BY ORDER OF THE COMMANDER
SPACE LAUNCH DELTA 30

SPACE LAUNCH DELTA
30 INSTRUCTION 91-106

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Safety

TOXIC HAZARD ASSESSMENTS

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This publication establishes the criteria, procedures, and responsibilities for development, usage, and control of Toxic Hazard Zones (THZ) and associated risk to affected populations. This publication applies to all operations that involve toxic propellants or toxic combustion byproducts, and to facilities that store, handle or transfer unconventional propellants. For launch operations, risk based analyses will be performed during launch countdown. The personnel toxic exposure risk is calculated and aggregated with accompanying blast overpressure and debris risk. The total aggregated launch risk must not exceed 100 in a million (IAM), in accordance with AFSPCMAN 91-710, Vol 1, para 3.2. In addition, the risk due to toxic exposure cannot exceed 30 IAM to ensure that acceptable exposure concentrations for the general public are not exceeded per AFSPCMAN 91-710, Vol 1, para A5.4.5.

THZ procedures and controls used to support the release of other hazardous materials will be consistent with the policies described in 30th Space Wing (30 SW) Plan 10-2, *VAFB Comprehensive Emergency Management Plan, Change 1, 28 April 2015*. The procedures described herein**,** when implemented, will provide the appropriate safety clear areas for storing, handling and transferring unconventional propellants, and will provide for protecting workers and the general public during vehicle processing and launch operations. Refer recommended changes and questions about this publication to the OPR listed above using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate chain of command. Requests for waivers must be submitted to the OPR listed above for consideration and approval. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Instruction (AFI) 33-322, *Records*

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SUMMARY OF CHANGES

This document has been substantially revised. The 30th Space Wing (30 SW) has been renamed Space Launch Delta 30 (SLD 30). Major changes include replacing the OPR and accompanying roles and responsibilities for developing Cold Spill THZ (chapter 4). Space Launch Delta 30 Assessment (SLD 30/SEA) replaces 30th Operations Support Squadron Weather Flight (30 OSS/OSW) in this function and have updated their procedures with provided guidance for range users in determining credible Cold Spill hazards. Tables **1 through 5** were added for this purpose. Numerous updates were made to office symbols, contact information and specific acronyms. Reference maps for Off Base Populations and Base Cantonment were updated. A margin bar (|) indicates newly revised material.

1. Responsibilities. Responsibilities detailed in this instruction vary depending upon the type of operation and the resulting toxic hazard zones and risks. Those responsibilities are described in detail in the appropriate sections. Section 5 covers developing THZ and risk assessments for Launch Operations (Hot Spill). Development of THZs for propellant storage, handling, and transfer are covered in section 4 (Cold Spill). Responsibilities for implementing this instruction are:

1.1. Space Launch Delta 30 Safety Office (SLD 30/SE). Ensures procedures described herein meet safety standards for all applicable operations. Uses approved methods and tools for both Hot Spill and Cold Spill operations. Computes personnel toxic exposure risk and insures adherence to AFSPCMAN 91-710, Vol 1, para 3.2 criteria for launch operations.

1.2. Base Bioenvironmental Engineer (BEE) (30 OMRS/SGXB). Provides guidance on the exposure criteria and protective measures described herein.

1.3. Users (e.g., 2d Space Launch Squadron (2 SLS), commercial launch contractors, etc.). Incorporates the user requirements described herein into governing operating procedures and provides funding for unique requirements.

1.4. Other Agencies (e.g., Command Post, 30th Security Forces Squadron (30 SFS), 30 OSS/OSW, 30th Civil Engineer Squadron (30 CES), 2d Range Operations Squadron (2 ROPS)). Ensures resources are available and procedures are in place to meet their requirements described herein.

2. Sheltering Requirements. The following defines acceptable mission essential personnel sheltering for each zone for Cold Spill and Hot Spill Potential Hazard Zones (PHZ). These definitions apply across all propellant types annotated in **Table 1**.

2.1. Zone 1. Sheltering is recommended only for individuals especially sensitive to low levels of industrial odors.

2.1.1. Immediately enter any vehicle or structure if breathing discomfort is noticed.

2.1.2. Close all windows.

2.1.3. Close all air intake vents.

2.1.4. Await “all clear” from On-Scene Commander or his/her representative before leaving the site unless an emergency situation requires immediate evacuation.

2.2. Zone 2. If an individual notices breathing discomfort or skin irritation, they will be directed to take shelter or evacuate by the Launch Support Team (LST) Chief pre-launch, and by the Emergency Operations Center (EOC) Director post-disaster. Protective actions would include taking shelter indoors or moving out of the zone.

2.2.1. Shelter must be fully enclosed with no open areas. Motor vehicles with engines off and windows and vents closed do qualify as adequate sheltering.

2.2.2. Close all windows.

2.2.3. Turn off all air recirculation devices.

2.2.4. Close all air intake vents.

2.2.5. If exiting a Zone 2 in a vehicle, emergency egress Personnel Protective Equipment (PPE) (i.e., Escape Breathing Apparatus (EBA) or Emergency Life Support Apparatus (ELSA)) should be worn only if safe to do so while driving since PPE can obscure vision and limit motor skills. Also, their limited air supply may necessitate removing the hood while in motion. For these reasons, while driving, PPE should only be worn to escape an immediate threat to life (Zone 3) that requires a traverse through noticeable toxic clouds.

2.2.6. If in a vehicle and not in an emergency situation, the vehicle is to be kept stationary to prevent inadvertent transit of a Zone 3.

2.2.7. Await "all clear" from EOC Director or designated representative before leaving the site unless an emergency situation requires immediate evacuation.

2.3. Zone 3. Wearing approved PPE, or having approved PPE readily available is mandatory for persons in Zone 3 PHZ. During a launch countdown, we recommend that personnel be evacuated from a Zone 3 PHZ. Personnel may be allowed to remain in a Zone 3 PHZ only if they have approved PPE, their assessed risks are acceptable, and their evacuation would impact the mission (e.g., LST has no back-up position to support the launch). Wearing approved PPE is mandatory for persons in an Operational Hazard Zone (OHZ).

2.3.1. Personnel must wear approved PPE or have approved PPE readily available as specified in the governing operation procedure.

2.3.2. Await “all clear” from the EOC Director or designated representative before leaving the site unless in an emergency situation.

