

**BY ORDER OF THE SECRETARY
OF THE AIR FORCE**

AIR FORCE INSTRUCTION 91-103

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Safety

**AIR FORCE NUCLEAR SAFETY
DESIGN CERTIFICATION PROGRAM**

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This Instruction implements AFPD 91-1, *Nuclear Weapons and Systems Surety*. This publication is consistent with AFPD 13-5, *Air Force Nuclear Enterprise*. It outlines the Nuclear Safety Design Certification Program, which is a major component of the overall USAF Nuclear Certification Program outlined in AFI 63-125, *Nuclear Certification Program*. It defines the process for obtaining nuclear safety design certification of hardware, software, procedures and facilities used with nuclear weapon systems. It applies to organizations that design, develop, modify, evaluate, nuclear certify, or operate nuclear weapon systems and equipment. This Instruction is applicable to the Air Force Reserve (AFR) and Air National Guard (ANG) units performing nuclear missions or equipped with nuclear certified support equipment. Ensure that all records created as a result of processes prescribed in this publication are maintained IAW Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW the the Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, Table 1.1 for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication OPR for non-tiered compliance items. Send major command (MAJCOM) supplements to this instruction to AFSEC/SEW at HQAFSCSEW@us.af.mil or 9700 G Avenue, Kirtland AFB NM 87117-5670 for coordination before publication. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847,

Recommendation for Change of Publication; route AF Form 847s from the field through the appropriate functional chain of command.

SUMMARY OF CHANGES

This revision includes minor administrative changes throughout and updates organizations. It clarifies SAF/AQ and AFMC responsibilities and also incorporates new AFI 33-360, guidance to include Tier waiver requirements

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Section A—Scope and Responsibilities

1. Program Overview. The USAF Nuclear Certification Program has two major components: Design Certification and Operational Certification. The Design Certification has four sub-components and the Nuclear Safety Design Certification is one of the sub-components. See AFI 63-125 for complete details of the USAF Nuclear Certification Program.

2. Program Goal. The Air Force Nuclear Safety Design Certification Program evaluates hardware, software, procedures, and facilities against specific nuclear safety criteria before use with nuclear weapons. The program's goal is to prevent nuclear weapon accidents and incidents.

3. Responsibilities.

3.1. Assistant Secretary of the Air Force (Acquisition) (SAF/AQ). SAF/AQ will ensure Program Managers for nuclear capable/certified weapon systems and nuclear certified mission support items comply with the following requirements.

3.1.1. Field, sustain, and maintain configuration control of hardware and software to be nuclear safety design certified throughout their life-cycle.

3.1.2. Comply with the nuclear safety design certification program.

3.1.3. Perform unauthorized launch (UL) studies IAW AFI 91-106, Unauthorized Launch, Threat Mitigation, and Launch Action Studies.

3.1.4. Support the TDI development and evaluation process.

3.1.5. Evaluate Air Force use of Department of Energy (DOE)-certified equipment with nuclear weapons to determine whether operating environments are identical and if any differences impact nuclear surety.

3.1.6. Review deficiencies (material deficiency reports, service bulletins, and nuclear safety deficiency reports) for possible impact on nuclear surety or certification status and implements required corrective action.

3.1.7. Ensure all Nuclear Surety Procedures (NSP), as defined in AFI 91-101, are marked with the NSP symbol to enable positive identification. Apply special emphasis to the NSP to protect against degrading or rendering ineffective the critical nuclear safety features of the weapon system as determined by Air Force Safety Center's Weapon Safety Division or other appropriate technical engineering authority.

3.1.8. Develop operational certification (OPCERT) and decertification (DECERT) procedures.

3.2. **Chief of Safety (AF/SE).** AF/SE oversees the Air Force Nuclear Safety Design Certification Program that is an integral part of the overall Air Force Nuclear Certification Process.

3.3. **Air Force Safety Center, Weapons Safety Division Chief (AFSEC/SEW)** manages the nuclear safety design certification program for AF/SE. In this role, AFSEC/SEW will:

3.3.1. Publish design and evaluation criteria according to AFI 91-107, *Design, Evaluation, Troubleshooting, and Maintenance Criteria for Nuclear Weapon Systems*.

3.3.2. Review and coordinate on nuclear certification impact statements (NCIS) that affect nuclear safety design certification.

3.3.3. Approve the Nuclear Safety Certification annex to the Certification Requirements Plan (CRP) to ensure nuclear safety design certification requirements are adequately addressed.

3.3.4. Approve new or revised test and weapon maintenance procedures for nuclear weapons performed in Air Force facilities, as well as approve the performance of current procedures not currently approved for a given facility.

3.3.5. Review Nuclear Surety Evaluations (NSE) for compliance with all nuclear safety design certification requirements.

3.3.6. Provide nuclear safety design certification of hardware, software, procedures, and facilities to be used with nuclear weapons.

3.3.7. Issue a Nuclear Safety Certification Letter to the Air Force Nuclear Weapons Center (AFNWC) upon completion of all nuclear safety design certification actions identified in the CRP.

3.3.8. Designate and certify critical components according to AFI 91-105, *Critical Components*.

3.3.9. Certify Tamper Detection Indicators (TDI).

3.3.10. Identify nuclear safety designed certified hardware and software items, and restrictions on usage, to AFNWC for listing in the Master Nuclear Certification List (MNCL), located at <https://wwwmil.nwc.kirtland.af.mil/MNCL/index.cfm>.

