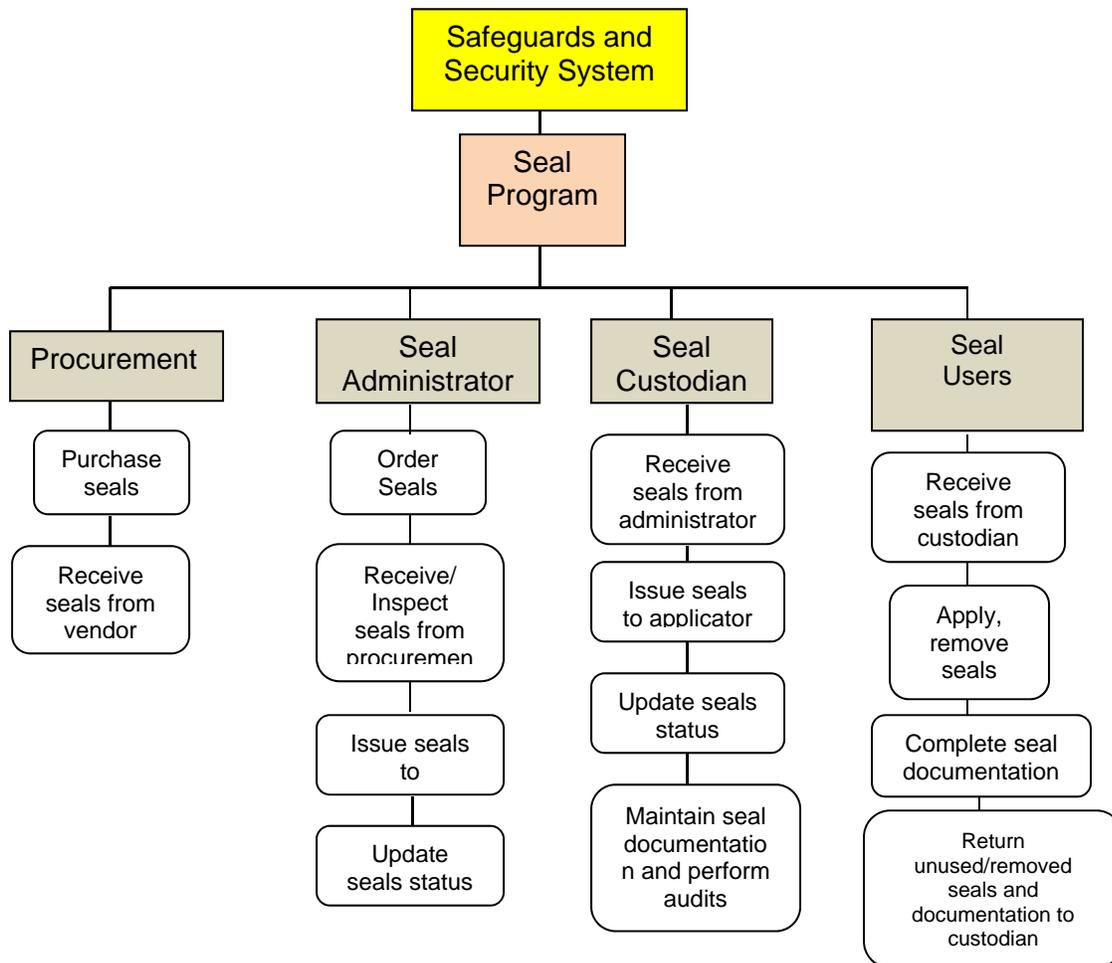
A facility's MC&A Plan or Site Safeguards and Security Plan should specify the contributions seals provide within the overall safeguards and security system. The tamper-indicating device control program should specify, as a minimum, the following elements:

- (1) Acquisition/procurement/destruction;
- (2) Types of tamper-indicating devices utilized;
- (3) Assurance of unique tamper-indicating device identification;
- (4) Secure storage;
- (5) Issuance and control;
- (6) Tamper-indicating device authorized personnel;
- (7) Containers on which tamper-indicating devices are to be applied;
- (8) Procedures and training for application/removal of tamper-indicating devices;
- (9) Frequency and method of tamper-indicating devices verification;
- (10) Tamper-indicating device violation criteria;
- (11) Response procedures for tamper-indicating devices violations;
- (12) Assurance that tamper-indicating devices are destroyed properly to prevent reuse;
- (13) Frequency of seal inventories by administrators and custodians;
- (14) Frequency and method of internal program audits; and
- (15) A DOE cognizant security authority approved listing of all containers considered to be intrinsically tamper-indicating (types of containers), if applicable to the site.

2.5 A Seals Program Plan

A facilities seals program plan as a part of an overall MC&A Plan can provide the proper perspective on the role that seals play within the total safeguards system.

The figure below shows the seals program as a subsystem of the total safeguards and security system. The seals program contributes to the overall effectiveness of the safeguards and security program.



2.6 Personnel Responsibilities

- Seal Administrator

- Responsible for determining the seal vendor, appropriate type of seal, and quantity ordered
- Responsible for coordinating order requirements and security specifications with site procurement department
- Responsible for maintaining the supply of seals and for replenishing that supply when it is depleted
- Receives and inspects seals from receiving department and stores in a secure storage
- Issues seals to authorized Seal Custodians
- Maintains records on the status of each seal in inventory

- Maintains training records to ensure all Seal Custodians, Applicators, and Removers are properly trained
- **Procurement**
 - Contacts the vendor and implements the purchase of the seals.
 - Receives seals from the vendor and delivers to the Seal Administrator
- **Seal Custodian**
 - Receives and inspects seals from Seal Administrator and documents receipt
 - Store in secure storage
 - Issues seals to authorized Seal Applicators
 - Maintains seal documentation on disposition of seals in inventory/performs seal audits
- **Seal User**
 - Verifies sealed items received into the MBA, receives seals from Seal Custodian for application
 - Applies and removes seals; should be trained in proper procedures for seal application/verification/removal; may serve at witness
 - May be referred to as seal applicator, seal remover, seal verifier or seal witness
 - Destroys seals after removal from MBA items
 - Documents seal application/removal and returns forms to Seal Custodian

All documentation concerning the verification/receipt, issuing, application/removal, and destruction of seals should be sent to the seal custodian (and/or seal administrator, depending on the set up of the program) so an accurate inventory is maintained. Alternatively, seals data can be transmitted electronically to the seals record system. Some facilities may also require that destroyed seals be returned to a designated custodian or seal administrator. Some facilities may require that unused seals be returned to the seal custodian for secure overnight storage.

