FINAL
ENVIRONMENTAL ASSESSMENT FOR DEMONSTRATIONS OF VARIOUS ELECTRIC FIRES AND LOITERING AERIAL MUNITION SYSTEMS AT FORT SILL, OKLAHOMA

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PRIVACY ADVISORY

Public comments on the Draft Environmental Assessment (EA) were requested. Letters or other written or oral comments provided to the U.S. Army at Fort Sill Garrison, Oklahoma, are contained in the Final EA. As required by law, substantive comments have been addressed in the Final EA and this document is being made available to the public. Any personal information provided to the U.S. Army, Fort Sill Garrison, is used only to identify your intent to make a comment or to fulfill requests for copies of the Final EA or associated documents.

FINDING OF NO SIGNIFICANT IMPACT

Environmental Assessment for Demonstrations of Various Electric Fires and Loitering Aerial Munition Systems at Fort Sill, Oklahoma

The Environmental Assessment (EA) has been developed in accordance with the National Environmental Policy Act (NEPA) of 1969 and implementing regulations issued by the President's Council on Environmental Quality (CEQ) and the Army (40 *Code of Federal Regulations [CFR]* §§ 1500-1508, and 32 *CFR* 651, *Environmental Analysis of Army Actions*). There are no cooperating agencies associated with this Environmental Assessment (EA). This Finding of No Significant Impact (FNSI) herein references the attached EA and has been developed as the final decision document for the EA.

The EA has been prepared to present and evaluate the Proposed Action and alternatives, including the No Action Alternative. Resources addressed in the EA include land use, health and safety, air quality, noise, biological, cultural, hazardous materials and waste, and cumulative impacts.

PROJECT LOCATION: The proposed location for this project is Fort Sill, located near Lawton, Oklahoma.

PURPOSE AND NEED: The purpose of the proposed action is to demonstrate concepts and capabilities that have the potential to change the way the Army conducts operations in the future. These demonstrations are proposed to examine or develop solutions and determine which solutions, if implemented, would result in the highest level of capability, effectiveness, and efficiency to the force (TRADOC Regulation 71-20). The need for the proposed action is a direct result of the requirement for the Capabilities Development and Integration Directorate (CDID) to develop and integrate new technologies to defend the Nation and its interests. Electric Fires and Loitering Aerial Munition Systems (LAMS) are both new technologies that promise advances in the ability of the warfighter to communicate, defend against enemy weapons, and destroy enemy threats with levels of speed, accuracy, and safety not possible with current conventional weapons.

ALTERNATIVES: Three alternatives were considered: the No Action Alternative; Alternative 1 Demonstrations on the West Range area; and Alternative 2 Demonstrations on the East Range area. Descriptions of these alternatives follow.

No Action Alternative. No demonstrations of Electric Fires or LAMS would occur with implementation of the No Action Alternative. Analysis of the No Action Alternative provides a basis for comparing the environmental consequences of the Proposed Action to the existing (baseline) conditions over time. While the No Action Alternative does not satisfy the stated purpose and need, its inclusion in this EA is required by NEPA regulations (40 CFR 1502.14[c]).

Preferred Alternative: Alternative 1: Demonstrations on the West Range Area. The West Range area at Fort Sill includes both the West Range and the training areas east of Highway 115 and west of I-44 on the installation (see Figure 2.6-1 in the EA). Implementation of this alternative would mean that the demonstrations described in the EA (Section 2.3 and Table 2.3-1) would be conducted in the portion of the West Range area at Fort Sill, west of Tower Two Road. No demonstrations would occur east of Tower Two Road as part of this alternative. Alternative 1 was selected as the Preferred Alternative for a number of reasons including ease of access to the training area, fewer potential conflicts with existing range uses (e.g. fewer agricultural fields and less interference with the basic and small arms training activities), and greater topographic relief increasing the potential number of areas with suitable backstops for demonstrations.