3.3.11. Approve Intercontinental Ballistic Missile (ICBM) OPCERT and DECERT procedures.

3.3.12. Rescind nuclear safety design certification of hardware, software, procedures, and facilities.

3.3.13. Review high fidelity Joint Test Assembly maintenance procedures performed in Air Force facilities.

3.4. **MAJCOM Responsibilities.** At bases with units and personnel from two or more MAJCOMs, the host/gaining command will have responsibility for the MAJCOM responsibilities outlined in this section. Memorandums of Understanding/Memorandums of

Agreement may be developed between MAJCOMs to delineate the actions required by each command to meet these responsibilities. MAJCOMs will:

- 3.4.1. Designate someone to manage the nuclear certification program IAW AFI 63-125.
- 3.4.2. Recommend new uses for TDIs, and request approval from AFSEC/SEW.
- 3.4.3. Ensure OPCERT of critical components before use and initiate DECERT when needed.
- 3.4.4. Ensure units report deficiencies on certified items IAW AFMAN 91-221, *Weapons Safety Investigations and Reports*.
- 3.4.5. Provide the Program Manager for the certification and configuration control of facilities (as defined in paragraph 4.1.9.) to include lifting and suspension systems. Perform the following when serving as the Program Manager for facility certification:
 - 3.4.5.1. Prepare NCIS IAW AFI 63-125 to support the nuclear safety design certification process of Section C, paragraph 7.2.
 - 3.4.5.2. Develop the Nuclear Safety Certification annex to the CRP for each facility to be nuclear safety design certified IAW AFI 63-125.
 - 3.4.5.3. Ensure processes and guidance are in place to maintain configuration control of facilities with nuclear safety design certification.
 - 3.4.5.4. Conduct NSE of nuclear weapons maintenance, handling, and storage facilities.
 - 3.4.5.5. Review deficiencies (materiel deficiency reports, service bulletins, and nuclear safety deficiency reports) for possible impact on facility certification status, and implement required corrective action.
 - 3.4.5.6. Evaluate nuclear surety compliance for facilities used with a nuclear weapons.
- 3.4.6. AFR and ANG units with nuclear tasked units or personnel will provide headquarter and unit-level OPRs to coordinate and assist the gaining MAJCOM/Wing with the duties and responsibilities outlined in this Instruction.

3.5. Air Force Materiel Command (AFMC). In addition to the responsibilities outlined in paragraph 3.4., AFMC will through the AFNWC:

- 3.5.1. Provide independent technical support (analyses, assessments, evaluations, reviews, etc.) to AFSEC/SEW.
- 3.5.2. Maintain archives of all pertinent documentation related to nuclear certification. Documentation requirements are summarized in AFI63-125, Chapter 7.
- 3.5.3. Ensure AFSEC/SEW is notified about nuclear weapon maintenance or test procedures not defined as a weapon alteration (ALT) or modification (MOD) (see paragraph 12.) that will be accomplished in Air Force facilities.
- 3.5.4. Ensure AFSEC/SEW is notified about nuclear weapon ALTs and MODs, as defined in paragraph 12, that will be accomplished in Air Force facilities.

Section B—Nuclear Safety Design Certification Criteria**4. Items That Require Nuclear Safety Design Certification.**

4.1. Hardware and Software:

4.1.1. Combat and noncombat delivery vehicles as defined in AFI 91-101.

4.1.2. Operational and support equipment used to move, support, store, handle, load and unload, or mate and demate nuclear weapons.

4.1.3. All hardware and software components that directly interface (electrically or physically) with a nuclear weapon, critical component, or certified software.

4.1.4. Items that, if failed or operating incorrectly, could degrade the nuclear command, control, and status reporting capability.

4.1.5. Hardware and software items designated as critical components IAW AFI 91-105.

4.1.6. All hardware or software used to directly control critical functions, as defined in AFI 91-107 and AFMAN 91-118.

4.1.7. TDIs used to maintain the OPCERT status of critical components and protection of secure nuclear command and control codes and coded components.

4.1.8. Operational and maintenance hardware and software used to command and control critical functions, and perform status reporting as required in AFMAN 91-118 and AFMAN 91-119.

4.1.9. Nuclear Weapons Maintenance, Handling and Storage Facilities. Nuclear safety design certification of facilities will be based on the design and evaluation of essential facility systems, IAW AFMAN 91-118 and AFMAN 91-119.

4.1.10. Modifications to non-specialized equipment that could impact the item's primary structure, electrical and hydraulic power systems, load-bearing capacity, steering and braking capability, software, or positive control features, as well as any changes resulting in noncompliance with specific AFI 91-107 design criteria.

4.1.11. Test equipment that:

4.1.11.1. Verifies the proper operation of circuits and functions of the Unit Under Test that perform nuclear critical functions (defined in AFI 91-107 and AFMAN 91-118).

4.1.11.2. Interfaces directly with a nuclear weapon or operationally certified critical component.

4.1.11.3. Is used to operationally certify, decertify, or verify proper operation of applicable items identified in paragraph 4.1, and all subparagraphs thereof.

4.1.11.4. Is used in special test or maintenance programs to identify system anomalies or failures.

4.2. Procedures. Nuclear weapon system technical order procedures involving OPCERT or DECERT. Other nuclear weapon or nuclear weapon system technical order procedures are certified IAW AFI 63-125.

4.3. Other. When items do not clearly fall into any of the categories identified, AFSEC/SEW determines if nuclear safety design certification is required.

4.4. Non-Specialized Commercial Off-the-Shelf Equipment and Other Agency Items. The following are considered to be nuclear safety design certified, and therefore do not require separate Air Force nuclear safety design certification actions provided the item is in its original unmodified condition and is used in its intended operating environment IAW approved technical data. Modifications or deviations from original manufacturer's specifications must be approved by AFSEC/SEW.

4.4.1. Tiedown chains and cables, straps, and adjusters used for restraint during transportation.

4.4.2. Support equipment and procedures for nuclear logistics movements that other DOD agencies have certified for nuclear weapons handling.