CHAPTER 3 SELECTING THE PROPER SEAL

This section describes some seal characteristics that should be considered in selecting a seal and some typical applications of seals.

3.1 Seal Characteristics

Selecting the proper seal for a particular application is an important part of any seals program. Making a decision about which seal to use involves the following considerations:

- Purpose of the seal. The principal purpose of the seal can be for materials control, materials accountability or a combination of these.
- Type of container to be sealed. The design of the container should accommodate the seal, and the container should be tamper-indicating when used in conjunction with the seal.
- Durability. The durability of the seal should be acceptable in both the interior and exterior environments to which it will be exposed. Some seals have a shelf life and should be periodically evaluated.
- Durability of the seal during transit. The durability of the seal should be acceptable to the expected transport environment.
- Length of storage and type of area. The durability of the seal should be compatible with the expected duration of use, the impact of the storage environment on the seal, and the amount of activity involving the stored container.
- Ease of application/removal. Consideration should be given to the ease of application and removal of seals and any associated adhesives. The hazard (i.e., chemical or mechanical) associated with the removal of residual adhesives must be considered.
- Detection capabilities. The detection capability should provide indication of minimal tampering yet be sturdy enough to endure the environment in which it is used. Indications (detection) should be easily recognizable with minimal observation or verification activities. Serial numbers should also be easily recognizable.
- Uniqueness. The seals selected should be resistant to easy counterfeiting and have a unique number that cannot be easily altered or duplicated. A letter to ensure uniqueness of seals within the MC&A organization should be obtained from the vendor.
- Size and shape of seal. Adhesive seal sizes, wire lengths and seal dimensions will be primarily determined by the container and the type of closure used with the container. Consideration should be given to determining the size needed to accommodate bar codes and other information needed on the seal or container. The seal must be applied in a manner that will indicate tampering prior to gaining access

to the material in the container. This can directly impact the size and shape of the seal.

- Cost effectiveness. The cost of the seal and its application should be considered; however, the cost should not dictate the use of an unacceptable seal.
- Interface with other safeguards and security elements. Consideration should be given to other safeguards and security elements protecting the item. The role of seals should be incorporated into the MC&A Plan.
- Disposition of the sealed container. The type of seal selected for a container may differ depending on whether the container will be shipped off-site, remain in a storage area, moved within the site, or disposed of as waste.
- Reliability. Each site should make a determination that the seal selected is reliable in indicating tampering for its specific use.

3.2 Uses of Seals in Materials Control and Accountability

The following are some typical (but not all inclusive) uses of seals in materials control and accountability:

- Empty shipping containers stored in a material access area or protected areas. Empty shipping containers in transit.
- Drums, “bird cages”, cans of SNM in storage vaults.
- Drums and boxes containing either clean or contaminated waste in material access areas.
- Drums and “bird cages” of SNM and other radioactive materials in transit.
- Small containers of SNM stored in 30-gallon and 55-gallon drums.
- Casks and caskets containing fuel or target material in transit or storage.
- Various small containers containing nuclear materials such as pails, metal cans, plastic bottles, and slip lid cans.
- Door hasps and cages for fuel and target tubes or assemblies storage.
- Infrequently accessed areas.
- Containers of numerous smaller items/pieces for physical inventory purposes.

CHAPTER 4 GENERAL PROCEDURES GUIDE

This and the following two chapters provide a general framework for developing the procedures, responsibilities, and other program elements of a Safeguards Seals Program. The chapter describes the types of procedures that should be used when implementing a Safeguards Seals Program.

4.1 Procurement

At a minimum, the procurement process should require, in writing, the provision of a vendor-certified statement that seals bearing the unique characteristics of the supplied seals will not be provided to another customer without approval from the purchaser. Other specific security requirements at the vendor's facility, such as stock control, die and mold control, access to product, and item accounting may be included in the contract. Background investigations and formal facility clearance may be requested of the vendors as well.

TID vulnerability testing may be conducted to assure performance requirements are met. Some facilities require TID vulnerability testing prior to procurement and use. Each facility can perform the vulnerability testing or utilize another facility's testing records. Because of possible manufacturer changes to the fabrication and material used in the production of the TIDs and differences in TID use per facility, if vulnerability testing reports are obtained from another facility, the facility that performed the testing is not responsible for any issues arising with the TIDs. Some elements of vulnerability testing may include the effort and time required to successfully defeat the seal, assurance the seal can only be used one time, and environmental testing such as heat, cold, and humidity.

Upon receipt, all seals should be inspected to assure that they are of acceptable quality, inventoried, input into the materials tracking database (if applicable), and secured. Once the seal administrator has obtained the seals from the procurement office he/ she has the authority to control and issue seals for the site as needed. Seals requisition forms and purchase order forms should be controlled to prevent easy, unauthorized use of the forms. The seal administrator or alternates should be the only persons authorized to purchase seals for MC&A purposes.

4.2 Control

Positive control over seals internal to the facility must be provided to prevent unauthorized substitution or modification. The seal administrator must keep all unissued seals in secure storage under controlled access and will be responsible for the following:

- Recording and maintaining a record of all seal serial numbers including those distributed to seal custodians.
- Maintaining a file of Letters of Authority (or other written authorizations) naming the TID Administrator and alternates.
- Maintaining a log of receipts and distributions for all seals.

