Department of Energy
National Nuclear Security Administration
Washington, DC 20585

February 11, 2002

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW.
Suite 700
Washington, D.C. 20004-2901

Dear Mr. Chairman:

In our response to your June 28, 2001, letter about the Justification for Continued Operations related to the W88 Hazard Analysis Report we agreed to:

- Reconsider the risk reduction provided by mats used to prevent High Explosive Violent Reaction due to High Explosive drops onto work surfaces in W88 operations and to reconcile the difference between the W88 value of the failure rate and the value used in the corresponding analysis of W78 operations.

- Issue a revised Section 11.8 of the Development & Production Manual.

Our letter of January 3, 2002, responded to the first commitment. This letter forwards the second.

If you have further questions, please contact me or have your staff contact Jeff Underwood at 301-903-8303.

Sincerely,

David E. Beck
Assistant Deputy Administrator
for Military Application and
Stockpile Operations
Defense Programs

Enclosure

cc w/enclosure:
Mark Whitaker, S-3.1

DEVELOPMENT AND PRODUCTION MANUAL

Chapter 11.8: INTEGRATION OF WEAPON RESPONSE INTO AUTHORIZATION BASES AT THE PANTEX PLANT

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1.0 PURPOSE

The purpose of this chapter is to define the methodology for developing and applying weapon response information to the process of identifying and classifying controls for nuclear explosive operations (NEO) at the Pantex Plant. This chapter applies to the development and maintenance of hazard analyses and control documentation at Pantex related to work on nuclear weapons or nuclear weapon components.

2.0 POLICY

It is U.S. Department of Energy/National Nuclear Security Administration (Department) policy that the risk of NEOs should be sufficiently defined in the authorization basis documentation and that an effective control set be established to prevent or mitigate hazards resulting in a residual risk that is deemed acceptable by the approval authority.

3.0 DEFINITIONS

See Section 11, Chapter 11.0

3.1 Control Classification Evaluation Guidelines:

Control classification evaluation guidelines are consequence and frequency values that the hazard analyst evaluates against to determine the adequacy of the selected controls. The guidelines are not indications of acceptable risk, but are used as a benchmark for comparison. The guidelines are applied against each scenario. The scenarios are developed by type of accident (e.g., hoisting, tooling drop, forklift impact in the ramp, truck collision). Care must be taken by the analyst to not subdivide the scenarios to reduce the calculated risk. *Note: The frequencies below are all based on a conservative assumption of 1000 operations per system occurring per year.* The guidelines are as follows:

- IND: Inadvertent Nuclear Detonation controlled to a frequency less than 1 x 10^{-8}/year without respect to radioactive material dispersal consequences.
- HED/D or HEVR: High Explosive Violent Reaction or high explosive deflagration/detonation (see note in HED/D definition) controlled to a frequency less than 1 x 10^{-7}/year without respect to radioactive material consequences.
- Radiological Release: Hazardous events with offsite exposure greater than 25 rem CEDE shall be controlled to a frequency less than 1 X 10^{-6}

/year. Hazardous events with onsite exposure greater than 100 rem CEDE shall be controlled to a frequency less than 1 X 10^{-6}/year or.

- Worker Safety: Hazardous events, other than standard industrial hazards, that result in a worker fatality or serious injury (permanent disability, loss of limb, etc.), are controlled to an acceptable level of risk as demonstrated by a qualitative evaluation of the controlled accident. This evaluation does not have a frequency guideline. However, any accidents that have a significant consequence potential to the public or workers, independent of likelihood, must be thoroughly evaluated, including the identification of appropriate engineered or administrative controls.

When the above have been met, the hazard analyst shall determine if there are any other controls that should be selected based on their significant contribution to defense-in-depth. This evaluation does not have a frequency or consequence guideline.

4.0 HAZARDOUS EVENT IDENTIFICATION, CONTROL IDENTIFICATION, WEAPON RESPONSE, AND CONTROL CLASSIFICATION

An effective and defensible control set to reduce the risk of NEOs is established through the process of hazardous event identification, control identification, weapon response determination, and control classification. *Refer to Figure 11.8-1.*

4.1 Hazardous Event Identification

The design agencies will identify the required parameters (for example: drop height, weight of object, heat flux, distance from heat source, etc., to the surface of the NE or NE component) for the insults that will be used in describing the hazardous events. The development of the parameters will allow the Hazard Analysis Task Team (HATT) to 'roll-up' events that have the same configuration and insult. Additionally, the parameters will ensure the HATT provides the necessary and sufficient information to the design agencies in requesting weapon responses (see section 4.4 below).