4.4.3. DOE Test, Handling, and Support Equipment provided by DOE to the Air Force for use with nuclear weapons or nuclear weapons systems, provided the equipment is used for the specific purpose intended, as outlined in approved Joint Nuclear Weapons Publication System publications, special procedures, or authorized Unsatisfactory Reports responses.

4.4.4. Commercial Vehicles.

4.4.4.1. CONUS. Commercial truck-tractors, which meet all of the following requirements, are nuclear safety design certified. These vehicles are authorized for towing nuclear certified semi-trailers.

4.4.4.1.1. Manufactured in 1979 or later.

4.4.4.1.2. Gross vehicle weight greater than 20,000 pounds.

4.4.4.1.3. Identified by a World Manufacturer Identifier (WMI) Vehicle Identification Number (VIN) first digit of a 1, 4 or 5.

4.4.4.2. OCONUS. Commercial truck-tractors, which meet all the following requirements, are nuclear safety design certified and are authorized for towing nuclear certified semi-trailers.

4.4.4.2.1. 1998 model year or later.

4.4.4.2.2. Tractor is a type "N1 or N2" (per European Community (EC) Directive 70/156/EEC Annex II and 97/27/ EC).

4.4.4.2.3. Meet all applicable EC standards.

4.4.4.2.4. Must be compatible with the nuclear certified semi-trailers (i.e. braking system, electrical system, mechanical mate/de-mate, etc.).

4.4.4.2.5. Incorporate a transmission/starter interlock system.

4.4.5. Tow Vehicles:

4.4.5.1. Original equipment pintle hook assemblies, and pin-and-clevis couplers are nuclear safety design certified. Replacements are considered certified if procured and installed per appropriate tech orders, used as intended, and meet applicable industry

standards. For pin-and-clevis couplers, only Tow Tractor OEM replacements are nuclear certified.

4.4.5.2. Vehicles modified IAW TO 36A-1-1341, *Compressed Natural Gas And Alternative Fuel For Vehicular (Engine Combusted) Propulsion*, or TO 36A-1-1331, *Propane Gas Conversion Guide For Vehicular Equipment*, for alternative fuels are considered nuclear safety design certified, if they were certified in their unmodified state.

4.4.6. Semi-trailers:

4.4.6.1. Non-specialized semi-trailers are considered nuclear safety design certified when they are in original unmodified condition and meet applicable industry standards.

4.4.6.2. The addition of a certified rollerized conveyor or other like item to an uncertified trailer does not certify that trailer, even if the stock number changes to a certified number. To have a certified unit, both the trailer and the modification kit are required to be separately certified.

5. Items That Do Not Require Nuclear Safety Design Certification.

5.1. Common items:

5.1.1. General purpose hand tools, such as pliers, wrenches, and screwdrivers.

5.1.2. Depot and intermediate-level test equipment, if the critical circuits of the tested items are verified at the organizational level before use with nuclear weapons.

5.1.3. Common, multipurpose, and non-specialized test equipment, such as multimeters, decade resistance boxes, and impedance bridges unless the equipment directly interfaces with nuclear weapons or end item that is nuclear safety design certified.

5.1.4. Delivery, Loading, Mating, Maintenance, and Explosive Ordnance Disposal (EOD) Training Equipment. All Air Force equipment designed and used for proficiency training, such as full-scale and miniature practice delivery bombs and bomb dispensers, practice loading bombs and warheads, training re-entry vehicles and payload sections, EOD disassembly/reassembly training equipment, etc., does not require nuclear safety design certification. Nuclear training shapes containing conventional explosives may require Non-nuclear Munitions Safety Board (NNMSB) certification per AFI 91-205.

5.1.5. Aircraft Mission Planning Software. Aircraft mission planning system software is not nuclear safety design certified. However, aircraft mission planning software that transfers operational flight program (OFP) software and cruise missile targeting data must ensure the integrity of data during this process is maintained. Mission planning systems must be designed and implemented such that:

5.1.5.1. During the transfer from one media source to another, the OFP software containing nuclear critical functions and the mission data containing nuclear targeting data are not altered.

5.1.5.2. Integrity of the data is maintained when loaded on the aircraft.

5.1.5.3. Procedures are formulated and implemented that satisfy these nuclear surety requirements and ensure future software revisions will not alter those modules that perform the verification tasks.

5.1.5.4. New mission planning systems (e.g., Joint Mission Planning System) must be documented in an NSE and submitted to AFSEC/SEW for approval with a copy to AFNWC to document the manipulation, processing and protection of flight software and nuclear targeting data.

5.2. Items listed in the General Guidance section of the MNCL as having blanket certification, provided they are in original, unmodified condition and used for their intended purpose.

6. Additional Requirements. The following requirements apply to critical components, TDIs, special test and maintenance programs, and host nation-operated weapon systems and procedures:

6.1. Critical components also require OPCERT before use in operational systems to verify the component is functioning as design certified. (Refer to AFI 91-105 and AFI 91-106). Certain critical components also require specific procedures for DECERT.

6.2. TDIs may be used to protect the certification status of critical components, if sufficient justification exists for their use. However, TDIs may not be used to substitute Two-Person Concept control of codes, coded devices, or critical components when an operational code that cannot be overwritten passes through it or if the code component or device has no operational decertification procedure. TDIs used in an operational system are identified in the safety rules for the affected nuclear weapon system IAW AFI 91-104, *Nuclear Surety Tamper Control and Detection Programs*.

6.3. Special test or maintenance programs conducted in operational facilities that are not covered by certified procedures must be approved by AFSEC/SEW.

6.4. When used with nuclear weapons in Air Force custody, host nation-operated nuclear weapon systems and procedures must satisfy the same nuclear safety criteria required for Air Force systems and procedures.

Section C—Nuclear Safety Design Certification Process

7. Nuclear Safety Design Certification Process for New or Modified Weapon System Hardware, Procedures, Facilities, and Software. Use the following paragraphs in conjunction with AFI 63-125 to determine the steps and timelines for the nuclear safety design certification process.