Additionally, measures should be taken to assure that seals inventory records are secure and that false information is not entered into the records.

Seal custodians should be designated by MBA Representatives/Custodians or management and are responsible for all seals issued to them. They also have the authority for issuing seals to trained and qualified users. Seal custodians should be responsible for complying with the following:

- Maintaining records of all seals issued to them, including for each seal:
 - the type of seal
 - the serial number
 - the date issued
 - the date used
 - receiver
 - the item the seal was applied to
 - the person who applied the seal
 - the person who verified the seal application.
 - disposals of seals including who removed the seal, item it was removed from, and when it was removed.
- Maintaining the seals in secure storage that has controlled access limited to seal custodian/alternates.
- Maintaining a list of approved personnel trained in verification, application, removal and witnessing for the seals and ensuring seal personnel maintain required training.
- Reporting and investigating circumstances in which the integrity of a seal in use cannot be verified, control of seals have been compromised, or seals records have been compromised. (See Section 6.3 below.)

Because of the critical nature of a seal custodian's safeguards responsibilities, seal custodians must be appointed, trained, and authorized.

Seal users are responsible for maintaining control of seals issued to them. To ensure that these procedures are followed, periodic scheduled and unscheduled assessments of the seals program should be performed, and physical inventory of unused seals should be conducted at a frequency determined by the site. Seal numbers should be compared to those on record, seals safeguards procedures should be incorporated into the appropriate safeguards manuals, weaknesses in the seals program should be identified and where feasible corrected. Violated seals and unexplained seal discrepancies should be reported and investigated as appropriate. (See Section 6.3 for appropriate investigation and reporting of violation of seal integrity.) The assessments

should be provided by independent parties such as the TID Administrator or MBA Custodian, who are not involved in day-to-day seal operations. The scope should include the verification of data records for application and removal of seals. Any deviation from established procedures must be approved and documented. The most common problems found during assessments are non-compliance with procedures, failure to identify items/containers to which TIDs are applied, failure to sign and date application/removal record, improper application of TIDs, and inadequate response procedures.

Checklists developed for the review and evaluation of a site's seals program may be of value during an assessment of the seals program. Sample checklists are provided in Appendix D.

4.3 Training

Management must assure that seal administrators, seal custodians, and seal users are trained and qualified to ensure they are capable of conducting their assigned duties. Training should be done in accordance with site procedures. After training, seal users should be able to correctly apply the types of seals typically used at their facility, verify the integrity of the seals, remove the seals according to approved procedures and witness the same. Additionally, seal users should demonstrate an understanding of the appropriate procedures and data flow requirements.

In order to help ensure that seal administrators, seal custodians, and seal users maintain an acceptable level of proficiency, it is recommended that a periodic re-evaluation be conducted to determine their current knowledge of the seals program in a manner and frequency to be determined by the site. For seal users, reevaluation may include testing of their ability to correctly apply, remove, and verify seals.

CHAPTER 5 SEALS AND NUCLEAR MATERIAL

5.1 Applying and Removing Seals

A detailed procedure for applying and removing seals should be established. Examples of these types of procedures are given in Appendix C or current TID Administrators may be contacted to obtain samples of procedures used at their site. When applying or removing seals, the appropriate data should be recorded and may include the following information as applicable:

- Container or Material identification
- Seal number and type of seal
- Information on whether the seal was applied, voided, broken, or removed
- Location of the container
- Identification of the seal user (signature and/or identification number)
- Identification of witness (signature and/or identification number)
- Date entries were made
- If applicable, the date and status of the final disposition of the seal or container (seal removed, item shipped or transferred)

The seal application and removal data should be: (1) auditable through an audit trail, (2) issued to user groups by the seal administrator and (3) retained as part of the record of the seal. It should also be delivered to the seal administrator or custodian within the time period required by seal procedures or the site MC&A Plan. Seal custodians and administrators should review the data to assure it is correct and complete. In addition, application and removal documentation should be controlled.

Examples of some application and removal forms used for recording seals data are provided in Appendix E.

5.2 Packaging Nuclear Material

A seal should be properly applied immediately after the nuclear material is packaged in a container while the container is still under the surveillance of two trained TID personnel. A measurement, if needed, should be obtained on the container or discrete item within the time period permitted by facility procedures or the MC&A Plan. When accountability measurements are determined by nondestructive assay, seals should be applied prior to the measurement. When accountability measurements are determined based on a destructive analysis, seals should be applied immediately after obtaining the sample.

When it is necessary to break the original seal but not to open the container, visual surveillance of the container should be maintained by use of a strict two-person concept

or other material surveillance mechanisms from the time the original seal is removed until a new seal is applied.

5.3 Storing Nuclear Material

A seal may be considered for use on each nuclear material container stored in an MBA. This is based on site specific safeguards criteria. Where feasible, items sealed for storage should receive an assay or other confirmation measurement. Additionally, where feasible, sealed containers should be positioned in storage to allow easier access for inspection of the seal and container.

5.4 Transferring Nuclear Materials Between MBAs

When containers being transferred to or from an MBA are sealed, the seals data should be recorded on the material transfer forms required for transfer between MBAs. The data should also be recorded in the TID records system and, if appropriate, in the materials accounting system. As part of the required transfer checks, personnel responsible for shipping, transferring, and receiving material in the MBA should inspect all containers to verify that: (1) containers requiring seals are sealed, (2) seals are not broken, damaged, or improperly applied, and (3) the seal numbers correspond to any accompanying paper work and, if applicable, to the seal numbers in the TID record or materials accounting system.