Hazardous events (weapon configuration, insult, and consequence) include those that result from the internal hazards of the weapon as identified in the Weapon Safety Specification and the hazardous events that can occur during operations on a weapon. Hazardous events are listed in a hazard table. Existing hazard tables should be referenced to support the identification of the hazardous events to support completeness and to reduce required resources.

Hazardous insult and associated configuration combinations that cannot result in a weapon response are identified in a Weapon Safety Specification (WSS) screening table included in the WSS and are not required to be listed as a hazardous event in the hazard analysis. The WSS screening table shall include the weapon configuration and the insult parameters as well as rationale (or reference to appropriate and defensible documentation) for determining no weapon response. *Refer to Table 11.8-1 for an example of a WSS Screening Table.*

Hazardous events that have been identified, analyzed, and controlled at the site or facility level are discussed in the Hazard Analysis Report with reference to the applicable section of the site or facility AB document. Any weapon specific controls relied upon in the facility AB must be included in the HAR and Technical Safety Requirement (TSR) for the weapon program. The information provided must include the evaluation of how the control meets the safety function derived from the analysis.

Hazardous events will include the frequency of the event and the maximum potential consequence. The frequency of the event will be based on 1000 operations per system per year unless a different rate is justified based on the actual planned operations.

4.2 Identify Reasonable Potential Controls

The identification of potential controls for hazardous events starts with the listing of possible defense in depth features that could be later selected as controls. These features can be either engineered or administrative in nature.

4.3 Derive Controls

Controls are selected based on the frequency and maximum consequence of the uncontrolled hazardous event. The minimum number of controls selected should be based on the Control Classification Evaluation Guidelines and the effectiveness of the selected controls. To follow the principle of first eliminating the hazard (i.e. remove the insult from the NE), controls are derived without consideration of weapon response.

To apply the Control Classification Evaluation Guidelines, the uncontrolled event frequency and maximum consequences are used. Then as controls are selected, the effectiveness of the control is determined. This effectiveness evaluation considers the reliability and availability of the control. For other than worker safety and defense-in-depth controls, the effectiveness evaluation determines the conditional probability that the control will fail. The justification for the control effectiveness is documented. The conditional probability of the

control failing is multiplied by the event frequency to determine the new controlled event frequency. If multiple controls are applied, the controls must be independent in order to multiply the conditional probability of failure for each control. This process continues until either the Control Classification Evaluation Guidelines are met or until no additional controls can be identified.

4.4 Weapon Response Uncontrolled Scenarios

For new operations, (i.e., those for which a HAR is being developed, leading to a NESS), hazardous events shall be evaluated to determine which events have a weapon response that cannot be screened based on design agency provided WSS screening tables. The weapon configuration and insult parameter for each selected event is documented in a weapon response request. The HATT forwards the weapon response request to the Project Team for review and approval consistent with *Appendix A—Evaluation and Documentation of Weapon Response Information.* The design agency project team members will ensure all scenarios adequately define the parameters required for developing weapon response. All the scenarios requiring a response are to be provided to both Sandia National Laboratories (SNL) and the appropriate physics laboratory.

For existing operations where new and/or changed scenarios and/or controls are postulated, the M&O contractor may continue operations if the M&O contractor determines that the weapon response is bounded by an existing hazardous event evaluation. The information relative to the application of the weapon response shall be forwarded to the appropriate design agencies for confirmation in accordance with Chapter 11.4 paragraph 5.6.2.

The design agencies develop a conditional probability using empirical data, expert judgment and analyses as required, with associated documentation that forms the basis for the weapon response in accordance with *Appendix A.* For hazardous events that can result in more than one weapon response, the conditional probability for each weapon response is provided (i.e., IND, HEVR, and Radiological Release). The conditional probability, as a minimum, is identified as a range of: anticipated, unlikely, extremely unlikely, beyond extremely unlikely, or sufficiently unlikely (*See Table 11.8-2—Conditional Probability Table*).