7.1. The operational MAJCOM or Program Manager identifies items that may require nuclear safety design certification according to paragraph 4. (T-1).

7.1.1. The program manager (for facilities, the program manager refers to the lead or using command) must maintain configuration control of identified hardware, software, and facilities to be nuclear safety design certified throughout their life-cycle. (T-1).

7.2. For new weapon systems or weapon system modifications, the Program Manager or MAJCOM prepares an NCIS IAW AFI 63-125.

7.2.1. The NCIS must address those items that require certification and recommend a certification approach for verifying compliance with AFI 91-106, AFI 91-107, AFMAN 91-118 and AFMAN 91-119.

7.3. As the development or modification effort nears completion (determined by the required operational capability or certification need date), the Program Manager or MAJCOM prepares a NSE according to Attachment 2, paragraph A2.2., and Attachment 4. This document will include a recommendation for nuclear safety design certification IAW A4.1 of Attachment 4. Submit the evaluation and certification recommendation to AFSEC/ SEW. Provide a copy to AFNWC. If required, AFSEC/SEW will task AFNWC to perform an independent NSE. **NOTE:** For new (and some modified) weapon systems, a Nuclear Safety Analysis Report typically serves as the NSE. (T-1).

7.3.1. If a safety study is required, as defined in DODM 3150.02, *DOD Nuclear Weapon System Safety Program Manual*, submit the evaluation to AFSEC/SEW 120 calendar days before the study IAW AFI 91-102, *Nuclear Weapon System Safety Studies, Operational Safety Reviews, and Safety Rules*.

7.3.2. If a safety study is not required, submit the evaluation 60 calendar days before the required operational capability or certification need date.

7.4. When tasked by AFSEC/SEW, AFNWC evaluates the design, evaluation, and certification recommendation according to Attachment 2, paragraph A2.3., and provides this assessment to AFSEC/SEW.

7.4.1. When a safety study is required, this assessment is submitted as required by AFI 91-102 in the form of a Technical Nuclear Safety Analysis.

7.4.2. If a safety study is not required, AFNWC must submit the assessment 20 calendar days before the required operational capability or certification need date.

7.5. AFSEC/SEW will provide a Nuclear Safety Design Certification letter to AFNWC IAW AFI 63-125. **NOTE:** Restrictions on the use of items in a nuclear role may be imposed to compensate for design deficiencies or significant operational hazards.

7.6. For host nation-owned nuclear weapon systems, the host nation as Program Manager shall submit nuclear safety design certification documentation through AFNWC Engineering Liaison Office (ELO). ELO will interface between the host nation and the USAF on all nuclear safety design certification processes and issues.

8. Certification Process for Nuclear Safety Design Certified Technical Order Procedures.

8.1. AFSEC/SEW approves new or major changes to OPCERT/DECERT procedures for critical components. These procedures must adequately verify the system or component functions as design certified and mitigates all credible threats and scenarios.

8.2. AFSEC/SEW approves troubleshooting and maintenance procedures and operations on loaded nuclear weapons systems, as identified by Program Manager.

9. Critical Components. For nuclear safety design certification of critical components, the organization with program management responsibility:

9.1. Initiates the design certification process for hardware and software. (T-1).

9.2. Provides for a nuclear safety cross-check analysis (NSCCA) or independent validation and verification (IV&V) of software critical components according to Attachment 2, paragraph A2.4. (T-1).

9.3. Develops OPCERT and DECERT procedures for hardware critical components and sends the procedures to AFSEC/SEW for approval. (T-1).

10. Tamper Detection Indicators (TDIs).

10.1. For certification of TDIs, the operational MAJCOM or Program Manager determines the need for TDI application and sends a request to AFSEC/SEW that:

10.1.1. Identifies the critical component requiring a TDI. (T-1).

10.1.2. Justifies why a TDI is needed. (T-1).

10.1.3. States whether the TDI will be used in an operational system or a nonoperational environment for storage and transportation. (T-1).

10.2. AFSEC/SEW evaluates the TDI application request and sends the approved application to the National Security Agency (NSA) for development of a suitable TDI.

10.3. By agreement, the NSA:

10.3.1. Develops the appropriate TDI, based on the parameters and intended-use data provided by the operational MAJCOM.

10.3.2. Coordinates TDI development with the organization having program management responsibility.

10.3.3. Sends the TDI data required for application, control, storage, and inspection procedures to AFSEC/SEW for certification.

10.4. The requesting MAJCOM maintains responsibility for all procurement actions and costs associated with TDI development and integration.

10.5. Upon approval of the application, the Program Manager provides the technical requirements to the NSA and develops the NSE required to obtain certification.

11. Special Test and Maintenance Programs.

11.1. The Program Manager must evaluate all aspects of the proposed program(s) for potential nuclear surety degradation. This evaluation includes conditions that could violate AFI 91-107 requirements, degrade safety and security features of the weapon system, or contribute to an AFI 91-106 scenario. (T-1).

11.2. The Program Manager provides this evaluation and requests approval of the proposed program(s) from AFSEC/SEW. (T-1).

11.3. AFSEC/SEW bases the approval decision on the findings of the evaluation and an independent review of the proposed program(s) (if required). A special safety study may also be required IAW AFI 91-102.

12. Nuclear Weapon Maintenance or Test Procedures.

12.1. Program Manager of the facility will perform an evaluation/review of all new or revised nuclear weapon maintenance or test procedures in relation to the facility where they

are to be performed, as well as evaluate/review the performance of procedures not specifically approved for a given facility. (T-1).