Alternative 2: Demonstrations on East Range Area. The East Range area at Fort Sill includes both the East Range and the training areas east of I-44 to the east boundary of the installation (see

Figure 2.6-1 in the EA). Potential impacts resulting from implementation of this alternative would be similar to those described for Alternative 1, with the exception of the improvements described for Firing Point 240E. No improvements would be required at any location in the East Range area and the LAMS would only be demonstrated at the sub-ranges identified on Figure 3.2.7. Although not significant, implementation of this alternative would result in slightly more minor impacts associated with deconflicting range usage due to the additional agricultural leases and the high use of the East Range area by other units.

ENVIRONMENTAL CONSEQUENCES OF IMPLEMENTING ALTERNATIVE 1: Implementation of Alternative 1 has the potential for minor impacts to land use, air quality, noise, and biological resources. These impacts would not be significant. No impacts to human health and safety, cultural resources, or hazardous materials and waste are anticipated to result from implementation of Alternative 1.

PUBLIC OUTREACH: On December 21, 2014, the Army published a public notice in the Lawton Sunday Constitution notifying the public that the Draft EA and FNSI were available at the Lawton Public library in Lawton, Oklahoma, the Nye Library on Fort Sill and via a website during the public review and comment period. On January 25, 2015, the Army published a second public notice in the Lawton Sunday Constitution notifying the public of an extension of the formal comment period to February 8, 2015. This extension was due to a delay in the receipt of the Draft EA and FNSI by a public agency.

One comment letter from a member of the public was received during the Draft EA public review period. The commenter expressed concern about the long-term health and environmental effects associated with the repeated use of the systems described in the Draft EA. The Army and Fort Sill are committed to providing a safe environment for both military personnel and civilians wherever they operate. Safety and protection of the environment are integrated into every activity that occurs at Fort Sill on a daily basis. As described in Section 3.2.2 of the EA, a detailed (up to 12 months) review and approval process would be required prior to the demonstration of any system at Fort Sill. This review and approval process would include a variety of different internal and external organizations and agencies.

Upon approval, each demonstration would be conducted in compliance with all required health and safety procedures and any site or demonstration specific procedures required by Range Operations, the same that is required for any other weapon system used at Fort Sill. In addition, the systems described in this EA were analyzed as demonstrations only and not part of the long-term training at Fort Sill. If any of these systems were to eventually be acquired by the Army and adopted as part of regular training, additional health, safety and environmental analysis would be completed as part of the NEPA documentation.

FINDING: Based upon the results of the EA, it has been concluded that implementation of the Preferred Alternative, Alternative 1 will not result in any significant impacts to human health or the environment. Therefore, no further environmental impact analysis is warranted at this time.

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Glenn A. Waters
Colonel, U.S. Army
Garrison Commander
Fort Sill, Oklahoma

Date

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
ACUB	Army Compatible Use Buffer
ADS	Active Denial System
AEC	U.S. Army Evaluation Center
AFI	Air Force Instruction
AFMO	Army Frequency Management Office
AGM	Absorbed Glass Mat
AHPA	Archeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
Al_2O_3	aluminum oxide
AR	Army Regulation
ARAC	Army Radar Approach Control
ARPA	Archaeological Resources Protection Act
AUZ	adaptable use zone
CAA	Clean Air Act
CDD	Concepts Development Directorate
CDID	Capabilities Development and Integration Directorate
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CHAMPS	Counter-Electronics High Power Microwave Advanced Missile Project
cm	centimeter(s)
CO	carbon monoxide
CRO	Cultural Resources Officer
DA PAM	Department of Army Pamphlet
DARPA	Defense Advanced Research Projects Agency
dB	decibel
dBP	peak level decibels
DoD	U.S. Department of Defense
DoDI	Department of Defense Instruction
DoI	U.S. Department of Interior
DSW	Demonstration Support Worksheet
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	electromagnetic
EO	Executive Order
EOD	explosive ordnance disposal
EQD	Environmental Quality Division
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
FAA	Federal Aviation Administration
FBL	Fires Battle Lab
FCC	Federal Communications Commission
FCoE	U.S. Army Fires Center of Excellence