5.5 Shipping Material Off-Site

Seals should be applied to all nuclear material containers being shipped off-site. All seal numbers and types should be recorded and transmitted to the receiver prior to or upon receipt of shipment. Shipping personnel should also inspect all containers prior to shipping to verify that (1) the containers are sealed; (2) the seals are not broken, damaged, or improperly applied; and (3) the seal numbers correspond to those indicated on the shipping documents. If the inspection fails to verify these, the container should not be shipped until these problems are resolved and corrected.

5.6 Receiving Nuclear Material From Off-Site or from other MBAs

Transfer checks should be made for material received into the MBA or operations area immediately after receipt. As a part of the transfer checks, the receiving group should inspect the containers and seals to verify that (1) containers requiring seals are sealed, (2) seals are not broken, damaged, or improperly applied, and (3) the seal numbers correspond to those provided by the shipper. If applicable, the shipping vehicle should also be checked on arrival to assure that it is properly sealed. If the inspection FAILS to verify the integrity of any of these items, the group performing the inspection should report and investigate the incident as required by the appropriate safeguards and security procedures.

5.7 Removing And Disposing of Seals

Any seal removed from a container or a shipping vehicle should be examined and disposed of according to approved site procedures. When a seal is removed, it must be intentionally damaged sufficiently to preclude its reuse (except for active seals which can be re-used), and prudent steps should be taken to prevent unauthorized persons from obtaining the seal. For seals that are likely to be contaminated, disposal according to facility waste-handling procedures should be sufficient. Uncontaminated seals should be disposed of according to site requirements.

CHAPTER 6 DETERMINING SEAL INTEGRITY

6.1 Verification of Seal Integrity

Seal integrity can be determined by verifying the seal has not been violated. Verification can be accomplished for some seals by visual inspection; other seals require a postmortem examination even though there is no apparent evidence of tampering. Verification activities should include determining the seal is properly in place, reading the seal number, and comparing the seal number and location with facility records. If seals cannot be verified by visual inspection or have not been under an approved materials surveillance program, they cannot be relied upon unless a postmortem examination provides assurance they have not been violated. In the latter case, a material confirmation or verification measurement would be warranted.

The integrity of seals should be verified at the following times:

- immediately before and after seal application
- prior to removing, breaking, or voiding a seal
- prior to transferring a sealed container into an MBA
- prior to removing a sealed container from an MBA
- when sealed containers are received
- during physical inventory
- when confirmation measurements are made
- during inspections and internal reviews

6.2 Conditions That May Require a Response

Some conditions that may require a response are:

- a missing seal
- a violated seal
- a seal number discrepancy
- a damaged seal
- an improperly applied seal
- an unauthorized seal
- uncontrolled seals or seal records
- obvious tampering with seal or seal markings

6.3 Proper Responses

****RESPONSE TO ABNORMAL SITUATIONS SHOULD BE IN ACCORDANCE WITH APPLICABLE SITE SECURITY DOCUMENTS****

If a seal becomes broken, damaged, or improperly applied during application of the seal, the seal should be removed and a new one applied immediately according to appropriate seal application and removal procedures. Except for possibly retraining the seal user, no other action is required.

If, at a later time, a broken, damaged, unauthorized, or improperly applied seal is discovered or a seal is found to be missing, the person discovering the problem must report it immediately in accordance with established procedures. The possibility of theft or diversion of nuclear material should be evaluated and possible corrective actions determined. If feasible, measurements should be made to assure that unauthorized removal of nuclear material has not occurred. Appropriate compensatory measures should be maintained until an authorized seal is properly applied. When a seal is found to be missing or damaged before it has been applied, notifications following site procedure should be made to document the situation.

If control of seals or seals records has been compromised, compensatory measures should be taken immediately, the possibility of theft or diversion of nuclear materials should be investigated, and the cause of the problem should be determined and corrected. Additionally, measurements may need to be made to verify that nuclear material has not been stolen or diverted.

6.4 Retention of Suspect Seals

A suspect seal is any applied seal that shows potential tampering such as being broken, damaged, unauthorized, or improperly applied.

A suspect seal should be retained until an investigation has resolved the situation involving the seal. When the situation has been resolved, management officials responsible for MC&A at the facility will prepare and distribute a report of the investigation to the parties involved. Once the investigation has been completed and the report has been issued, the seal administrator can authorize destruction and disposal of the suspect seal.

CHAPTER 7

REVIEWS, AUDITS, SURVEYS, INSPECTIONS, AND PERFORMANCE TESTING OF SEALS PROGRAMS

7.1 Requirements for Inventories

Inventory requirements should be performed at a frequency documented in the MC&A Plan or other appropriate document. Inventories should be performed on applied and unused seal inventory. Note: inventory of applied seals is usually done at a frequency and in conjunction with material inventories.

7.2 Requirements for Audits

Internal reviews and assessments of the MC&A system are required. Frequencies and methods of internal reviews should be documented in the MC&A Plan. A seals program is only one of many elements in a safeguards system and as such should be appropriately valued when evaluating overall system effectiveness. In particular, the effectiveness of seals as a safeguards element will depend directly on the environment in which the seals are used.

7.3 Performance Testing

The effectiveness of seals programs should be validated by performance testing. Performance requirements for seals programs should adhere to the site's MC&A Plan. Testing needed to verify the performance requirements are met may be conducted at the time of physical inventory. In addition to the performance testing needed to verify requirements are being met, tests may be conducted to assess the effectiveness of the tamper-indicating device program against specific insider scenarios. The accuracy of the record system for inventories of unused seals may also be tested.

7.4 Checklists

Three sample checklists are provided in Appendix D of this document for the review and evaluation of a site's TID program.

**APPENDIX A.
REQUIREMENTS FOR THE USE OF SEALS
AS SPECIFIED IN DOE o 474.2, Administrative change 1
(June 27, 2011)**

This appendix restates the requirements of DOE Order 474.2, Administrative Change 1 that address the use of seals in MC&A.