3. Toxic Hazard Zone (THZ) Development Criteria.

3.1. Exposure Limits. **Table 1** lists the exposure limit criteria to be used in computing all forms of THZs. The values for HCl, NO2, and HNO3 were derived from the Expert Elicitation study conducted in FY99 and FY00. The Expert Elicitation study was performed by a panel of nationally recognized toxicologists, including Air Force representatives, wherein upper and lower bound exposure thresholds were recommended for HCl, NO2 and HNO3. Any variances to these limits must have the prior approval of 30 OMRS/SGXB and SLD 30/SE before their use in an operational THZ. Where two exposure criteria are listed for one of the tiers, the one producing the larger and longer time to clear THZ will be used.

3.2. PHZ Valid Times. The valid time for cold spill PHZs must not exceed two hours.

3.3. Updates. Cold spill Emission Hazard Zone (EHZ), OHZ, and PHZs must be updated as source strengths or meteorological conditions change, at intervals not to exceed 45 minutes for EHZs and 90 minutes for PHZs. OHZs must be updated at intervals not to exceed 15 minutes, or until emergency conditions are terminated by the EOC Director or LST for OHZs.

3.4. Toxic Hazard Zone (THZ) Computation Timelines. As a baseline, operation decisions based upon THZs are to be made with cold spill PHZs computed and given to the requester at T-150 minutes; and hot spill PHZ and OHZs at T-105 minutes, and T-45 minutes for launch operations. Computations based on T-0 weather data will be made and used as an OHZ if an accidental release occurs. These timelines are specified in the Range Safety Operation Requirements (RSOR) and can change based upon operation requirements.

Table 1. Exposure Criteria on which Toxic Hazard Zones are Based.

EXPOSURE CRITERIA ON WHICH TOXIC HAZARD ZONES ARE BASED				
	PHZ/OHZ			EHZ
	Tier 1 (Zone 1 boundary)	Tier 2 (Zone 2 boundary)	Tier 3 (Zone 3 boundary)	TLV/PEL
HCl(1)	4 ppm	20 ppm	35 ppm	5 ppm (OSHA-C -15 min)
N_2H_4(2)	N/A	2 ppm (4)	50 ppm (30 min)	0.01 ppm (TLV-8 hr)
UDMH(2)	N/A	5 ppm (4)	15 ppm (30 min)	0.01 ppm (TLV-8 hr)
A-50(2)	N/A	2 ppm (4)	15 ppm (30 min)	0.01 ppm (TLV-8 hr)
MMH(2)	N/A	2 ppm (4)	20 ppm (30 min)	0.01 ppm (TLV-8 hr)
HNO_3(1)	0.5 ppm	4 ppm	10 ppm	2 ppm (TLV-8 hr) 4 ppm (STEL15 min)
NO_2(1)(3)	1 ppm	6ppm	15 ppm	1 ppm (OSHA-STEL - 15 min)

All values to be treated as ceiling limits (1 minute or less) unless an averaging time is specified

1-Governing criteria by Expert Elicitation

2-Governing criteria is NIOSH 1/2 IDLH (Tier 3), SPEGL or EPA LOC (Tier 2)

3-NO_2 is the measurable result and breakdown product in nitrogen tetroxide (N_2O_4)

4-Averaging time of 30 minutes for cold spill computation, 60 minutes for hot spill computation

4. Cold Spill Operations (e.g., Propellant Transfer or Handling Operations).

4.1. Responsibilities.

4.1.1. 30th Operations Support Squadron Weather Flight (30 OSS/OSW). The duty forecaster will provide forecasts and real time weather conditions as requested by the user.

4.1.2. The user is responsible for the following:

4.1.2.1. Determining the credible spill amount for their specific operation. Tables **1 through 5** can then be used to determine the zone distances with the real time weather information provided from the 30 OSS/OSW. See **Figure A2.2** for zone development visual aid. SLD 30/SEA can provide distances for other fuel types and credible spill amounts as needed. Contact SLD 30/SEA at least 30 days prior to operations involving other fuel types and credible spill amounts.

Table 2. 1 gal N2O4 Worst Case Credible Spill.

1 Gal N2O4 Worst Case Credible Spill
Protection Area, Distance Downwind +/-30 degree Azimuth

Air Temperature (deg F)	Wind Speed (kts)	Tier 1 (ft) (1 ppm)	Tier 2 (ft) (6 ppm)	Tier 3 (ft) (15 ppm)
<70	<4 (calm/light + variable)	200 (radius)	150 (radius)	150 (radius)
	4-6	425	300	200
	6-8	425	300	200
	8-10	500	300	200
	10-12	500	300	200
	12-14	500	300	200
	14-16	500	300	200
	16-18	425	300	200
	18-20	425	300	200
	20-22	425	300	200
	22-24	425	300	200
	24-26	425	300	200
	26-28	425	300	200
	28-30	425	300	200
71-90	<4 (calm/light + variable)	800 (radius)	325 (radius)	225 (radius)
	4-6	1000	430	325
	6-8	1100	535	
	8-10	1225	625	
	10-12	925		
	12-14	1050		No tier 3 Hazard
	14-16	1150	No tier 2 Hazard	
	16-18	1150		
	18-21	1225		
	21-30	No Hazard		
91-100	<4 (calm/light + variable)	800 (radius)	325 (radius)	300 (radius)
	4-6	1000	430	300
	6-8	1100	535	
	8-10	1150	625	
	10-12	925		
	12-14	1050		No tier 3 Hazard
	14-16	1150	No tier 2 Hazard	
	16-18	1150		
	18-22	1225		
	23-30	No Hazard		

Table 3. 5 gal N2O4 Worst Case Credible Spill.

5 gal N2O4 worst case credible spill

Protection Area, Distance Downwind +/-30 degree Azimuth

Air Temperature (deg F)	Wind Speed (kts)	Tier 1 (ft)	Tier 2 (ft)	Tier 3 (ft)
		(1 ppm)	(6 ppm)	(15 ppm)
<70	<4 (calm/light + variable)	600 (radius)	400 (radius)	325 (radius)
	4-6	625	400	325
	6-8	650	425	350
	8-10	725	500	350
	10-12	725	500	350
	12-14	725	525	350
	14-16	725	525	350
	16-18	725	525	350
	18-20	725	525	350
	20-22	725	450	350
	22-24	725	450	350
	24-26	650	450	325
	26-28	650	450	325
	28-30	625	425	325
71-90	<4 (calm/light + variable)	1100 (radius)	550 (radius)	350 (radius)
	4-6	1600	850	450
	6-8	1600	850	500
	8-10	1800	850	600
	10-12	1800	850	700
	12-14	1800	850	700
	14-16	2000	1000	350
	16-18	2000	1000	350
	18-22	2000	550	350
	22-30	2000	550	350
91-100	<4 (calm/light + variable)	1000 (radius)	600 (radius)	350 (radius)
	4-6	1600	800	400
	6-8	1600	850	500
	8-10	1800	850	600
	10-12	1800	900	750
	12-14	2000	1000	750
	14-16	2000	1000	350
	16-18	2000	1000	350
	18-22	2000	600	350
	23-30	2000	600	350

Table 4. 5 gal A50 Worst Case Credible Spill.