ACRONYMS AND ABBREVIATIONS (Continued)

FM	Frequency Manager
FNSI	Finding of No Significant Impact
FRF	Frequency Request Form
GHG	greenhouse gas
GPS	global positioning system
GWP	global warming potential
HAP	hazardous air pollutant
HERF	high-energy radio frequency
HIMARS	High Mobility Artillery Rocket System
I-44	Interstate 44
ICRMP	Integrated Cultural Resources Management Plan
IEEE	Institute of Electrical and Electronic Engineers
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
IMCOM	Installation Management Command
INRMP	Integrated Natural Resource Management Plan
IPaC	Information, Planning, and Conservation
ISCP	Installation Spill Contingency Plan
ITAM	Integrated Training Area Management
Keeper	Keeper of the Register
kV/m	kilovolts per meter
kW	kilowatt
kW/cm^2	kilowatts per square centimeter
LAMS	loitering aerial munition systems
LGAC	laser-generated air contaminant
LOS	line-of-sight
LRAD	Long Range Acoustic Device
LRSO	Laser Range Safety Officer
LUPZ	Land Use Planning Zone
MBTA	Migratory Bird Treaty Act
MIL-HDBK	Military Handbook
MJ	megajoule
MLRS	Multiple Launch Rocket System
mm	millimeter(s)
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEC	Network Enterprise Center
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOA	Notice of Availability
NRHP	National Register of Historic Places
NS	nanosecond(s)
OKDWC	Oklahoma Department of Wildlife Conservation

ACRONYMS AND ABBREVIATIONS (Continued)

O_3	ozone
Pb	lead
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns
PM_{10}	particulate matter equal to or less than 10 microns
PPE	personal protective equipment
QRBA	Quanah Range Buffer Area
RA	Restricted Area
RDX	cyclotrimethylenetrinitramine
RM	risk management
ROI	Region of Influence
RTLP	Range and Training Land Program
SAR	specific absorption rate
SDZ	Surface Danger Zone
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_X	sulfur oxide
SPCC	Spill Prevention, Control, and Countermeasure
SRP	Sustainable Range Program
TCM	TRADOC Capability Manager
TCP	Traditional Cultural Property
TRADOC	Training and Doctrine Command
UAS	unmanned aircraft system
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VOC	volatile organic compound
W/cm^2	watts per square centimeter
W/kg	watts per kilogram
WMWR	Wichita Mountains National Wildlife Refuge

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1. PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) analyzes and documents the potential environmental consequences resulting from proposed demonstrations of various Electric Fires and loitering aerial munition systems (LAMS) at Fort Sill, Oklahoma. Electric Fires is a conceptual term used by the Army to identify systems that use electromagnetic (EM) energy to destroy, degrade, and deny enemy threats. The LAMS are explosive guided munitions used to counter aerial and ground threats.

32 megajoule railgun being prepared for testing at Naval Surface Warfare Center Dahlgren. Photo Credit U.S. Navy.

The proposed demonstrations could occur on range areas included in this EA with proper coordination and approval from numerous organizations on and off the Installation, including Range Operations. Completion of these demonstrations would help establish the foundation for future acquisitions and training of Electric Fires and LAMS at Fort Sill. These systems are revolutionary technologies that show promise to reduce costs and hazards, and achieve enormous gains in flexibility and mobility versus present day gun powder-based systems. LAMS are guided munitions, while Electric Fires technologies are grouped into two categories: electro-dynamic kinetic energy and directed energy. Examples of these technologies are: (1) electro-dynamic kinetic energy systems: EM launch (railgun), combustion light gas gun, electrothermal-chemical; and (2) directed energy: acoustic, high power microwave, radio frequency, laser, particle beam, and laser-induced plasma channel. Electro-dynamic kinetic energy and directed energy systems are not linked to any specific platform (tank, aircraft, truck, etc.).