In general, DOE Order 474.2, Administrative Change 1 requires that tamper-indicating devices used for MC&A purposes be procured, stored, distributed, and applied according to a documented program. A TID Program Plan should be completed and referenced in the site MC&A Plan.

APPENDIX B. CURRENTLY USED SEAL TYPES AND VENDOR INFORMATION

The listing of Vendors and types of seals currently in use is documented below and is for your information only. ***There is no requirement stating you can only use seals or vendors from these listings. No specific seal or manufacturer is recommended; inclusion of seals and manufacturers does not imply recommendation or that they are appropriate for safeguarding nuclear material.***

This listing is for information purposes only. Information on certain types of TIDs and vendors can be obtained by contacting other TID Administrators who use these seals/vendors. A current listing of site TID administrators with their contact information can be found on the MC&A EFCOG website.

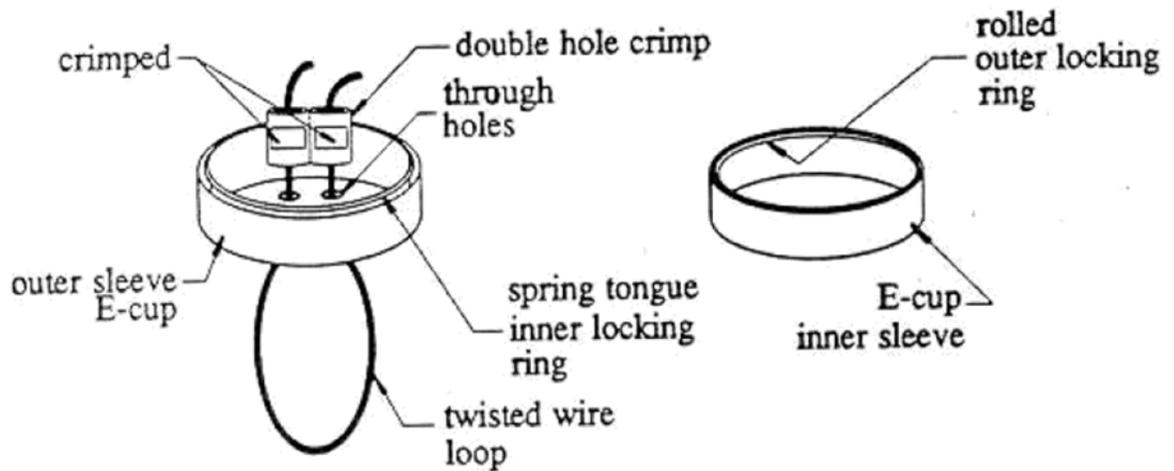
TYPES OF SEALS CURRENTLY IN USE

Tyden Brooks Multi-Loks
Stoffel Large Cable Seals
Stoffel Multi-Lok Type Cable Seal
Stoffel NR Adhesive
TydenBrooks Mylar Adhesive
NIC Quick Seals
TydenBrooks MRS-2 Seals
Designer Decal Mylars (WA)
Cambridge Multi-Lok Type Cable Seal
Radio Frequency Seals
E-Cups

SOME TYPES OF SEALS COMMERCIALY AVAILABLE

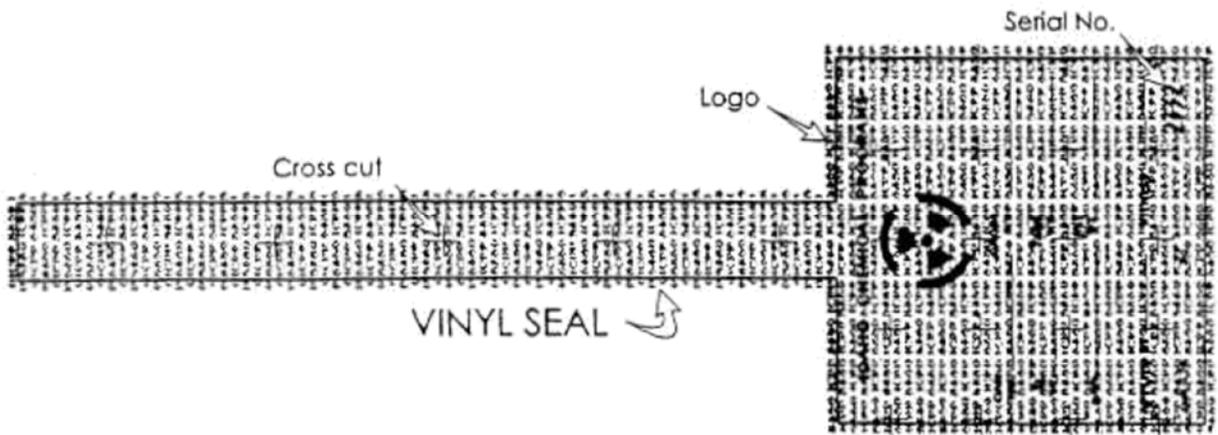
Cup-wire (Type E) Seal

The seal consists of two metal parts that when snapped together form a closed box about the knot or crimp on the wire passing through the hasp. One or both halves of the box are numbered or marked. This seal is commonly used throughout the DOE complex for sealing containers, drums, and other openings.