5 gal A50 worst case credible spill

Protection Area, Distance Downwind +/-30 degree Azimuth

Air Temperature (deg F)	Wind Speed (kts)	Tier 1 (ft)	Tier 2 (ft)	Tier 3 (ft)
		N/A	(2 ppm)	(15 ppm)
<70	<4 (calm/light + variable)	N/A	125* (radius)	125* (radius)
	4-6		125	125
	6-8		125	125
	8-10		150	150
	10-12		150	150
	12-14		150	150
	14-16		150	150
	16-18		150	150
	18-20		150	150
	20-22		150	150
	22-24		150	150
	24-26		150	150
	26-28		150	150
	28-30		150	150
71-90	<4 (calm/light + variable)	N/A	125 (radius)	125 (radius)
	4-6		150	150
	6-8		150	150
	8-10		150	150
	10-12		150	150
	12-14		150	150
	14-16		150	150
	16-18		150	150
	18-21		150	150
	21-30		150	150
91-100	<4 (calm/light + variable)	N/A	125 (radius)	125 (radius)
	4-6		150	150
	6-8		150	150
	8-10		150	150
	10-12		150	150
	12-14		150	150
	14-16		150	150
	16-18		150	150
	18-22		150	150
	23-30		150	150

*Evaporation less than min required to run analysis model

Table 5. 5 gal MMH Worst Case Credible Spill.

5 gal MMH worst case credible spill

Protection Area, Distance Downwind +/-30 degree Azimuth

Air Temperature (deg F)	Wind Speed (kts)	Tier 1 (ft)	Tier 2 (ft)	Tier 3 (ft)
		N/A	(2 ppm)	(20 ppm)
<70	<4 (calm/light + variable)	N/A	150* (radius)	150* (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-20		225	150
	20-22		225	150
	22-24		225	150
	24-26		225	150
	26-28		225	150
	28-30		225	150
71-90	<4 (calm/light + variable)	N/A	150 (radius)	150 (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-21		225	150
	21-30		225	150
91-100	<4 (calm/light + variable)	N/A	150 (radius)	150 (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-22		225	150
	23-30		225	150

*Evaporation less than min required to run analysis model

Table 6. 5 gal UDMH Worst Case Credible Spill.

5 gal UDMH worst case credible spill

Protection Area, Distance Downwind +/-30 degree Azimuth

Air Temperature (deg F)	Wind Speed (kts)	Tier 1 (ft)	Tier 2 (ft)	Tier 3 (ft)
		N/A	(5 ppm)	(15 ppm)
<70	<4 (calm/light + variable)	N/A	150* (radius)	150* (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-20		225	150
	20-22		225	150
	22-24		225	150
	24-26		225	150
	26-28		225	150
	28-30		225	150
71-90	<4 (calm/light + variable)	N/A	150 (radius)	150 (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-21		225	150
	21-30		225	150
91-100	<4 (calm/light + variable)	N/A	150 (radius)	150 (radius)
	4-6		225	150
	6-8		225	150
	8-10		225	150
	10-12		225	150
	12-14		225	150
	14-16		225	150
	16-18		225	150
	18-22		225	150
	23-30		225	150

*Evaporation less than min required to run analysis model

4.1.2.2. No later than 24 hours prior to starting the operation the user shall:

4.1.2.2.1. Schedule Hazardous Operations Support (HOS), with 2 ROPS (via operations directive (OD)) or appropriate scheduling agency if necessary. Verify scheduled resources and support agencies through Range Scheduling office (2 ROPS/DOS) as needed.

4.1.2.2.2. Review all evacuation instruction and notification procedures.

4.1.2.2.3. Prioritize list of facilities to be evacuated should a mishap occur. Prioritization will be based upon the number of personnel at the facility and the distance between the facility and the operation location. Points of contact for affected facilities can be obtained from 30 CES Customer Service (30 CES/CEOER) at 606-0010.

4.1.2.2.4. Notify personnel in potentially affected facilities and areas (i.e., personnel inside PHZs 2 and 3).

4.1.2.3. Ensure personnel performing HOS duties are fully trained (as of this publication) by UPC/PEMO.

4.1.3. The Space Launch Delta 30 Command Post (SLD 30/CP) is responsible for the following:

4.1.3.1. Monitoring any activity that has any zone that falls outside the base land boundary, or over offshore oil platforms, or over the base cantonment area, including potentially populated recreational areas outside of main cantonment such as beaches, trails, etc.

4.1.3.2. Notifying on-base and off-base agencies of the OHZ/EHZ if a release occurs. Specifically, when the Space Launch Delta 30 Commander (SLD 30/CC) or his/her official representative directs activation of Emergency Mass Notifications Systems (i.e. AtHoc, Giant Voice, Public Address systems, Secondary Crash Network).

4.1.3.3. Notifying Airfield Operations (30 OSS/OSAA) (606-5570) to alert aircraft flying in the local area to remain clear of the OHZ/EHZ.

4.1.3.4. Notifying Union Pacific Railroad Emergency Response Line (888-877-7267) if the incident hazard zones 2 or 3 encompasses Union Pacific railroad tracks.

4.1.4. 30 OMRS/SGXB (606-7811) is responsible for the following:

4.1.4.1. Acting as the Wing point of contact on toxic chemical exposure criteria.

4.1.4.2. Coordinating on sheltering requirements.

4.1.4.3. Providing guidance on neutralizing propellants.

4.1.4.4. Approving and/or recommending using health related PPE.

4.1.5. SLD 30/SE is responsible for the following:

4.1.5.1. Approving all modifications to and replacements of cold spill (and hot spill) prediction models for adequacy of personnel protection prior to their operational use.

4.1.5.2. Approving using safety related PPE.

4.1.5.3. Evaluating and approving user requests for set evacuation distances for EHZs.

4.1.5.4. Updating this Instruction.

4.1.6. The Range Scheduling office (2 ROPS/DOS) will schedule resources per the governing OD and user input to support planned or potential propellant release.

4.1.7. The HOS Supervisor or task leader is responsible for maintaining control of Zones 2 and 3 by posting personnel at directed checkpoints during propellant operations.

4.2. Operations Requiring Cold Spill PHZs. The following operations require SLD 30/SE assessment to determine if a Cold Spill Analysis needs to be performed before or during the operation (other operations may require PHZs if deemed necessary after analyzing planned operation):

4.2.1. Transferring propellants, where a credible spill of more than 5 gallons may be released, from one storage, missile or spacecraft vessel to another, at tank farms, launch complexes, or servicing or maintenance facilities.