1.2 BACKGROUND

Fort Sill is located approximately 90 miles southwest of Oklahoma City and approximately 50 miles north of Wichita Falls, Texas, on Interstate 44 (I-44) (Figure 1.2-1). The City of Lawton, Oklahoma, borders Fort Sill to the south. The Installation encompasses approximately 94,000 acres. Military restricted airspace over Fort Sill is currently divided into six segments, with a maximum altitude of 40,000 feet. The Federal Aviation Administration (FAA) is currently in the process of creating two new areas of restricted airspace in the vicinity of Fort Sill.

The Installation is the home of the U.S. Army Fires Center of Excellence (FCoE), an organization combining the U.S. Army Field Artillery Center and School; the U.S. Army Air Defense Artillery Center and School; the U.S. Army Electronic Warfare School; and the Training and Doctrine Command (TRADOC) Capabilities Development and Integration Directorate (CDID). TRADOC is the capability developer and operational architect of the Army. TRADOC designs, develops, and integrates warfighting requirements; fosters innovation; and leads change for the Army. TRADOC Regulation 71-20 describes the role of TRADOC relative to concept and capability development and integration.

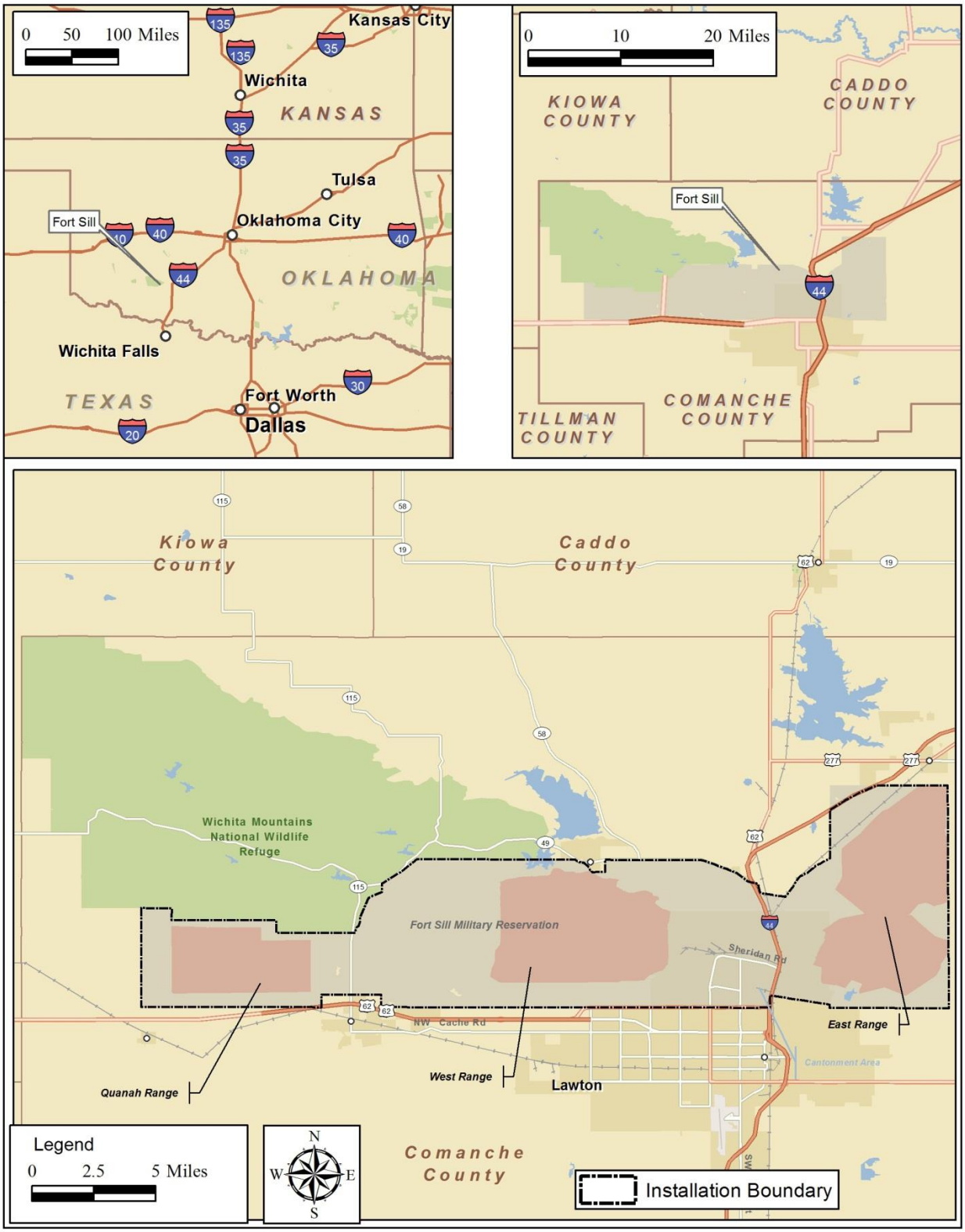

Figure 1.2-1. Regional Map of Fort Sill

Principal operational units at Fort Sill include the 75th Fires Brigade, the 428th and 434th Field Artillery Brigades, and the 30th and 31st Air Defense Artillery Brigades. Fort Sill is also one of the five locations for Army Basic Combat Training. As the home of the FCoE, the Installation's mission is to train soldiers and develop Field Artillery, Air Defense Artillery, and Electronic Warfare leaders; design and develop fire support for the force; support unit training and readiness; mobilize and deploy operating forces; and maintain Installation infrastructure and services.

As part of the design and development mission, the FCoE CDID is responsible for developing FCoE-related concepts, requirements, and experimentation to accompany the lessons trainees are receiving in the classroom. These integrated capabilities complement existing resources and allow industrial developers to better serve the Field Artillery and Air Defense Artillery Soldier. Within CDID, the Fires Battle Lab (FBL) and TRADOC