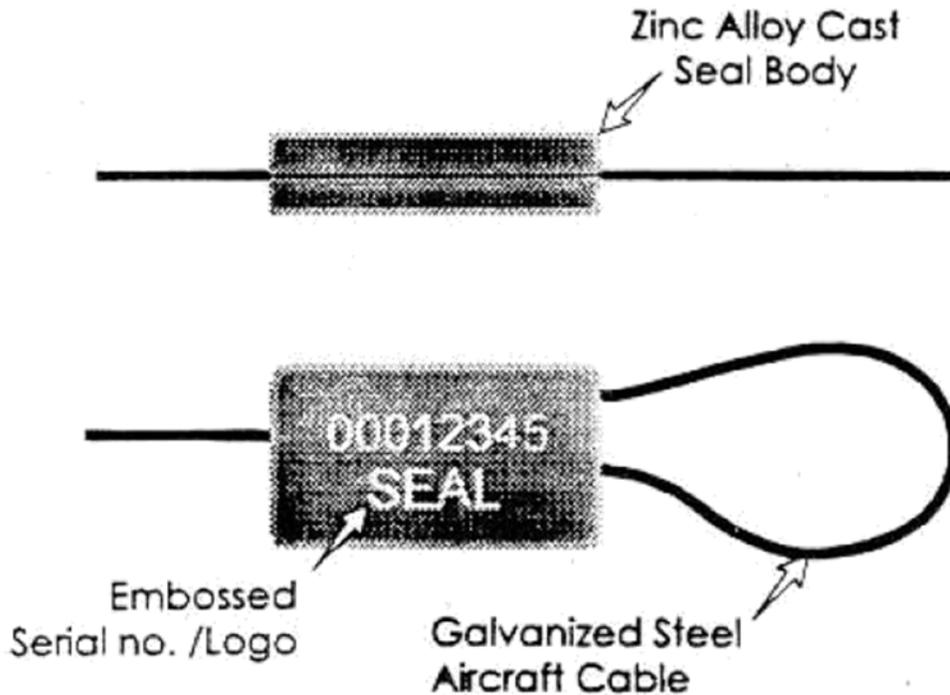
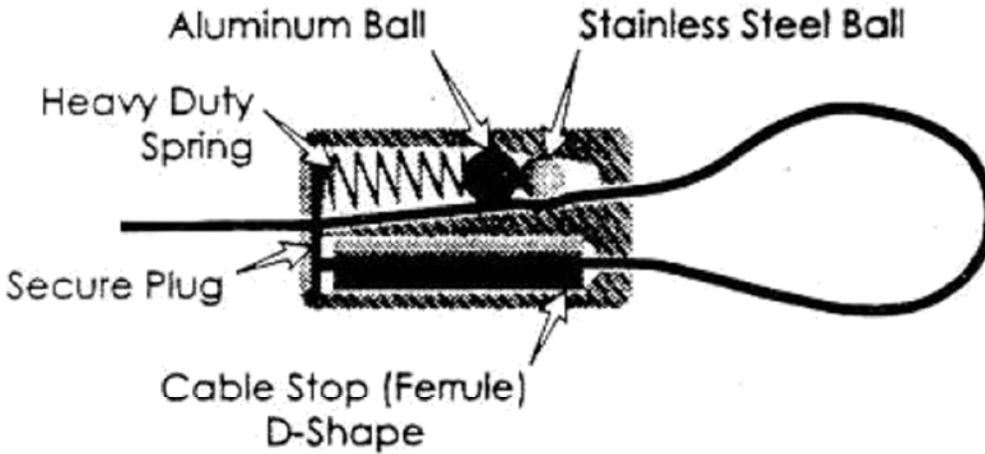
Pressure Sensitive “Adhesive” Seal

Pressure Sensitive Seals include paper, vinyl, or mylar outer coats with an adhesive backing. Adhesive-backed seals can be made of one or more layers of material. After application these seals are difficult to remove without an indication (tearing or delamination) that tampering has occurred. When removed, the self-voiding adhesive labels will clearly show the word “VOID” message through the body of the seal. Two common forms of adhesive seals used are delaminating adhesives which when lifted leaves a “VOID” message on the application surface, and a non-residue adhesive which when lifted does not leave a residue behind on the application surface when aesthetics are important. Adhesive seals when requested have a cross-cut [+] repeatedly made along the length of the seal body making peeling very difficult without tearing which usually starts at the crosscuts. These types of seals are commonly used on special nuclear material containers. **NOTE:** It is beneficial to order adhesive seals with a cut on the paper backing which enables users to peel labels easily for application.



Multi-Lok Cable Seals

The free end of a twisted-wire cable is passed through a hasp and then inserted into a hole in a metal box having spring loaded balls that allow the wire to pass by when initially inserted but bind with attempts to retract the wire. The metal box is usually numbered, but the wire is not.



VENDOR INFORMATION

1. NIC Products Inc (Quick Seal TIDs)

3100 Oak Road, Suite 210
Walnut Creek, CA 94597
Phone: 925-930-2883
Website: www.nicproducts.com

2. TydenBrooks (Cable and Adhesive TIDs)
227 North Route 303
Suite 101
Congers, NY 10920
Phone: 1-845-353-3800
Fax: 1-845-353-3876
E-Mail: sales@tydenbrooks.com
Website: <http://www.tydenbrooks.com/>
3. Stoffel Seals Corp. (Cable and Adhesive TIDs)
400 High Ave.
Nyack, NY 10960-0825
Phone: 845-348-7151
Fax: 845-353-3876
Website: www.stoffel.com
4. Designer Decal, Inc. (Adhesive TIDs)
1120 E. First Avenue
Spokane, WA 99202
Phone: 800-622-6333 or 509-535-0267
Fax: 509-535-1476
Email: info@designerdecal.com
Website: www.designerdecal.com
5. Cambridge Security Seals
One Cambridge Plaza
Pomona, NY 10970
Phone: 845-520-4111
Fax: 845-290-0676
Email: info@CambridgeSeals.com

APPENDIX C. SAMPLE PROCEDURES FOR APPLICATION AND REMOVAL OF SAFEGUARDS SEALS

The sample procedures contained in this appendix may be used as guidance. Site specific procedures should be developed for each facility.

The following sections describe the process for applying and removing cup-wire (Type E) seals and vinyl or other adhesive seals. Application and removal procedures for other types of seals can be obtained from the seal vendors.

Application of Cup-Wire (Type E) Seals

The cup-wire seal consists of two metallic parts that, when snapped together, form a numbered enclosure around the joined ends of a length of wire. The wire is attached to the object to be sealed in a manner that requires breaking the wire or destroying the seal to open the object. This procedure defines the technique for proper application of the cup-wire seal.