4.2.2. Initial pressurization of propellant systems that contain more than 5 gallons.

4.2.3. Transporting non-DOT approved containers or mechanical handling (e.g., lifting) propellants in quantities exceeding 5 gallons. Note: Transporting DOT containers of any size including delivery trucks do not require a cold spill analysis.

4.2.4. Propellant system maintenance (unless engineering analysis confirms PHZ will not exceed local control area or system is leak free). **NOTE**: For paragraphs **4.2.3 and 4.2.4**, the following requirements do not apply: sheltering requirements in **paragraph 2**; notification requirements in **paragraph 4.1**; responsibility requirements in **paragraph 4.4**.

4.3. Cold Spill PHZ Input Data Requirements. Contact SLD 30/SE at least 30 days before operations involving other fuel types and credible spill amounts from the tables provided in section 4.1.2. Source strength determinations, assumptions, calculations, and test data must be documented in the Missile System Prelaunch Safety Package (MSPSP), Launch Complex or Facility Safety Plan, or Ground Operations Plan. Each facility will provide worst-case credible release strength information to the SLD 30/SE for planning purposes. This information is subject to SLD 30/SE review and approval.

4.4. Actions Required for Cold Spill PHZs. The requester of the cold spill PHZ has the following responsibilities:

4.4.1. Maintain positive control of personnel within Zone 3 during an operation. These personnel must either wear PPE or have emergency egress PPE readily available and be able to safely evacuate outside the Zone 3. They must be briefed on the operation in progress and on evacuation routes. The governing operation procedures will specify how the above conditions will be satisfied.

4.4.2. Ensure personnel within Zone 2 have:

4.4.2.1. An emergency evacuation route. If the evacuation route passes through Zone 3 or approaches the source location, PPE must be readily available.

4.4.2.2. The means to be immediately notified of an unplanned propellant release.

4.4.3. Ensure adequate communication is available to all personnel in Zones 2 and 3. Planners may use telephone notification, public address, HOS, etc., to comply.

4.4.4. Inform SLD 30/CP if Zone 2 crosses the airfield flight path, railroad right-of-way, or offshore oil platforms, and if Zone 2 extends beyond base land boundary.

4.4.5. Hold the operation if Zone 2 extends, or is predicted to extend, over the base cantonment area, other on base facilities, outside the base land boundary or over offshore oil platforms until risk assessment and acceptance (RA) can be performed. If the operation is in progress and updated PHZ extends over these areas, secure the operation at a safe point or perform a RA (see **paragraph 4.6**) and obtain SLD 30/CC or designated representative's acceptance of risk. Notify the Command Post if the operation is in progress and the updated PHZ extends over these areas.

4.4.6. Pre-position HOS (Hazardous Operations Support) in the most advantageous location to control access to Zone 3 and evacuate personnel, if necessary. HOS will possess emergency egress PPE and will have the ability to be contacted directly by the task supervisor.

4.4.7. Once the operation begins, allow only essential personnel to enter Zone 3. These personnel must be briefed on the operation in progress and evacuation routes. They must have emergency egress PPE readily available.

4.4.8. Hold the operation if Zone 3 extends over the Union Pacific railroad tracks until risk assessment and acceptance (RA) can be performed.

4.4.9. Controls on personnel transiting Zone 1 are not necessary.

4.4.10. Personnel transiting Zone 2 must be informed that they are in a PHZ. This may be accomplished via roadblocks, signs, or other notification procedure as approved by 3SLD 30/SE.

4.5. Cold Spill EHZ Requirements. The EHZ will be based on the applicable EHZ criteria in **Table 1** Tiered exposure criteria are not applicable. The requester of the EHZ is responsible for doing the following:

4.5.1. Hold the operation if the EHZ extends, or is predicted to extend, over the base cantonment area, outside the base land boundary or over offshore oil platforms. If the EHZ encompasses Union Pacific railroad tracks, the user will request SLD 30/CP to contact Union Pacific to determine current train schedules. If railroad traffic inside the EHZ is expected during the operation, the operation will be held until the train has cleared the area.

4.5.2. Only essential personnel may remain within the EHZ. These personnel will be protected as follows:

4.5.2.1. Air Force and/or Space Force personnel are required to wear SLD 30/SE and 30 OMRS/SGXB approved PPE. Other government or contractor personnel are required to use appropriate PPE.

4.5.3. Inform SLD 30/CP if the EHZ crosses the airfield flight path.

4.5.4. Do not allow personnel to enter or exit the EHZ once the operation begins unless they are in SLD 30/SE and 30 OMRS/SGXB approved SCAPE or other PPE.

4.6. Facility Cold Spill Engineering Controls and Risk Acceptance for PHZs.

4.6.1. If the worst-case credible source strength Zone 2 for a facility extends beyond the base land boundary, over the base cantonment, or over offshore oil platforms, then one of the following must be done:

4.6.1.1. Implement engineering controls (foam suppression system, covered release containment system, etc.) to eliminate or reduce the size of Zone 2.

4.6.1.2. Limit operation to weather conditions which will keep Zone 2 within the base land boundary away from the base cantonment, and away from offshore oil platforms.

4.6.1.3. If mission need dictates and paragraphs **4.6.1.1 and 4.6.1.2** cannot be followed, perform a RA. If Zone 2 goes over the base cantonment or off-base and over a populated area (see **Figure 1** for general locations), SLD 30/CC or his/her designated representative will make a risk assessment and decide whether or not to proceed with the operation. If Zone 2 goes off base but does not overlay a populated area, this RA may be delegated by SLD 30/CC. **NOTE:** The requester must have a database of nearby off-base population areas (houses, ranches, commercial facilities, etc.). SLD 30/SE can provide geographic coordinates of populated areas upon request. **NOTE:** If the user requests delegation of authority to act upon the risk assessment, he or she should request it in writing from SLD 30/CC prior to starting the operation.

4.6.2. Procedures to request RA must be defined in the Launch Complex or Facility Safety Plan, or Ground Operations Plan.

4.6.3. The user must brief all commanders required to make risk acceptance decisions, or their designated representatives, on the following minimum information:

4.6.3.1. Propellant operation requiring THZ.

4.6.3.2. Engineering and operating controls.

4.6.3.3. THZ forecasts.

4.6.3.4. Populated areas at risk. If the Union Pacific railroad tracks are at risk, the latest train schedule must be briefed.