Capability Managers (TCMs) conduct demonstrations in order to refine ideas, concepts, solutions, prototypes, and evolving technologies. TCMs currently support limited testing and fielding of selected technologies. The CDID currently uses computer modeling and simulation to test potential capabilities and concepts. Both organizations require the ability to expand the types of live fire demonstrations available to them in order to demonstrate how these technologies and concepts may operate on future battlefields.

1.3 PURPOSE OF THE PROPOSED ACTION

The purpose of the proposed action is to demonstrate concepts and capabilities that have the potential to change the way the Army conducts operations in the future. These demonstrations are proposed to examine or develop solutions and determine which solutions, if implemented, would result in the highest level of capability, effectiveness, and efficiency to the force (TRADOC Regulation 71-20). Fort Sill would provide a venue for FCoE combat developers, training developers, operational unit leaders, and FCoE leadership assigned to Fort Sill to investigate and assess emerging technologies and concepts that may fill military deficiencies. Fort Sill would also provide a venue to military, civilian, and government officials external to Fort Sill.

1.4 NEED FOR THE PROPOSED ACTION

The need for the proposed action is a direct result of the requirement for the CDID to develop and integrate new technology to defend the Nation and its interests. Electric Fires and LAMS are both new technologies that promise advances in the ability of the warfighter to communicate, defend against enemy weapons, and destroy enemy threats with levels of speed, accuracy, and safety not possible with current conventional weapons.

Army Regulations (ARs) 5-22 and 73-1, and TRADOC Regulation 71-20, direct the FCoE and CDID to: serve as the force modernization advocate for Field Artillery and Air Defense Artillery branches; provide the link between science and technology and the Army acquisition community; and to conduct demonstrations to put capabilities in the hands of Soldiers earlier. This coordination between military and civilian entities would allow the Army to maintain its technological advantage on the modern battlefield and would facilitate a quicker transition from concepts to reality.