Procedure

NOTE: Two authorized seal applicators must be present when cup-wire seals are applied to nuclear material containers. Eye protection should be worn when working with wire type seals.

1. Obtain the following equipment and material :
 - a) Cup-wire seals (tops and bottoms).
 - b) approved wire and cursh-type sleeves if not attached to the wire
 - c) Pliers (capable of crimping collars) and a pair of wire cutters.
2. Apply the seal to a strategic location that will ensure that the container cannot be opened without destroying the seal's integrity.
3. Estimate the length of wire needed and cut that amount from the roll if not pre-cut wire. (Exact length will depend on the container to be sealed.)
4. Run the wire through the fixture and bring ends to approximately equal length. For drums, insert wire through the hole in the bolt, into the gap in the split lug of the ring, and across one half of the lug. At all times, remove any slack in the wire by pulling it "finger-tight." Then pull the end of the wire around the half-lug, through the gap, and around the other half lug, through the gap, and around the other half-lug in a "Figure-8."
5. Run the wire ends through the holes in the numbered cup.
6. Slip the cup down the wire until it is in position near the fixture.
7. Place ends through a sleeve.
8. Pull ends of the wire to move the sleeve into position near the seal top.

9. Use electrician pliers to crush sleeve firmly on the wire and pull on cup to ensure it is secure.
10. Trim the wire ends, leaving approximately 1 inch beyond each sleeve end.
11. Loop the remaining ends of wire into the inner cup area, then pull on the cup while pushing the wire and collar into the inner cup area, ensuring that there is no interference with closure of the seal.

NOTE: Before performing Step 12, check that serial numbers of the seal bottom and top cups are identical.

12. Place the numbered bottom cup over the numbered top cup and apply firm pressure with fingers around the rim of the bottom to ensure full closure. Cups should rotate freely when closed properly.
13. Inspect the seal and wire. If the wire was damaged during application or full closure was not achieved, cut the wire, remove the seal (according to the cup-wire seal removal procedure), and apply another.
14. Complete
 - a) the material identification, location, seal number, and date portion of the appropriate transfer form, and
 - b) a seal application and removal form including signatures and badge numbers of applicator and witness.
15. Deliver the seal application and removal form to the custodian within the specified time.

Removal of Cup-Wire (Type E) Seals

This procedure defines requirements for the removal of cup-wire seals.

Procedure

NOTE: Two authorized seal applicators must be present when cup-wire seals are removed from nuclear material containers.

1. Before a previously-applied cup-wire seal is removed, the seal and container will be inspected by an authorized seal applicator to verify:
 - a) That the seal is not broken, damaged, or improperly applied and the container has not been compromised.
 - b) That the seal number corresponds to the number on the latest seal log listing, shipper back-up papers, and/or container label.
2. If the inspection falls to verify (a) or (b) above, the seal applicator will initiate the required response procedure.

3. To remove the seal, the wire must be cut at least 2 inches away from the seal, then the seal/wire is removed from the container.
4. The seal applicator will record the date the used seal is removed, examine it for tampering and incorrect application, and dispose of it in a manner that prevents its reuse and that is consistent with procedures for disposal of controlled waste. The date of disposal will be recorded in the seal accountability records and the remover and witness will sign their names and badge numbers to the form.
5. The seal applicator will deliver the seal application and removal form to the seal custodian as soon as possible.

Application of Vinyl or Other Adhesive Seals

The vinyl or other adhesive seal is a nontransferable strip. An attempt to remove these seals from the application surface will damage the seal. When removal is attempted, the material will destruct and leave identifying marks showing that it has been violated. The seal is applied to containers or other objects in a manner that requires destroying the device to open the object.

Procedure

NOTE: Two authorized seal applicators must be present when seals are applied to nuclear material containers.

1. Ensure container is clean prior to seal application.
2. Remove any previously applied labels and seals. If a previously-applied seal cannot be peeled off the can, apply the new seal at 90 degrees which will allow minimal overlap on the old label.
3. Slip the seal through any handle (if present) on top of the container. Peel the label/seal portion of the seal away from the backing material by lifting one of the corners and slowly separating the seal from the backing.
4. Apply the bar code portion of the seal, if applicable, to the container so the bar code is on the side near the top edge and the tape extending from the top of the bar code is applied across the top of the container and down the opposite side. Exercise care to ensure that the bar code is applied close enough to the top edge to allow the tape to reach across the top of the container and extend down the opposite side at least 1 inch. Both ends of the seal should extend at least 1 inch down the sides of the can if possible. For drums, place the seal behind the bolt. **NOTE:** The locking ring should be bolted down so the gap in the ring behind the bolt is as small as possible. The seal should be centered over this gap. The end opposite the bar code should be on the side of the drum, between the top edge and the first rolling hoop. No part of the decal should be below the first rolling hoop.
5. Apply firm pressure to the entire surface of the seal to ensure that the seal adheres to the surface. Give special attention to the edges of the seal. Be careful not to fold or wrinkle the device where it laps over the edges of the can. Apply the seal smoothly to prevent wrinkles, especially in the area of the bar code and the sequential number but do not lift the seal once applied or it will be damaged.

6. Inspect the seal to verify:
 - a) That the seal is applied across the top of the container with at least 1 inch extending down opposite sides of the top of the container. It is recommended that another seal is applied identically across the bottom of the container if possible.
 - b) That the seal is not torn.
 - c) That the seal has adhered to the surface of the can.
 - d) That the bar code and sequential number block are not wrinkled and are readable.
 - e) That both seal and ID numbers are properly recorded.
7. If the seal is not properly placed on the can, is torn, or if the numbers do not match, the seal will be voided according to the procedure for breaking or voiding vinyl or other adhesive seals. A new seal can then be applied.
8. Complete
 - a) the material identification, location, seal number, seal date, and other required portions of the appropriate transfer documents, and
 - b) seal application and removal form including applicator and witness signatures and badge numbers and date.
9. Deliver the application form to the seal custodian immediately.