The design agencies will identify the assumptions (e.g., which inherent weapon characteristics [e.g., IHE, bomb case] were credited) used in developing the weapon response in the Weapon Response Bases Document that supports entries in the Summary Weapon Response Table (see *Appendix A*). This information should also include pertinent assumptions and initial

conditions utilized to develop the weapon response that may affect Pantex operating procedures, tooling, or other controls.

The M&O contractor may conservatively assign a conditional probability of one (1) if they deem a lower probability estimate is not necessary. In this case, weapon response for these events will not be evaluated or documented.

4.5 Weapon Response Controlled Scenarios

When the controls identified in section 4.3 are mitigators that reduce the severity of the insult (e.g., HE can rim guard mitigates the mechanical insult to the HE), a new weapon response will need to be determined. If the parameters of the insult, considering the controls, are within those identified in the WSS screening table, then a reference to the WSS screening table will be made to justify that there is no weapon response. For all other hazardous events, the new insult parameters will be provided to the design agencies for a new weapon response evaluation. The process identified in section 4.4 above is followed using the newly identified mitigated results.

4.6 Classify Controls

The controls identified in Section 4.3 above will be classified as Technical Safety Requirement (TSR) or Important to Safety. The frequency of the event for control classification will be the uncontrolled frequency from Section 4.1 times the conditional probability of the weapon response from Section 4.4. This frequency will be used to determine the required TSR controls using the Control Classification Evaluation Guidelines

To apply the Control Classification Evaluation Guidelines, the event frequency as identified above (i.e., considering weapon response) and maximum consequences are used. Then as controls are applied, the conditional probability of the control failing is multiplied by the event frequency to determine the new controlled event frequency. This process continues until either the Control Classification Evaluation Guidelines are met or until all controls identified in Section 4.3 have been applied.

All controls applied to meet the Control Classification Evaluation Guidelines are classified as TSRs. All controls not classified as TSR will be classified as Important to Safety. TSR controls are further developed in a TSR document while Important to Safety Controls are not included in the TSR. All controls are listed in the HAR/BIO/SAR and are required to be flowed-down into implementing documents.

Inherent weapon characteristics (e.g., IHE, bomb case, etc.) are not to be identified as controls in the AB documents. If the weapon design agency takes credit for a weapon design feature that can change state (e.g., stronglink) as part of the weapon response evaluation, the physical verification (e.g., electrical check, radiograph) of the "safe state" is required to be a TSR control.

4.7 Residual Risk

A discussion of the residual risk is provided to demonstrate that the hazard is adequately controlled for each hazardous event. If the Control Classification Evaluation Guidelines are met, a simple statement to that effect will be provided.

If the Control Classification Evaluation Guidelines cannot be met, a more detailed discussion of the residual risk is required. The residual risk discussion may include:

- A discussion of the limitations associated with the development of the weapon response. The design agency may be contacted to provide information related to weapon response development and how the weapon response provides a conservative value. This may include identifying a conditional probability value or smaller range instead of the probability bins identified in section 4.4. Additionally, this may include a discussion of the distribution and mean value of the weapon response.
- A discussion of weapon safety design features and their contribution to reduction of risk. The respective design agencies will provide a discussion of the additional reduction in event frequency that **may** be provided by the weapon safety design feature. In addition, the laboratories will provide a defendable estimate with known limitations of the risk reduction provided by the weapon design feature(s). This is to ensure that the Department approval authority has the best information possible before accepting the residual risk.

4.8 New Information

New information (such as newly considered phenomena which could result in new accidents) has the potential to affect new or existing weapon response determinations. Often, further research is necessary to determine its effect on nuclear explosive operations at the Pantex Plant. The design agencies are responsible to document and formally provide to the Pantex Plant M&O contractor new information that could identify a new hazard or could result in a change to previously provided weapon response information. The Pantex M&O contractor is responsible for determining when new information is

sufficiently developed (technical report issued, applicability to Pantex operations established) for initiating the NEO change control process per D&P Chapter 11.7, "Nuclear Explosive Operations Change Control Process".