12.2. AFSEC/SEW must approve implementation of all new or revised nuclear weapon maintenance or test procedures that will be accomplished in Air Force facilities, as well as approve the performance of current procedures not currently approved for a given facility. Example programs include:

12.2.1. Programs to accomplish warhead ALTs and MODs.

12.2.2. Any programs that require bypassing or disabling any weapon safety features.

12.2.3. Procedures that introduce new or significant potential safety hazards, e.g., sources of electrical energy, fire hazards, etc.

12.3. AFNWC must notify AFSEC/SEW of weapon ALTs or MODs and any other new or revised maintenance or test procedures accomplished in Air Force facilities.

12.3.1. The notification via a Statement of Intent (SOI) will initiate an AF safety review/evaluation of the proposed procedures in relation to the facility where they are to be performed and must:

12.3.1.1. Provide background information and describe the maintenance action to be performed.

12.3.1.2. Identify proposed temporary removal, bypass, or disablement of the surety features of the weapon itself, and provide general information concerning the susceptibility present due to the temporary removal, bypass, or disablement of these surety features.

12.3.1.3. Specify the Air Force facility where the procedures will be performed.

12.4. For Product Change Proposals, AFNWC will submit the notification SOI no later than 180 days before scheduled maintenance. For Special Procedures and Retrofit Orders, submit the notification when it is distributed for Air Force review/coordination.

12.5. AFSEC approval (via formal documentation) must be obtained before implementation of procedures described in paragraphs 12.2. and 12.3.

13. Non-specialized Equipment. Any equipment used with nuclear weapons, but not specifically designed for that purpose, is considered non-specialized equipment, specifically, items listed in paragraphs 4.4 through 4.4.6.2. Certain modifications to non-specialized equipment do not require formal nuclear safety design certification. These modifications include:

13.1. Common add-on equipment such as fire extinguishers, radios, lights, bedliners, camper shells, sirens, foreign object damage magnets or containers.

13.2. Minor field-level modifications to vehicles or aerospace ground equipment that do not impact the braking, steering, lifting, powertrain, or load carrying/restraint systems.

13.3. The following process should be used by the field unit to determine the appropriate course of action for evaluation and local approval of minor field-level modifications.

13.3.1. Identify item(s) to be modified, and provide a complete description of the proposed changes to the item Maintenance Supervisor/Superintendent (or equivalent) and the Unit Safety Office. These offices will jointly review the proposed modification to determine if approval can be granted at the unit level or if further evaluation of the nuclear safety impact is necessary.(T-1).

13.3.1.1. If there is no impact to nuclear surety, approve the modification locally.

13.3.1.2. If further evaluation is required, submit a formal request for evaluation/approval from the using MAJCOM's safety office.

13.3.2. If formal nuclear safety design certification is not required, the using MAJCOM will:

13.3.2.1. Provide formal approval to the field unit.

13.3.2.2. Inform the Program Manager and AFSEC/SEW of the approved modification.

13.3.3. If the modification requires formal nuclear safety design certification, the using MAJCOM will:

13.3.3.1. Notify the submitter that further evaluation is necessary.

13.3.3.2. Follow the process specified in paragraph 7.

13.3.4. For all non-specialized equipment (including foreign manufactured, US or host nation owned), the host nation as Program Manager shall submit certification documentation through AFNWC's ELO. ELO will serve as the interface between the host nation and the USAF on all nuclear safety certification processes and issues. (T-1).

14. Lifting and Suspension Systems.

14.1. The owning command performs a NSE and sends a certification request to AFSEC/SEW, according to paragraph 7.4.

14.2. A design or civil engineering agency evaluates the facility that will support the lifting or suspension system to determine if the structure meets the design requirements in AFMAN 91-118. This evaluation and appropriate analysis that the structure is safe for the rated load and meets the required margins of safety, IAW AFMAN 91-118, must be included with the lead/using command's NSE. (T-1).

14.3. An inspection and maintenance cycle for each certified facility lifting system will be established IAW AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*.

14.4. The lead/using command is authorized to use suspended load-frame assemblies at 100 percent of their rated load. Suspended load frames do not require periodic load testing, but must be periodically inspected.

14.5. The lead/using command evaluates item or facility support structure modifications to determine their impact on the certification status.

14.6. AFSEC/SEW nuclear safety design certifies the facility lifting system and notifies AFNWC. The AFNWC will then update the MNCL accordingly.

*Section D—Decertification Process***15. Design Decertification.**

15.1. AFSEC/SEW may remove nuclear safety design certification for items that have demonstrated inadequate safety through analysis, testing, or operational performance.

15.2. Any Air Force agency may send a recommendation for removal of nuclear safety design certification to AFSEC/SEW. The recommendation must identify the item as listed in the MNCL and include documentation that supports the recommendation.

15.3. Removal of nuclear safety design certification is done via a formal notification letter from AFSEC/SEW to AFNWC, with courtesy copies forwarded to MAJCOM Safety Offices.

15.4. An individual nuclear safety design certified item may be restricted from use with nuclear weapons any time for any reason (e.g., damage, modifications, or changes to intended usage, etc.). Such restrictions do not constitute removal of nuclear safety design certification. However, appropriate documentation in historical or permanent records is required to preclude inadvertent use. Submit request via memorandum to AFSEC/SEW to restrict specific item(s) from use. AFSEC/SEW will notify AFNWC to update the MNCL accordingly and provide a courtesy copy of notification to MAJCOM Safety Offices.

16. Operational Decertification.

16.1. Critical components that have been improperly stored or not maintained IAW AFI 91-105 require decertification, if the resulting mishap investigation does not positively rule out tampering. Decertification is also required if a critical component is connected to an uncertified interface (i.e., not certified via OPCERT procedures or through nuclear safety design certification approval as documented in this publication).

16.2. Operational MAJCOMs may decertify critical components, if they use approved decertification procedures (when applicable) and the intended life cycle for the critical component does not specifically prohibit decertification.