NOTE: If it is not possible to apply the seal completely across the top of the container due to the size, apply two seals, one to each side of the top of the container.

Removal of Vinyl or Other Adhesive Seals

Resealing, relabeling, recanning, or opening a nuclear material container that is sealed with a vinyl or other adhesive seal requires breaking or voiding the seal. This procedure defines the inspection, recording, and notification requirements for breaking or voiding applied seals.

Procedure

- NOTE: Two authorized seal applicators must be present when vinyl or other adhesive seals are applied to nuclear material containers are broken or voided.
1. When voiding an unapplied vinyl or other adhesive seal, the seal applicator must destroy the seal and return a completed seal application and removal form to the seal custodian within 24 hours.
 2. Prior to breaking or voiding an applied vinyl or other adhesive seal, a seal applicator will inspect the seal to verify:
 - a) That the seal is not broken, damaged, or improperly applied.
 - b) That the number of the seal matches the number of the shipping documents and the container integrity has been maintained.
 3. If the inspection fails to verify these criteria, the authorized seal applicator will initiate the required response procedure.

4. If the inspection verifies the integrity of the seal, it may be broken or considered void for authorized resealing, relabeling, recanning, or opening.
5. The authorized seal remover and witness will complete and sign a seal application and removal form and deliver to the seal custodian by hand.

APPENDIX D. CHECKLISTS

A checklist(s) should be developed for review and evaluation of each facility's seals program. The following sample checklists provide examples that can be used in developing facility specific checklists.

Seals Program Checklist

1. Does the facility have a documented program for the use of seals to detect violations of container integrity?
2. Does the facility have a documented program that specifies procedures for application, removal, and destruction of seals?
3. Do access controls for seals include procedures to assure that procurement, storage, and distribution of seals are controlled?
4. Do procedures exist for verification of seals integrity at specified frequencies?
5. Are the seal procedures documented?
6. Does the seals program specify the type of seal available for use and on which type of container?
7. Does the program for the control of seals specify the frequency and method of seal verification?
8. Does the seals control program specify methods of assuring that seals cannot be reused after having been violated or voided?
9. Does the seals control program specify methods of assuring that each seal has a unique identification?
10. Is the process by which tampering is indicated described for each type of seal?
11. Do the procedures address abnormal situations (e.g. seal number discrepancy; damaged, broken, missing, and improperly applied seals)?
12. Does the facility have an internal review program that includes audits and assessments of the seals program?
13. Is the seal custodian trained and is there a record of this training?
14. Are there training records for those who apply, verify, remove, and destroy seals?
15. Inventory of applied and unused seals.

Checklist for Control of Seals

1. Does the facility have a program for control of seals during procurement, storage, distribution, application, removal, and disposal?
2. Does the facility have a documented program for control of seals which includes procedures for applying the seals?
3. Does the facility have a documented program for control of seals which has procedures for response to and reporting of seal violations?
4. Does the facility have a documented program that specifies personnel authorized to apply, remove, and dispose of seals?
5. Does the facility's program for control of seals specify the frequency and method of internal program audits?
6. Do access controls for seals include procedures to assure that individuals with responsibility for control of seals storage and distribution are designated?

Checklist for Seal Use

1. Is every seal at the site listed in the seals accountability system?
2. Are sealed items that are found with damaged or misapplied seals reported? Are the items re-measured using verification or confirmation measurements?
3. Does the two-person concept for seal application and destruction include reading, recording, and transferring of seal identification number, container identification number, and other data including location of the container? (*Section 5.1. Applying and Removing Seals*)
4. Is access to the seals accountability system controlled so that seal applicators do not have access to the seals accountability system and that personnel with access to the seals accountability system are not allowed to apply seals?
5. Are seals checked for indications of tampering?
6. Are seal requisition forms and purchase order forms controlled to prevent easy, unauthorized access to the forms?
7. Is there a check to verify that the quantity of seals shipped is the same as seals received by the receiving office? By the receiving administrator?
8. Are unused seals stored in a secure storage area? Is access to the storage area controlled?
9. How is the seals inventory data secured? Can an unauthorized person insert false information into the seals inventory records?
10. How are seals destroyed?

11. Is the number of broken or misapplied seals consistent with an adequate seals control program?
12. Are all seals discrepancies reconciled?
13. How are the internal audits of the seal program carried out? How often?
14. Are seals custodians familiar with the procedures for handling seals? Are they properly trained and qualified?
15. Are procedures thorough for applying, removing, verifying, and destroying seals? Are the procedures followed?
16. Who is authorized to add names to the authorized list of seals applicators?
17. Are there notification and response procedures established in the event of discovery of a violated seal?

APPENDIX E. EXAMPLES OF SEAL FORMS FROM VARIOUS LOCATIONS

These seal form examples provided on the following pages is general guidance provided for developing seal forms to meet your site specific needs. When creating your seal forms consider your various site specifications and the procedures you use to tailor you seal forms. You may also contact other TID Administrators from other sites to help you tailor seal forms to meet your specific needs.

MBA: _____

Form X

TID APPLICATION / REMOVAL and WITNESS RECORD

PAGE: _____

TID SERIAL NUMBER	TYPE OF TID	CONTAINER OR MATERIAL ID NUMBER	APPLICATION DATE	TID APPLICATOR AND WITNESS SIGNATURE AND BADGE NUMBER	REMOVAL DATE	TID REMOVER AND WITNESS SIGNATURE AND BADGE NUMBER
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)
				(APPL.)		(REM.)
				(WIT.)		(WIT.)

TID KEY	
ML	Multi-Lok
AH	Mylar
EC	E-Cup
P	Paper