5.0 RESPONSIBILITIES

5.1 Project Team

1. Approves the weapon response request.
2. Approves the classification of controls

5.2 Design Agencies

1. Establish the weapon insult parameters to be used in hazard event identification.
2. Develop a WSS screening table for each weapon and include this table in the Weapon Safety Specification.
3. Develop a process for establishing and documenting the justification for weapon response that meets the needs of the Pantex Plant Operating Contractor.
4. Develop and document uncontrolled and mitigated weapon response in accordance with *Appendix A*
5. Provide input to residual risk justification when a discussion on weapon safety features is needed (Section 4.7).

5.3 Hazard Analysis Task Team

1. Identifies the hazardous events associated with the nuclear explosive operation.
2. Identifies potential controls for each hazardous event.
3. Develops the insult parameters for each hazardous event.
4. Presents the weapon response request to the Project Team for approval.
5. Derives the controls for each hazardous event.
6. Develops new insult parameters for hazardous events with control that provide a mitigative function.
7. Classifies the derived controls.
8. Develops the residual risk conclusion for each hazardous event.
9. Supports HAR and TSR development and coordination

5.4 Pantex Plant Operating Contractor

1. Concurs that the process for establishing/documenting the weapon response basis meets their needs.

2. Determines the suitability of the weapon response basis for inclusion into the authorization basis.

6.0 RESPONSIBLE ORGANIZATION

The Office of Weapon Programs (OWP) is responsible for this chapter.

7.0 REFERENCES

1. Development and Production Manual Chapter 2.8, "Technical Business Practice System"
2. Development and Production Manual Chapter 8.3, " Quality and Product Acceptance"
3. Development and Production Manual Chapter 11.4, "Authorization Basis for Pantex Plant Nuclear Explosive Operations"
4. Technical Business Practice 301, Methods of Definition
5. Technical Business Practice 404, Engineering Authorization System