To better utilize subject matter experts and conduct/coordinate Electric Fires efforts across the Army, the Electric Fires Office was authorized in November 2012 as a subordinate office within the CDID's FBL and transferred to the CDID Requirements Development Division in July 2014. The FCoE Commander determined that having the capabilities to demonstrate Electric Fires systems at Fort Sill is needed to meet their near-term focus on Army vulnerabilities; to gain insights into currently available technologies; and to develop new tactics, techniques, and procedures.

1.5 SCOPE OF THE ENVIRONMENTAL ANALYSIS

This EA is developed in accordance with the National Environmental Policy Act (NEPA) of 1969 and implementing regulations issued by the President's Council on Environmental Quality (CEQ) and the Army (40 *Code of Federal Regulations [CFR]* §§ 1500-1508 and 32 *CFR* 651, *et seq.*). The purpose of this EA is to inform decision makers of the likely potential consequences of implementation of the proposed action and alternatives. This EA identifies, documents, and evaluates the human and natural environmental effects of the demonstrations at Fort Sill, Oklahoma. An interdisciplinary team of health physicists, environmental scientists, biologists, planners, economists, engineers, archaeologists, and military technicians analyzed the proposed action and alternatives relative to existing conditions and identified relevant beneficial and adverse effects associated with implementation of the proposed action. The proposed action and alternatives are described in Chapter 2. Conditions existing as of 2014, considered to be the "baseline" conditions, are described in Chapter 3, Affected Environment and Environmental Consequences. The expected effects of the proposed action, also described in Chapter 3, are presented immediately following the description of baseline conditions for each environmental resource addressed in the EA. Chapter 3 also addresses the potential for cumulative effects and identifies mitigation measures where appropriate.

1.6 PUBLIC INVOLVEMENT AND AGENCY AND TRIBAL COORDINATION

Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, requires intergovernmental notifications prior to making any detailed statement of environmental consequences. Through the process of Interagency and Intergovernmental Coordination for Environmental Planning (IICEP), the proponent must notify concerned federal, state, and local agencies and allow them sufficient time to evaluate potential environmental consequences of a Proposed Action. Comments from these agencies are subsequently incorporated into the environmental analysis. Consultation with Native American Tribes was conducted in accordance with 36 *CFR* 800. Public participation opportunities with respect to this EA and decision making on the proposed action are guided by 32 *CFR* 651.

The Army encouraged and invited public/agency, tribal, and other participation in the NEPA process. Consideration of the views and information of all interested persons promotes open communication and enables better decision making. All agencies, organizations, and members of the public with a potential interest in the proposed action, including minority, low-income, disadvantaged, and Native American groups, were encouraged to participate in the decision-making process during the Draft EA public review period.

On December 21, 2014, the Army published a public notice in the Lawton Sunday Constitution notifying initiation of the 30-day Draft EA comment period. The public notice included a brief summary of the Draft EA, addresses of two local libraries where the document was located, and a website link where the document could be downloaded. On January 13, 2015, the Lawton Constitution published a front page newspaper article titled, "*Comment sought on new types of Fort Sill munition*". This article provided a summary of the Draft EA, described the 30-day public review process, and included contact information for comments or questions about the Draft EA.

On January 25, 2015, the Army published a second public notice in the Lawton Sunday Constitution notifying the public of an extension of the formal comment period to February 8, 2015. This extension was due to a delay in the receipt of the Draft EA by a public agency. Copies of the public notices and the newspaper article are contained in Appendix A.

One comment letter from a member of the public was received during the Draft EA public review period (see Appendix A). The commenter expressed concern about the long-term health and environmental effects associated with the repeated use of the systems described in the Draft EA. The Army and Fort Sill are committed to providing a safe environment for both military personnel and civilians wherever they operate. Safety and protection of the environment are integrated into every activity that occurs at Fort Sill on a daily basis. As described in the EA, a detailed (up to 12 months) review and approval process would be required prior to the demonstration of any system at Fort Sill. This review and approval process would include a variety of different internal and external organizations and agencies. Upon approval, the demonstration would be conducted in compliance with all required health and safety procedures and any site or demonstration specific procedures required by Range Operations, the same that is required for any other weapon system to be used at Fort Sill. In addition, the systems described in this EA were analyzed as demonstrations only and not part of the long-term training at Fort Sill. If any of these systems were to eventually be acquired by the Army and adopted as part of regular training, additional health, safety and environmental analysis would be completed as part of the NEPA documentation.