4.6.3.5. Disaster response procedures.

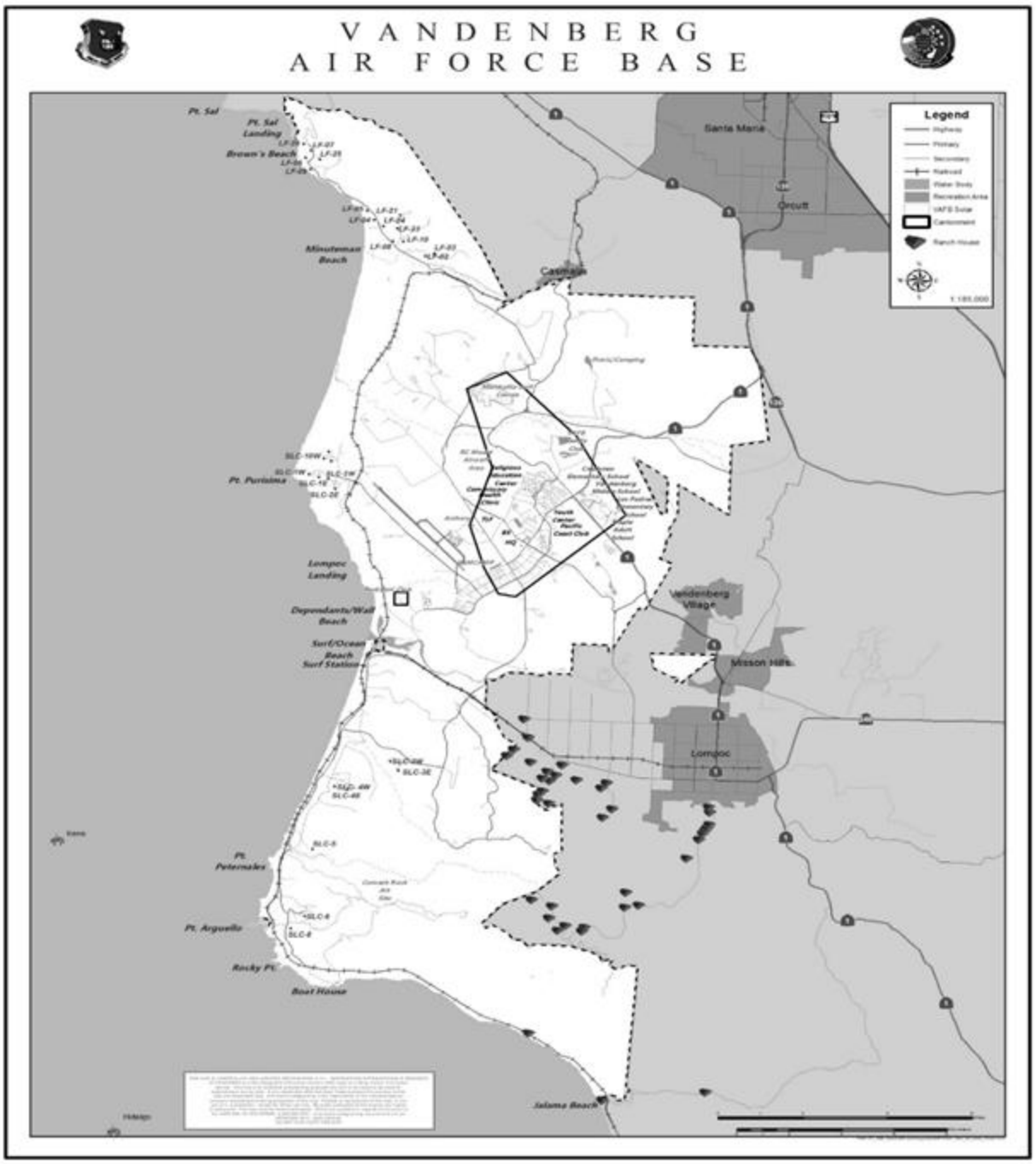
4.6.3.6. Mission impact if the operation is held.

4.6.3.7. Extended meteorological forecast.

4.6.4. New facilities at which unconventional propellants will be stored, processed or used will be designed to meet AFSPCMAN 91-710, Vol 5 requirements. Worst-case credible releases will be evaluated and containment systems will be designed to reduce the source strength values where possible and to prevent Zone 2 from exceeding the base land boundary for specific weather conditions. These values will be updated as project design changes occur.

4.6.5. Modifications to facilities at which unconventional propellants will be stored, processed or used will be designed to meet AFSPCMAN 91-710, Vol 5 requirements in addition to the normal approval process. Worst-case credible releases will be evaluated and containment systems will be designed so the original facility design source strength values are reduced where possible, and/or not exceeded by the modification. These values will be updated as project design changes or modifications occur.

Figure 1. Off Base Population Centers.



4.6.6. All facilities where unconventional propellants are processed or stored will develop a THZ Plan (may be contained in the Launch Complex Plan, Facility Safety Plan, or Ground Operations Plan) which will address all applicable portions of this instruction. SLD 30/SE must approve this plan.

4.7. Actions to Take After Accidental Release. If an accidental release occurs, personnel supervising the operation are responsible for stabilizing the situation as follows:

4.7.1. Initiate evacuation procedures. Acceptable sheltering requirements for each Zone are given in **paragraph 2**, Sheltering Requirements.

4.7.1.1. The PHZs will become the OHZs until more timely information is available on the source strength of the actual release or on meteorological conditions. If there is a release when a propellant operation is not taking place, the facility worst-case credible source strength will be used to calculate the OHZ until more specific information is available.

4.7.1.2. Task supervisors will direct security forces evacuation.

4.7.2. Notify Security Forces/Fire Department by calling 911 and follow procedures outlined in 30 SW Plan 10-2.

4.7.3. Notify SLD 30/CP of the OHZ Zone 2 and 3 dimensions and specify if either crosses the airfield flight path, offshore oil platforms or railroad tracks.

4.7.4. If the OHZs Zones 2 or 3 extend off base, SLD 30//CP will notify civilian authorities of the release and provide information on the potential public exposure effects and sheltering recommendations.

4.7.5. EOC response will be per 30 SW PLAN 10-2, *Comprehensive Emergency Management Plan*.

5. Hot Spill Operations (e.g., Launch Operations).

5.1. Responsibilities:

5.1.1. 30 OSS/OSW will be responsible for the following:

5.1.1.1. Scheduling necessary resources required to provide forecast meteorological data to SLD 30/SE.

5.1.1.2. Delivering forecast data at times specified in the Range Safety Operation Requirements (RSOR) vehicle peculiar annex. A forecast delivery timeline may vary depending upon the launch vehicle.