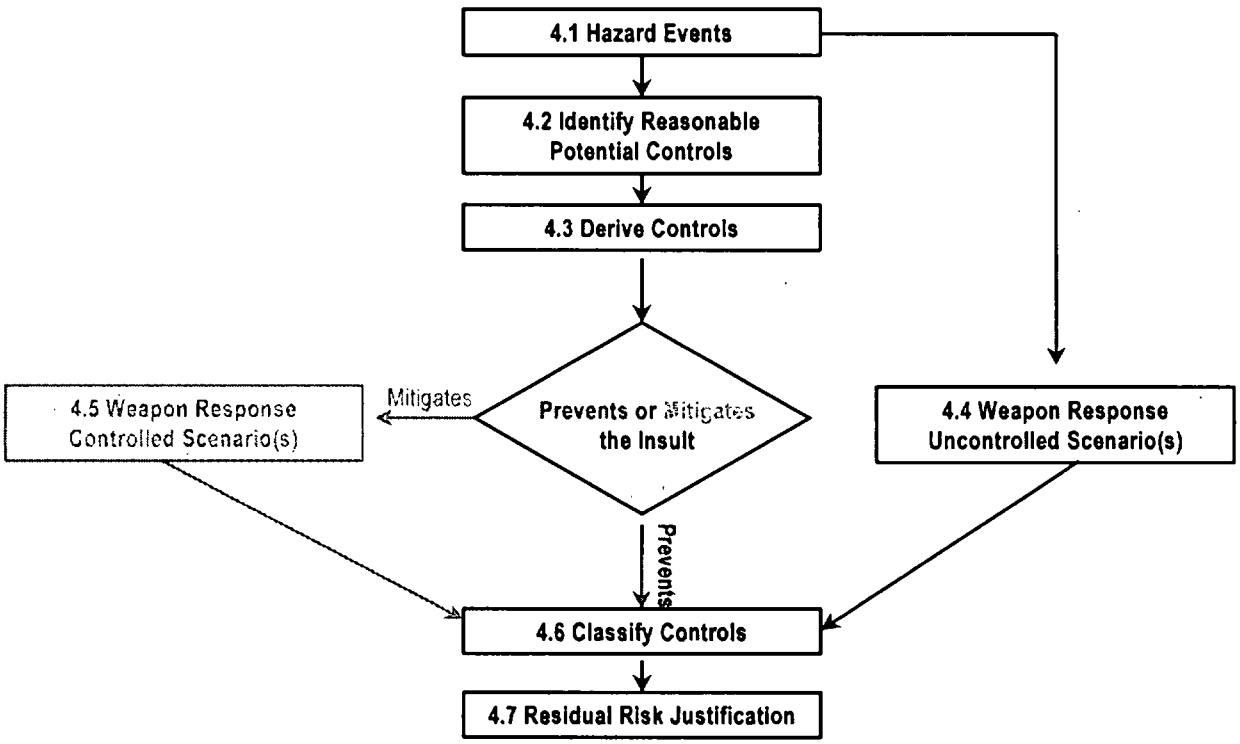

Figure 11.8-1: Weapon Response Process Flow:

Table 11-8-1: WSS Screening Table Example

Ref. #	Weapon Configuration	Affected Component	Insult Category	Insult Parameters	Comments
1	In Shipping Container	Main Charge HE	Mechanical Impact	300 lb. Object Falls 20 ft.	
2	In Shipping Container	Main Charge HE	Mechanical Drop	SC dropped 6 ft right side up	
3	Full up Weapon	Main Charge HE	Mechanical Impact	300-lb. object falls 20 ft.	
4	Full up Weapon	Main Charge HE	Mechanical Drop	Weapon dropped 6 ft. right side up	

Table 11.8-2: Conditional Probability Table

A – Anticipated	$10^{-2} \leq p < 10^{0}$
U – Unlikely	$10^{-4} \leq p < 10^{-2}$
EU – Extremely Unlikely	$10^{-6} \leq p < 10^{-4}$
BEU – Beyond Extremely Unlikely	$10^{-6} > p$
SU – Sufficiently Unlikely	$10^{-6} > p$ Rad, $10^{-7} > p$ HEVR, $10^{-8} > p$ IND

APPENDIX A –EVALUATION AND DOCUMENTATION OF WEAPON RESPONSE INFORMATION

A.1 GENERAL

Provide the expectations for the execution of Steps 4.4 and 4.5 of *Figure 11.8-1, "Weapon Response Process Flow"* (Section 4.4 and 4.5). Each of the following sub-steps below is numbered 4.X. where the X is either 4 or 5.

This process applies to the development and maintenance (i.e., life cycle) of the authorization basis documents.

Step 4.X.1—Request Weapon Response

The process is initiated when the Pantex M&O contractor forwards the hazard analysis to the Design Agency and requests weapon response. The Hazard Analysis must be under Pantex M&O configuration control at the time of the request.

General Engineering Documentation consistent with TBP-301 that may be entered into the Engineering Authorization System consistent with TBP-404, is created to formally document the Pantex M&O request to the Design Agencies. Any changes to the Hazard Analysis that could impact the weapon response must be re-submitted to the Design Agency for a weapon response determination.

Step 4.X.2—Develop and Document Weapon Response

Based on the formal request and the Hazard Analysis Document, the Design Agencies develop the weapon response for each scenario in the hazard analysis. The design agency deliverables to the Pantex M&O contractor to be included in the Pantex safety basis documentation are:

1. Summary Weapon Response Table (*See Table 11.8-3*);
2. Hazard Analysis Events cross-referenced to the Weapon Responses if applicable* (*See Table 11.8.4 and11.8.5); and,*
3. Weapon Response Bases Document.

*Note: Weapon response to hazard event number is not required if the information is within the *Summary Weapon Response Table (See Table 11.8-4)*

Summary Weapon Response Table

The Summary Weapon Response Table summarizes the weapon response by weapon configuration and insult. Each entry in the Summary Weapon Response Table can cover multiple entries in the hazard analysis. Each entry in the Summary Weapon Response Table will include the following information at a minimum:

a. Unique Number
b. Applicable hazardous events number *
c. Weapon configuration
d. Weapon Environment (type of insult)
e. Parameters of insult
f. Initial Conditions and Assumptions for each Unique Number
g. Frequency of consequence for each type of weapon response: IND, HEVR, Burning Dispersal, and Mechanical Release of Radiological Material
h. Worker safety concerns