ANDREW M. MUELLER
Major General, USAF
Chief of Safety

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

- DOD Directive 3150.02, *DoD Nuclear Weapons Surety Program*, 24 April 2013
- DODM 3150.02, *DoD Nuclear Weapon System Safety Program Manual*, 31 January 2014
- AFPD 33-3, *Information Management*, 8 September 2011
- AFPD 63-1, *Integrated Life Cycle Management*, 3 July 2012
- AFPD 91-1, *Nuclear Weapons and Systems Surety*, 13 December 2010
- AFI 63-101_20-101, *Integrated Life Cycle Management*, 7 Mar 2013 w/IC-2, 23 February 2015
- AFI 63-125, *Nuclear Certification Program*, 8 August 2012
- AFI 91-101, *Air Force Nuclear Weapons Surety Program*, 15 August 2014
- AFI 91-102, *Nuclear Weapon System Safety Studies, Operational Safety Reviews, and Safety Rules*, 25 February 2014
- AFI 91-104, *Nuclear Surety Tamper Control and Detection Programs*, 23 April 2013
- AFI 91-105, *Critical Components*, 2 August 2013
- AFI 91-106, *Unauthorized Launch, Threat Mitigation, and Launch Action Studies*, 30 June 2015
- AFI 91-107, *Design, Evaluation, Troubleshooting and Maintenance Criteria for Nuclear Weapon Systems*, 11 December 2012
- AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*, 15 June 2012
- AFI 91-204, *Safety Investigations and Reports*, 12 February 2014
- AFMAN 33-363, *Management of Records*, 1 March 2008
- AFMAN 91-118, *Safety Design and Evaluation Criteria for Nuclear Weapon Systems*, 28 July 2015
- AFMAN 91-119, *Safety Design and Evaluation Criteria for Nuclear Weapon Systems Software*, 5 June 2012
- AFMAN 91-221, *Weapons Safety Investigations and Reports*, 8 November 2010
- AFPD 13-5, *Air Force Nuclear Enterprise*, 6 July 2011
- Air Force Records Disposition Schedule (RDS) located at <https://www.my.af.mil/afrims/afrims/afrims/rims.cfm>
- TO 36A-1-1331, *Propane Gas Conversion Guide for Vehicular Equipment*, 1 September 1983
- TO 36A-1-1341, *Compressed Natural Gas and Alternative Fuel for Vehicular (Engine Combusted) Propulsion*, 1 September 1985

Adopted Forms

- AF Form 847, *Recommendation for Change of Publication*

Abbreviations and Acronyms

AF—Air Force
AFI—Air Force Instruction
AFMC—Air Force Materiel Command
AFNWC—Air Force Nuclear Weapons Center
AFPEO—Air Force Program Executive Office
AFR—Air Force Reserve
AFSEC—Air Force Safety Center
AFSEC/SEW—AFSEC, Weapons Safety Division
AFSEC/SEWN—AFSEC/SEW, Nuclear Weapons Branch
AFTO—Air Force Technical Order
AGE—Aerospace Ground Equipment
ALT—Alteration
ANG—Air National Guard
CONUS—Continental United States
COTS—Commercial Off-the-Shelf
CRP—Certification Requirements Plan
DECERT—Operational Decertification
DAO—Designated Acquisition Official
DOD—Department of Defense
DOE—Department of Energy
EC—European Community
ELO—Engineering Liaison Office
EOD—Explosive Ordnance Disposal
FOD—Foreign Object Damage
IAW—In Accordance With
ICBM—Intercontinental Ballistic Missile
IV&V—Independent Validation and Verification
JMPS—Joint Mission Planning System
JNWPS—Joint Nuclear Weapons Publication System
JTA—Joint Test Assembly
MAJCOM—Major Command

MNCL—Master Nuclear Certification List
MOD—Modification
NCIS—Nuclear Certification Impact Statement
NCM—Nuclear Certification Manager
NSA—National Security Agency
NSAR—Nuclear Safety Analysis Report
NSCCA—Nuclear Safety Cross-Check Analysis
NSE—Nuclear Surety Evaluation
NSO—Nuclear Safety Objective
NSP—Nuclear Surety Procedures
NSR—Nuclear Safety Requirement
OCONUS—Outside Continental United States
OFP—Operational Flight Program
OPCERT—Operational Certification
PCP—Product Change Proposal
PM—Program Manager
RDS—Records Disposition Schedule
RO—Retrofit Orders
SAF/AQ—Assistant Secretary of the Air Force, Acquisition
SDP—System Program Director
SOI—Statement of Intent
SP—Special Procedures
TDI—Tamper Detection Indicator
TNSA—Technical Nuclear Safety Analysis
TO—Technical Order
TOMA—Technical Order Management Agency
UL—Unauthorized Launch
UR—Unsatisfactory Report
USAF—United States Air Force

Terms

Definitions—For additional definitions, see AFI 91-101, *Air Force Nuclear Weapons Surety Program*.

Master Nuclear Certification List (MNCL)—Identifies equipment, hardware, facilities and software that are certified IAW AFI 63-125. The MNCL is the sole source for verifying the nuclear certification status of nuclear certified equipment (system, hardware, software).

Nuclear Certification Impact Statement (NCIS)—Document issued by the Program Manager to initiate the certification process of an item/software, etc. This statement advises AFNWC that a new weapon system or a change to an existing weapon system, equipment item, software, facility, or procedure needs to be evaluated for its impact to the nuclear certification status of a weapon system. The NCIS must be submitted at least 45 days before the release of a request for proposal or an equivalent program milestone.