As part of the public/agency and tribal review process, the Final EA, along with the Draft Finding of No Significant Impact (FNSI), is being made available to the public for a second 30-day review period. The Army will consider any additional comments submitted by individuals, agencies, or organizations on the proposed action, the Final EA, or Draft FNSI. As appropriate, the Army may then execute the FNSI and proceed with implementation of the proposed action. If it is determined, prior to issuance of a Final FNSI, that implementation of the proposed action would result in significant impacts, the Army would publish a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the *Federal Register*, commit to mitigation actions sufficient to reduce impacts below significant levels, or not implement the action.

1.7 DECISIONS TO BE MADE

As stated in Section 1.6, this EA would result in either a FNSI or publication of a Notice of Intent in the *Federal Register* announcing the Army's intent to prepare an EIS due to the potential for significant environmental impacts to result from implementation of the proposed action. As part of the decision process, this document presents the Garrison Commander with all relevant environmental information and stakeholder issues identified as part of this EA process. If significant environmental impacts are not identified, or if environmental impacts cannot be

mitigated to not be significant, the Garrison Commander would document the decision to implement the demonstrations of all listed technologies assessed in a range area currently established on Fort Sill or adopt the No Action Alternative in the FNSI. Under the No Action Alternative, the Army would not pursue demonstrations for the Field Artillery and Air Defense Artillery branches, possibly increasing the military technological gaps, and vulnerabilities to potential threats.

1.8 ENVIRONMENTAL RESOURCES NOT CARRIED FORWARD FOR DETAILED ANALYSIS

The determination of environmental resources to be analyzed versus those not carried forward for detailed analysis is part of the EA scoping process. CEQ and Army regulations (40 *CFR* 1501.7(a)(3) and 32 *CFR* 651.5(d)(5)) encourage project proponents to identify and eliminate resource areas from detailed study that are not important or have no potential to be impacted through implementation of their respective proposed actions. One alternative of the proposed action would require minimal construction, including the construction of one building, construction of a cement pad with four grounding rods, and creation of a gravel parking area. This alternative would also include burying a portion of a power line. Additional details on construction are included in Chapter 2.

Airspace – No new airspace would be required for implementation of the proposed action. Some technologies (e.g., lasers shooting over the horizon) have safety implications for aircraft and satellites, and these safety implications will be evaluated in the Safety resource area of the EA. Therefore, further analysis of airspace was determined unnecessary.

Soil and Water Resources – Minimal construction would be required to implement one alternative of the proposed action. The construction of a concrete pad (100 x 100 feet), burial of 1,500 feet of utility line, construction of one building (a 20 x 30 foot building with an observation deck), earth work to remove and flatten existing man-made berms (less than 0.2 acres), and construction of a gravel parking area (100 x 100 feet) is not anticipated to result in significant impacts to soil or water resources at Fort Sill. Appropriate management practices would be incorporated into this construction to minimize soil erosion and sedimentation. The proposed construction site is located in an area that is currently in use as an improved firing point with no unique soil or water resources. Therefore, further analysis of soils and water resources was determined unnecessary.

Aesthetics and Visual Resources – No changes to the aesthetics and visual resources of Fort Sill or surrounding areas would occur with implementation of the proposed action; thus, further analysis of aesthetics and visual resources was determined unnecessary.

Surface Transportation – The pattern of traffic flow would not be expected to significantly change, as the proposed action does not include any permanent increases to personnel. Some roads would require closure during demonstration periods. However, this is common during existing training at Fort Sill. Further analysis of transportation systems was determined unnecessary.