Weapon Response Bases Document

The Design Agencies will document the bases for each entry in the Weapon Response Summary Table. The *Bases Document* will be maintained and controlled by the Design Agencies. The Bases Document will provide the rationale for the weapon response and will reference any pertinent analyses, tests, literature, etc. used in developing the weapon response. Most importantly, the Bases Document will provide the rationale on how the initial conditions and assumptions were used in developing the weapon response. It is the Department's expectation that all reference information used to support the Weapon Response Bases Documents(s) (including all reference documents) is accurate and available to support the Safety Basis Review Team review of the officially submitted authorization basis documentation (HAR/TSR, BIO/TSR, SAR/TSR).

Step 4.X.3—Weapon Response Review and Approval

The Design Agencies will conduct a review of the Weapon Response Summary Table, Cross-Reference Tables if applicable, and the Bases Document prior to release. This review will be in accordance with the Design Agencies internal quality assurance process. The Design Agency review is to verify the completeness and accuracy of the information and to form the bases for the laboratory official submittal.

Prior to acceptance, the Pantex M&O will review the Bases Document to ensure that the information required to support the authorization basis development has been provided. The design agencies shall provide weapon response documentation to the M&O contractor that has been integrated between the applicable design agencies to the extent practicable in order to preclude internal inconsistencies and to gain efficiencies wherever possible.

Note: During the development and documentation of the Summary Weapon Response Tables and Bases Documents, the Design Agencies may provide draft weapon response information to the Pantex M&O contractor to support initial derivation and classification of controls (See Sections 4.3 and 4.6). This draft weapon response information will be maintained under Design Agency configuration control. The draft information submittal will identify the revision of the Hazard Analysis used to develop the weapon response and the revision of the weapon response provided.

Step 4.X.4—Issuing Weapon Response Information

The Design Agency will formally transmit the Weapon Response Summary Document to the Pantex M&O contractor. This submittal will be through General Engineering Documentation (GED) consistent with TBP-301 that may be entered into the Engineering Authorization System consistent with TBP-404. The information will include a reference to the Summary Weapon Response Table, a reference to the Bases Document, and a summary of the review process that was used in verifying the weapon response information.

Step 4.X.5 Incorporation of Weapon Response Information

The Pantex M&O contractor will revise the hazard analysis document to incorporate the weapon response information as formally transmitted by the Design Agency. For each hazardous event that required a weapon response, a reference to the associated entry in the Summary Weapon Response Table that applies to that event will be entered in the hazard analysis table.

The Pantex M&O contractor will provide information copies of the hazard analysis with the incorporated weapon response information to the Design Agencies.

Based on the GED from the Design Agency, the Pantex M&O contractor will complete the Authorization Basis development process. At Milestone III, the Design Agencies provide an Engineering Release to formally document their concurrence with the incorporation of the weapon response information as described within D&P Manual Chapter 11.4, "Authorization Basis for Pantex Plant Nuclear Explosive Operations".

Note: In order to preclude extensive, last minute reviews, the Design Agencies will work with the Pantex M&O to ensure accuracy of the weapon response information within the tables prior to Milestone III.

A.2 Weapon Screening Table

For weapon response information provided in the Screening Table identified in Section 4.4 that is to be included in the Weapon Safety Specification (WSS), the Bases Document requirements of Step 4.X.2 and the review process of Step 4.X.3 apply. However, instead of issuing a separate GED, the weapon response information is provided in the WSS in accordance with *Table 11-8-1, "WSS Screening Table."*