Program Manager (PM)—The PM, as defined in AFI 63-101/20-101, *Integrated Lifecycle Management*, is the designated individual with the responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs. For facilities, the PM is the operational MAJCOM vested with life cycle management and configuration control responsibility for the facility. **Note:** Terms such as Single Manager or Single Program Manager are no longer used in the Acquisition Enterprise AFI 63-101/20-101.

Attachment 2

GROUPS, SAFETY ANALYSES, PLANS, EVALUATIONS, AND REVIEWS

A2.1. Nuclear Surety Working Group (ICBMs) and Nuclear Weapon Delivery System Project Officer Groups:

A2.1.1. For ground-launched missile systems, a nuclear surety working group is used to coordinate nuclear surety requirements among the various agencies involved in nuclear certification.

A2.1.2. For aircraft and air-launched missile systems, a delivery systems project officer's group is used to coordinate nuclear certification issues.

A2.2. Nuclear Surety Evaluation (NSE). Evaluates hardware, software, facilities, and procedures to be nuclear safety design certified, using the approved certification approach (as identified in the CRP). The NSE focuses on all AFI 91-107, AFMAN 91-118, and AFMAN 91-119 design and evaluation criteria applicable to the item. It includes a recommendation for certification or certification with restrictions (to meet AFI 91-107, AFMAN 91-118, and AFMAN 91-119).

A2.3. Independent Nuclear Surety Evaluation. The independent nuclear surety evaluation:

A2.3.1. Is of sufficient depth to ensure the nuclear surety evaluation is technically correct and complete.

A2.3.2. Specifically addresses the design requirements.

A2.3.3. Indicates if the design meets AFI 91-107, AFMAN 91-118, and AFMAN 91-119.

A2.3.4. When requirements are not met, the evaluation must include comments and documentation on adequacy of compensatory measures and specify if the reviewing agency concurs with the evaluating agency's recommendation for nuclear safety design certification.

A2.3.5. For host-nation procured support equipment, the independent nuclear surety evaluation is conducted internally during the NSE development process conducted by AFMC's engineering liaison office.

A2.4. Software Evaluations. Nuclear critical software evaluation can be accomplished by NSCCA, or IV&V, or regression testing. Nuclear safety design certified software can be evaluated by IV&V or other Quality Assurance analyses as delineated in the CRP. AFMAN 91-119 provides guidelines for determining the method of, and criteria for, evaluation. Requirements for software evaluation can range from full NSCCA to qualification testing, depending on the relationship to critical functions (authorization, prearming, launching, releasing, arming, and targeting). Additional factors include the potential for UL threats and scenarios. Although these evaluations use many similar techniques, they are typically performed by different organizations, have different objectives, and produce different results. NSCCA and IV&V are performed by an organization technically, managerially, and financially independent of the developer. AFSEC/SEW will make the final determination regarding independency requirements.

A2.4.1. An NSCCA has the single objective of ensuring that the program cannot perform in any way that could contribute to a nuclear safety violation. Analysis and testing focus on

ensuring that nuclear safety-critical functions are performed correctly and that the program does not perform any unintended functions that could violate nuclear safety. The NSCCA is also unique in its concern for sabotage. While the other forms of software evaluation assume that any program deficiencies will be unintentional, the NSCCA also looks for intentionally caused problems and employs special security and control measures to prevent sabotage of the NSCCA effort itself. An NSCCA begins with the development of nuclear safety objectives (NSOs) and nuclear safety requirements (NSRs). NSOs represent the overall objectives a nuclear weapon system must satisfy in order to obtain nuclear safety certification. NSRs form the basis for all subsequent NSCCA activities. A traceability analysis is performed to demonstrate that all NSOs are represented in the NSRs and that all NSRs are derived from one or more NSOs. The NSCCA is completed by conducting a bit-for-bit comparison (under the Two-Person Concept) between the software delivered to the operational MAJCOM and the software analyzed by the NSCCA organization.

A2.4.2. Independent Validation and Verification (IV&V). IV&V is a software evaluation process that includes both analysis and testing and extends throughout program development. “Verification” analyzes software requirements, design, and code to detect program deficiencies before they can propagate into later development phases. “Validation” analyzes and tests the final program to determine its compliance with requirements. IV&V is distinguished from qualification testing by its emphasis on detecting program weaknesses and unforeseen circumstances that the program will be unable to handle. Attachment 3 provides a generic IV&V program plan to define the approach used by the IV&V contractor/evaluation team in support of software nuclear safety design certification.

A2.4.3. Regression Testing. Regression testing is the selective retesting of a software system that has been modified to ensure any errors or defects have been fixed, and no other previously working functions have failed as a result of the reparations, and that newly added features have not created problems with previous versions of the software. It is initiated after a programmer has attempted to fix a recognized problem or has added source code to a program that may have inadvertently introduced errors. It is a quality control measure to ensure that newly modified code still complies with its specified requirements and that unmodified code has not been affected by the maintenance activity.

Attachment 3

GENERIC INDEPENDENT VALIDATION AND VERIFICATION (IV&V) PROGRAM PLAN

A3.1. Purpose. The purpose of this program plan is to define the approach to be used by the IV&V contractor/evaluation team in support of nuclear safety design certification of the software/firmware in question. The overall nuclear safety design certification effort is defined in another program plan. Nuclear certification of software/firmware is one of the positive measures the Air Force uses to assure that the software/firmware, as designed, coded, and implemented, complies with the DOD Nuclear Weapon System Surety Standards (DOD Directive 3150.02, *DoD Nuclear Weapons Surety Program*) and meets the safety design and evaluation criteria for nuclear weapon systems in AFI 91-107.

A3.2. Equipment/System Description. This section provides a brief description of the weapon system that will allow the reader to understand the functional and nuclear safety implications of the weapon system. Where individual software/firmware pieces are involved, provide a brief description of each item at the block diagram level. A brief description includes performance requirements and software/firmware design showing correlation to requirements and stressing features that provide nuclear surety.