5.1.1.3. Toxics Forecaster products will be made available on Range Safety processors when requested.

5.1.2. SLD 30/SE will be responsible for the following:

5.1.2.1. Determining the need for hot spill THZ risk assessments.

5.1.2.2. Providing Zone 1, 2, and 3 PHZs and OHZs for both normal flight and catastrophic abort scenarios.

5.1.2.3. Making a GO/NO GO recommendation to the Launch Decision Authority (LDA) at L-1:45 and L-45 minutes, based upon the toxic risk assessment. The risk assessment will account for the probability of a mild, moderate, and severe reaction from exposed populations based upon the criteria established by an Expert Elicitation study completed in FY99 and FY00. An Expected Casualty (EC) risk value will be computed that will be included in the overall mission EC calculation used to ensure risk to the public and mission essential personnel meet allowable collective risk levels, in accordance with AFSPCMAN 91-710 (aggregated EC not to exceed 100 IAM). Further, EC due solely to toxic risk shall not exceed 30 IAM. Key inputs to this assessment include the launch vehicle probability of failure, launch day climatological conditions, and population respiratory vulnerability.

5.1.2.4. Directing actions to mitigate unacceptable toxic exposure risks. Possible actions include sheltering or evacuation of personnel.

5.1.2.5. Providing SLD 30/CP the coordinates of the catastrophic abort Zone 1 PHZ if any portion of it lies outside the base boundary.

5.1.2.6. Providing the LST Chief the Catastrophic Abort PHZ and Normal Launch OHZ Zones 2 and 3 (if applicable) coordinates.

5.1.2.7. Providing the Area Surveillance Officer (ASO) the coordinates of the toxic exclusion areas (PHZ or OHZ) for ship and support aircraft and railroad and oil platform protection requirements, the vertical depths of the areas for aircraft protection, and the length of time during which a Zone 2 exists (operationally referred to as a time-to-clear (TTC)).

5.1.2.8. Approving using safety related PPE.

5.1.3. SLD 30/CP will monitor the launch progress and notify any applicable non-base agencies of Zone 1 if a catastrophic abort occurs during the first sixty seconds of flight.

5.1.4. The LST Chief will do the following:

5.1.4.1. Monitor personnel inside all Zones 2 and 3.

5.1.4.2. Ensure no one is allowed in Zones 2 or 3 unless they are equipped with a proper breathing apparatus.

5.1.5. 30 OMRS/SGXB will be responsible for the following:

5.1.5.1. Recommending tier exposure criteria.

5.1.5.2. Approving using health related PPE.

5.1.6. The ASO will be responsible for the following:

5.1.6.1. Clearing Zones 2 and 3 over the ocean.

5.1.6.2. Keeping aircraft clear of Zones 2 and 3.

5.1.6.3. Holding trains outside the required railroad protection per 30 SWI 91-103, *Train Hold Criteria*.

5.1.6.4. Notifying and confirming oil platform operators have accomplished personnel protection requirements.

5.2. Actions to Take After a Catastrophic Abort. If there is a catastrophic abort within the first sixty seconds of flight, the following emergency actions will be taken:

5.2.1. SLD 30/CP will relay the location of Zone 1 to the Santa Barbara County Sheriff Dispatcher.

5.2.2. The ASO will, upon request from the Mission Flight Control Officer (MFCO), notify offshore oil platforms within Zone 2 or 3 to take appropriate emergency response actions per 30 SWI 13-210, *Evacuating or Sheltering of Personnel on Offshore Oil Rigs*.

5.2.3. 30 OSS/OSW will provide the SLD 30/SE immediate weather data, and provide one hour Hot Spill forecast data (surface to 10,000 ft atmospheric profile) at 15 minute intervals until notified to discontinue.

5.2.4. SLD 30/SE is responsible for the following:

5.2.4.1. Requesting the ASO to notify oil platforms through the actions completed by the MFCO in **para 5.2.2**.

5.2.4.2. Requesting immediate data from 30 OSS/OSW.

5.2.4.3. Performing risk assessments on revised weather forecast data and relay the appropriate footprints to the LST, ASO and SLD 30/CP (pre-launch), and to the EOC (post anomaly).

5.2.4.4. Apprising LDA of each risk assessment.

5.2.5. The EOC will respond per 30 SW PLAN 10-2, *Comprehensive Emergency Management Plan*.

ROBERT A. LONG, Colonel, USSF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

30 SW PLAN 10-2, *VAFB Comprehensive Emergency Management Plan, Change 1*, 28 April 2015

30 SWI 13-210, *Evacuating or Sheltering of Personnel on Offshore Oil Rigs*, 2 October 2006

30 SWI 91-103, *Train Hold Criteria*, 29 September 2016

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Philipson, Lloyd L. Technical Report No. 99-400/11.2-01, *An Expert Elicitation of Estimates of Exposure Limits for Space and Missile Launch Toxicants*, 30 September 1999. Contract No. FO 4684-97-C-001, Task No. 11, Project 2.

Philipson, Lloyd L. Technical Report No. 00-430/16.2-01, *An Expert Elicitation of Estimates of Exposure Limits for Mixtures of Space and Missile Launch Toxicants*, 31 March 2000. Contract No. FO 4684-97-C-0001, Task No. 16.

Abbreviations and Acronyms

A-50—Aerozine 50

ASO—Area Surveillance Officer

ACGIH—American Conference of Governmental Industrial Hygienist

AFSPC—Air Force Space Command

AFSPCMan—Air Force Space Command Manual

AWDS—Automated Weather Distribution System

BEE—Base Bioenvironmental Engineer

C—Ceiling

DoD—Department of Defense

EBA—Escape Breathing Apparatus

EHZ—Emission Hazard Zone

ELSA—Emergency Life Support Apparatus

EOC—Emergency Operations Center

EPA—Environmental Protection Agency

HAZMAT—Hazardous Materials

HCl—Hydrochloric Gas

HOS—Hazardous Operations Support

IDLH—Immediately Dangerous to Life or Health

LDA—Launch Decision Authority

LOC—Level of Concern

LST—Launch Support Team

MFCO—Mission Flight Control Officer

MMH—Monomethylhydrazine

MSPSP—Missile System Prelaunch Safety Package

N2H4—Hydrazine

N2O4—Nitrogen Tetroxide

NO2—Nitrogen Dioxide

NASA—National Aeronautical and Space Administration

NIOSH—National Institute for Occupational Safety and Health

OD—Operations Directive

OHZ—Operational Hazard Zone

OPR—Office of Primary Responsibility

OSHA—Occupational Safety and Health Administration

PEL—Permissible Exposure Limits

PHZ—Potential Hazard Zone

PPE—Personal Protective Equipment

RA—Risk Assessment and Acceptance

RSOR—Range Safety Operation Requirements

SCAPE—Self-Contained Atmospheric Protective Ensemble

STEL—Short-Term Exposure Limit

THZ—Toxic Hazard Zone

TLV—Threshold Limit Value

TWA—Time Weighted Average

UDMH—Unsymmetrical Dimethly1-Hydrazine

Terms

All Clear—When the On-Scene Commander, using all necessary resources, including physical monitoring by 30 OMRS/SGXB , ensures that ambient concentrations of the released propellant are below the associated tier value.