Figure 11.8-2: Weapon Response Step Flow Process

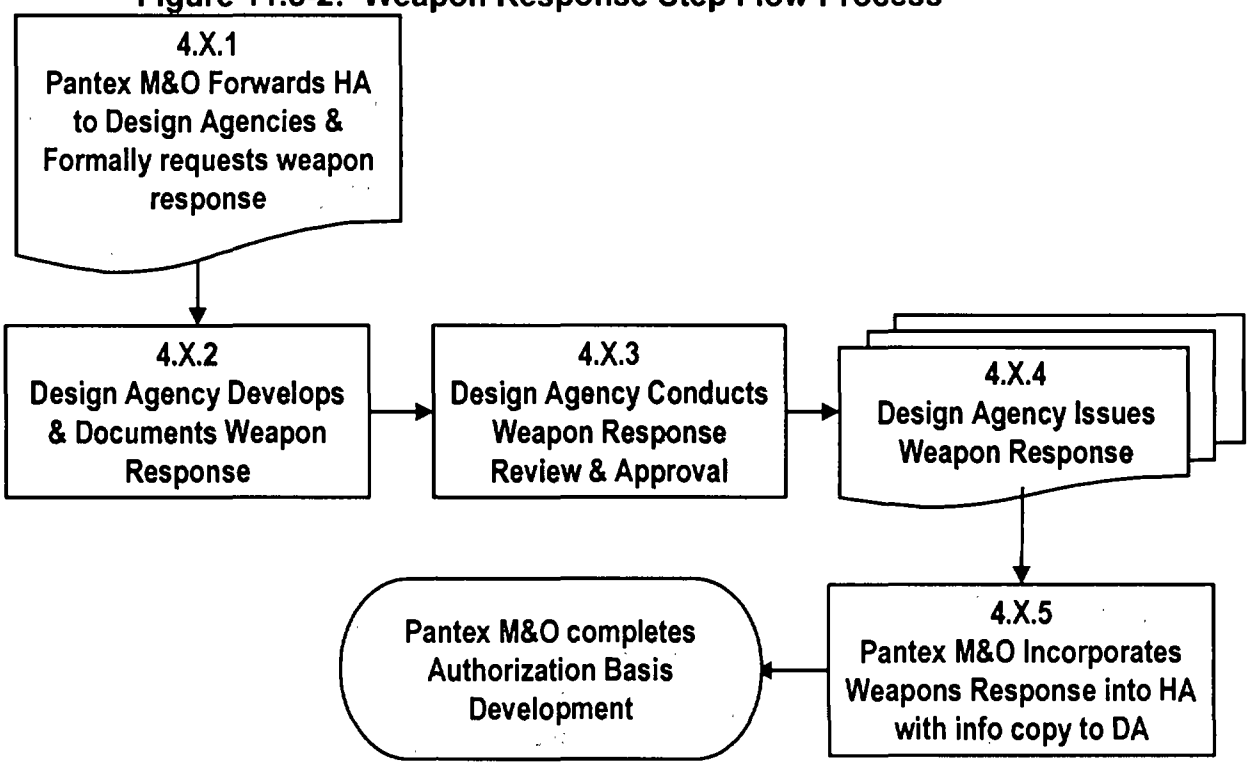

Table 11.8-3: Sample Summary Weapon Response Table

1.1.1 Mechanical insult onto the shipping container

Rule	Config.	Insult	IND	HEVR	HEBD	Rad	WS
1.1.1.1	SC	Blunt object drop <250 ft-lbs, <12 ft, <100 lbs	S	S	S	S	S
1.1.1.2	SC	Blunt object drop <10000 ft-lbs < 12 ft, < 850 lbs	SU	SU	SU	SU	SU

Conditions

- An object drops onto the top of the shipping container containing a warhead.
- A blunt object is defined as any object that does not contain a probe. Here, a probe is defined as metal object that is at least 6 inches long, has a tip cross-sectional area of under one square inch, and has a base (as measured six inches from the tip) cross-sectional area of under 10 square inches.

Assumptions

- The objects that are analyzed to drop on top of the shipping container are not modified in a manner that would violate the blunt object definition as described above.
- The shipping container is assembled appropriately for offsite shipment.

Justification

- For Rule 1.1.1.1, all the consequences are prevented by the combination of the H1223B and the H1224A cover (See Bases 6.1.2 and 6.1.4)
- For Rule 1.1.1.2, all the consequences are prevented by the H1224A (See Bases 6.1.1)

Notes

- None

Table 11.8-4: Sample Summary Weapon Response Table with Cross-Reference to Hazardous Events in the Hazard Analysis

Rule	Hazard Event Number
1.1.1.1	E1.01-1.04
1.1.1.2	E1.10-1.12, E1.14
1.1.1.3	E1.05, E1.06
1.1.2.1	E1.07, E1.07, E1.25
1.1.2.2	E2.35, E1.104-1.200