A3.3. IV&V Concepts.

A3.3.1. “Validation” is the test and evaluation process that ensures the software/firmware meets all system and software performance requirements; “verification” is the repetitive process for ensuring that, during each development phase, the software/firmware satisfies and implements only those requirements approved at the end of the previous phase. For the purpose of nuclear safety, the validation and verification effort has primary emphasis placed on the nuclear safety issues identified below. Using an independent contractor to perform this task adds an additional layer of confidence and security to the process.

A3.3.2. The IV&V effort will concentrate on the software/firmware functions that must be verified to obtain nuclear safety design certification in accordance with this AFI. The key step in this effort is identifying the nuclear safety contributions and how the software/firmware could possibly impact or affect the weapon system nuclear critical functions, as defined in AFMAN 91-118. These critical functions are: authorization, launching/releasing, warhead prearming/arming, and targeting. All of the software/firmware functions and capabilities will be evaluated to determine the level and extent of their contributions, resulting in nuclear safety impacts to the above critical functions. Contributions that cause a possible degradation of nuclear safety or performance will be reported as discrepancies for program office evaluation.

A3.3.3. All nuclear safety discrepancies will be identified, evaluated, and prioritized according to their potential impact on nuclear safety. A priority scheme is used to evaluate nuclear safety discrepancies and determine their impact on nuclear safety (Critical, Urgent, Degraded, Noncritical, Minor).

A3.3.4. The results obtained from the IV&V effort will be included in the final IV&V report and will also be used in the preparation of the demonstration test plan and NSE report. Inputs will also be made to the qualification demonstration, and data will be examined from

those tests with regard to verification of the software/firmware. Finally, the data from these efforts will be maintained in a database at the program office to support future modifications and technical order updates.

A3.4. IV&V Approach. This section describes the specific approach that will be taken to conduct the IV&V effort.

A3.4.1. Test Plan. The IV&V contractor designs and conducts tests to verify the software/firmware design complies with AFI 91-107. This test approach is detailed in the IV&V Test Plan.

A3.4.2. Configuration Control. The program office will maintain configuration control. This task may be contracted out, but the ultimate responsibility for configuration control remains with the program manager. Discrepancy reports will address performance, as well as nuclear safety aspects of the software/firmware functions and capabilities. These reports will provide all pertinent information (such as problem areas, descriptions, impacts, and recommendations) required to pursue appropriate action.

A3.4.3. Analysis Tools. To implement the IV&V approach effectively, specific analysis tools may be developed to perform both the tracing studies and the software/firmware checkout. The analysis tools themselves will be validated to the degree required to ensure accuracy and completeness.

A3.4.4. AFI Compliance. AFI 91-107 and AFMAN 91-119 will be used to guide and direct the IV&V efforts. Particular attention will be given to memory organization, fault detection/handling capabilities, and adequacy of self-test circuitry. A summary table should show compliance and the specific analysis or demonstration efforts.

A3.4.5. Source Code Testing. The source code is checked for implementation, using the Computer Program Development Specification and the Computer Program Product Specification. Items that will be checked are the code structure, decision/branch points, input/output handling, and module coupling. The test plan outlines the steps to check the source code at both the modular and/or functional level for those areas impacting nuclear safety. A "test requirements" checklist versus a "test approach" checklist will be generated to determine how functions will be verified. A "master procedures" checklist will be constructed to identify which tests are exercised for each module (or logical group of modules). The tests will be a combination of manual analysis and development site testing.

A3.4.6. Test Results Report. A test results report will discuss the software/firmware code checkout effort. Summary result tables will be provided. All discrepancy reports with an evaluation and recommendation for resolution will be included.

A3.4.7. Object Code Testing. Once the source code is checked, it will be compiled into an executable object code. For ground-launched missile systems, a bit-by-bit compare against the object code delivered by the development contractor will be accomplished. Differences will be identified and explained. Discrepancies will be documented and resolution recommended.

A3.4.8. Final Report. A final report will include IV&V results. The report will evaluate whether the software/firmware satisfies AFI 91-107 design standards and, via the discrepancy reports, will identify any known nuclear surety concerns. The report will

conclude with a recommendation on nuclear safety design certification. The report will be included as part of the NSE.

A3.5. Schedules. Significant milestones are submittal/approval of IV&V Program Plan, IV&V Test Plan, Final IV&V Report, and the NSE report. The first two items are especially critical to the success of IV&V.

Attachment 4

RECOMMENDED OUTLINE FOR THE NUCLEAR SURETY EVALUATION (NSE)

A4.1. Certification Action. Recommend certification or certification with restrictions (to meet AFI 91-107).

A4.2. Item Identification. For hardware or software (as applicable) provide:

A4.2.1. Nomenclature or common name.

A4.2.2. National item identification number.

A4.2.3. Manufacturer and code.

A4.2.4. Model and part number.

A4.2.5. Computer program identification number.

A4.2.6. Item manager (include the functional address symbol and telephone number).

A4.3. Uses and Description. Provide information on:

A4.3.1. Equipment uses.

A4.3.2. Weapons.

A4.3.3. Weapon types (as considered in the analysis).

A4.3.4. Top-level description.

A4.4. Summary of Engineering Analysis (Evaluation and Test):

A4.4.1. Identify the specific AFI 91-106, AFI 91-107, AFMAN 91-118 and/or AFMAN 91-119 criteria used in the design and evaluation process for the item.

A4.4.2. Discuss the certification approach used (compliance verification methods).

A4.4.3. Identify or reference the specific test and analysis procedures used.

A4.4.4. Summarize the results of the certification analysis, and discuss any discrepancies identified during the evaluation and their disposition.

A4.5. Recommended Restrictions. Recommend any restrictions needed to compensate for uncorrected design deficiencies or discrepancies.