Base Cantonment—Base cantonment encompasses the areas marked in **Figure A2.1**.

Ceiling (C)—A worker's exposure level which shall not be exceeded for any length of time.

Cold Spill—Release of toxic propellants in liquid or vapor form from a propellant transfer or vent operation. Propellant combustion does not occur.

Environmental Protection Agency Level of Concern (EPA LOC)—EPA term defining the concentration of an extremely hazardous substance in the air above which there may be serious irreversible health effects or death as a result of a single exposure for relatively short periods of time.

Emission Hazard Zone (EHZ)—The toxic hazard zone established before a planned release of propellants into the atmosphere; e.g., propellant tank venting or scrubber venting. An EHZ is based upon the worst-case credible emission rate or source strength.

Emergency (EOC)—The command and control element responsible for directing, monitoring, and supporting the installation's actions and supporting activities through an incident's life cycle.

Giant Voice/Public Address System—Public address system for North and South Vandenberg AFB.

Hot Spill—Release of toxic propellants through propellant combustion, such as a launch operation.

Immediately Dangerous to Life or Health (IDLH)—The current National Institute for Occupational Safety and Health (NIOSH) definition for IDLH is "a condition that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment." The level of exposure for the IDLH "is to ensure the worker can escape from a given contaminated environment in the event of failure of the respiratory protection equipment." The effects at these levels are based on an exposure time of 30 minutes to add a safety margin. However, this does not mean workers should stay in that environment any longer than necessary. Evacuation should take place immediately.

Launch Support Team (LST)—Formed to support launch operations. In the event of a launch mishap or anomaly, the LST assists the On-Scene Commander (OSC) as SLD 30 Safety, Security, and Health Representatives by providing real time consultation to the OSC per 30 SW PLAN 10-2.

Hazardous Operations Support (HOS)—Contractor or government personnel charged with providing hazardous propellant operations security support as directed by the Operations Directive (OD).

Operation-Essential Personnel—The minimum number of personnel required to accomplish a specific operation.

Operations Directive (OD)—The single formal document designed to consolidate host-base support for missile and space operations. The OD serves as a combination of support and notification checklist.

Operational Hazard Zone (OHZ)—The toxic hazard zone established following an accidental cold spill, unplanned liquid or gaseous release, or normal launch or catastrophic launch abort, based upon actual or worst-case credible source strength. Zones 1, 2, and 3 are established for an OHZ, as appropriate.

Permissable Exposure Level (PEL)—Defined by NIOSH as the time weighted average concentration that must not be exceeded during any 8-hour work shift of a 40-hour workweek.

Personal Protective Equipment (PPE)—Breathing apparatus such as Escape Breathing Apparatus (EBA), Emergency Life Support Apparatus (ELSA) or Self-Contained Atmospheric Protective Ensemble (SCAPE) designed to protect individuals from exposure to hazardous chemicals or provide supplemental sources of oxygen. 30 OMRS/SGXB and SLD 30/SE will approve all PPE and determine when it is required.

Potential Hazard Zone (PHZ)—Planning zone established prior to a specific operation to assess risk should an accidental cold spill or unplanned release, or a hot spill catastrophic abort occur. The zones are based upon the worst-case credible emission rate or source strength for a specific operation. A PHZ may have a Zone 1, 2 or 3 for nitrogen tetroxide/nitrogen dioxide vapor ($N_2O_4/N0_2$) and hydrochloric gas (HCl). A PHZ may have a Zone 2 or 3 for hydrazine-family propellants.

Short-Term Exposure Limit (STEL)—A short term exposure limit averaged over a 15-minute period (unless another time limit is specified in a parenthetical notation below the limit).

Short-Term Public Emergency Guidance Level (SPEGL)—The exposure limit expressed in parts per million (ppm) related to an unplanned single exposure normally lasting 60 minutes or less and never more than 24 hours, and whose occurrence is expected to be rare.

Threshold Limit Value (TLV)—Refers to airborne concentrations of substances and represents conditions under which the American Conference of Governmental Industrial Hygienists (ACGIH) believes nearly all workers may be occupationally exposed day after day without adverse effect. TLVs are published by the ACGIH. The Occupational Safety and Health Administration (OSHA) publishes similar values called Permissible Exposure Limits (PELs). The most conservative of the OSHA or ACGIH values must be used.

Tier 1—An airborne exposure level (maximum concentration) which poses no hazard to the general population but which may affect certain sensitive individuals (e.g., asthmatics, individuals with emphysema, and certain other lung diseased people). Tier 1 separates Zone 1 from the area where no controls are required. See **Table 1** for Tier 1 exposure level values.

Tier 2—An airborne exposure level (maximum concentration) which may cause short term symptoms but which most individuals could endure without experiencing or developing irreversible or other serious health effects or symptoms which could impair their ability to take protective action. Tier 2 separates Zone 2 from Zone 1. See **Table 1** for Tier 2 exposure level values.

Tier 3—An airborne exposure level (maximum concentration) based on the NIOSH IDLH values. Tier 3 separates Zone 3 from Zone 2. See **Table 1** for Tier 3 exposure level values.

Time Weighted Average (TWA)—A worker's average airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded.

Toxic Combustion Byproducts—During a planned burn of a rocket engine or an unplanned combustion of propellants, toxic byproducts can be created and/or released which pose a hazard to downwind areas. The significant toxic byproduct of solid propellant combustion is hydrogen chloride (HCl). Unplanned combustion, such as an explosion of a vehicle burning hypergolic propellants during flight, can release toxic vapors. These vapors include hydrazine (N_2H_4), unsymmetrical dimethyl-hydrazine (UDMH), monomethylhydrazine (MMH), and nitrogen dioxide (NO_2). The combustion byproducts of aerozine-50 (A-50) released from an explosion of a vehicle fueled by this propellant are N_2H_4 and UDMH.

Toxic Hazard Zone (THZ)—A generic term which describes an area in which predicted concentration of propellant or toxic byproduct vapors or aerosols may exceed acceptable tier levels. Predictions are based on analyzing potential source strength, applicable exposure limit, and prevailing meteorological conditions. THZs are plotted for potential, planned and unplanned propellant releases, and launch operations. OHZs, PHZs, and EHZs are types of THZs.

Unconventional Propellants—A propellant fuel based upon chemical reactions, unlike combustion of fossil or hydrocarbon materials. Typical unconventional propellants at Vandenberg AFB are an oxidizer (e.g., nitrogen tetroxide) and a fuel (e.g., Aerozine-50) which spontaneously ignite when mixed together, which is known as a hypergolic reaction.

User—SLD 30 clients, such as Department of Defense (DoD), National Aeronautical and Space Administration (NASA), civilian commercial companies, etc., that use SLD 30 facilities and test equipment, or conduct prelaunch and launch operations on the Western Range.

Worst-Case Credible Release Strength—Used to facilitate prediction of a cold spill THZ. The responsible engineer (user) should determine the worst-case credible failure mode, then determine the associated liquid or vapor release rate (in pounds per minute), or the wetted area (in square feet).

Zone 1—An area where the airborne concentrations of any toxic product are equal to or exceed Tier 1 levels, but are less than Tier 2 levels. This zone can result from either a hot or cold spill. Within Zone 1, sheltering is recommended only for sensitive mission essential individuals and no controls are required to monitor or prevent personnel from transiting the zone. See **Figure A2.2** below.

Zone 2—An area where the airborne concentrations of any toxic product are equal to or exceed Tier 2 levels, but are less than Tier 3 levels. This zone can result from either a hot or cold spill. Within Zone 2, sheltering is required if an individual notices breathing discomfort or skin irritation. *(**Note**: exposure to some chemicals (e.g. nitrogen dioxide) at Zone 2 concentration levels may not be immediately irritating but can have delayed adverse health effects. For these chemicals, depending on the circumstance, a delay in the operation or evacuation will be required)*. To protect the general public, an operation is required to be delayed or ceased at a safe point in the procedure if a Zone 2 region extends beyond base boundaries, extends over designated public areas on base, or extends over off-shore oil platforms. Certain exemptions may be permitted under proper authorization if an off-base Zone 2 lies within an uninhabited area. See **Figure A2.2** below.

Zone 3—An area where the airborne concentrations of any toxic product range from a low defined by Tier 3, to an unknown high. This zone can result from either a hot or cold spill. Within Zone 3 personnel must either evacuate or wear appropriate personal protective equipment (PPE) or have such equipment close at hand. In the event of an actual release it is mandatory that personnel wear PPE. Operations are subject to hold for Zone 3 in the same manner as Zone 2 with the additional requirement that if a Zone 3 region infringes on the Union Pacific railroad tracks the operation is required to hold until a risk analysis indicates it is safe to proceed or winds shift to move the Zone 3 away from the tracks. See **Figure A2.2** below.

Attachment 2

BASE CANTONMENT

Figure A2.1. Base Cantonment.

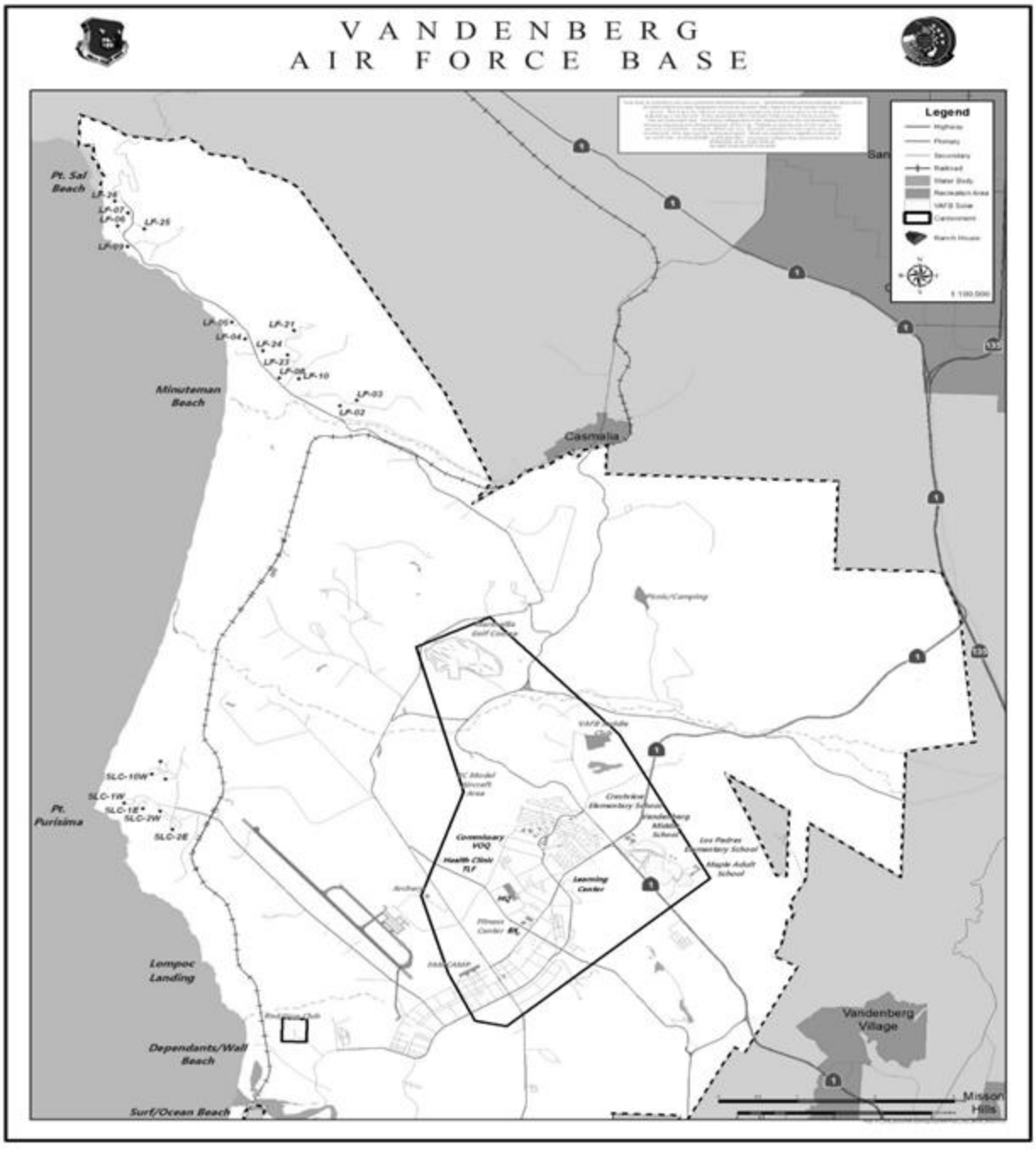

Figure A2.2. Zone Development.