Utilities – For one alternative of the proposed action, approximately 1,500 feet of existing overhead power line would be buried three feet below the ground surface. Conversion of the power line from aboveground to below ground is to protect the power line from radio frequency interference and is not related to an increase in demand for electrical power. Any power required for demonstrations of technologies would be supplied by portable generators. Therefore, further analysis of utilities was determined unnecessary.

Socioeconomics, Environmental Justice, and Protection of Children – The proposed action would result in only minimal economic benefits from short-term construction activities and from the short-term, minimal increase in personnel during demonstrations; therefore, further analysis of socioeconomics was determined unnecessary. As there is no potential for significant adverse impacts to areas outside the boundary of Fort Sill, no communities would be adversely impacted and there is no potential for disproportionate impacts to minorities or children.

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2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter presents the No Action Alternative (in accordance with CEQ regulations (40 *CFR* 1502.14[d]); a description of the proposed action and alternatives; the narrowing criteria used to identify and develop the proposed action and alternatives; and a description of the alternatives not carried forward for analysis.

2.2 NO ACTION ALTERNATIVE

Implementation of the No Action Alternative would fail to meet the purpose and need for the FCoE to provide advanced technology demonstrations at Fort Sill. FCoE leadership would not have the benefit of actual capability demonstrations to help forge new concepts for future warfighting capabilities and identify/validate capability gaps. No construction activities would occur under the No Action Alternative, and no demonstrations would occur at Fort Sill.

2.3 DESCRIPTION OF THE PROPOSED ACTION

2.3.1 Electric Fires and Loitering Aerial Munition Systems

The proposed action is to demonstrate the technologies listed in Table 2.3-1. The technologies evaluated in this EA are at various stages in the development process and specific parameters of a system such as maximum power output or frequency might not be known or available at this time. The power levels shown in the power output column in Table 2.3-1 represent the maximum amount of power expected to be used by each technology during demonstrations on Fort Sill in the next 20 years, but not necessarily the maximum power of the technology. Furthermore, the category names are based on the general technology type; some future technologies might have a different name but still fall within these broad categories.

Table 2.3-1. Proposed Electric Fires Systems

System	Nominal Power Output for EF Range	EM Spectrum
Electro-Dynamic Kinetic Energy Systems		
EM Launch	32 megajoules (MJ)	Not Applicable
Combustion Light Gas Gun	32 MJ	Not Applicable
Electrothermal-Chemical	32 MJ	Not Applicable
Directed Energy		
Acoustic	170 decibels (dB)	0-20 kilohertz
High Power Microwave	10 gigawatts	1-300 gigahertz
Radio Frequency	10 gigawatts	10 megahertz – 1 gigahertz
Laser	180 kilowatt (kW)	Infrared to Visible
Particle Beam	1.2 kAmps	Not Applicable
Laser Induced Plasma Channel	1 gigavolts; 10^{11} watts/square centimeters (W/cm^2)	Not Applicable
Loitering Aerial Munition Systems		
Not Applicable		

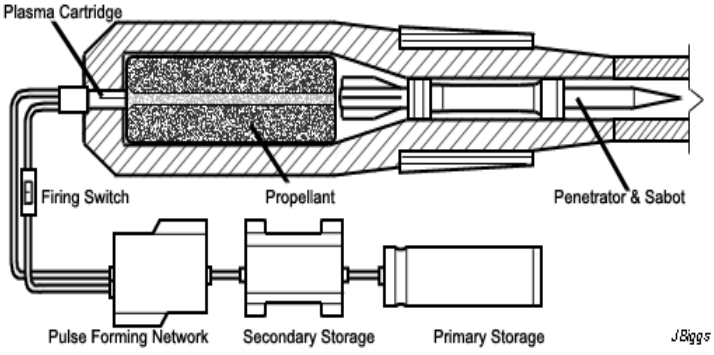
2.3.1.1 Electro-Dynamic Kinetic Energy Systems

For the purposes of this EA, electro-dynamic kinetic energy systems are advanced technology systems that have the potential to propel a projectile further and faster than conventional weapon systems. Three types of electro-dynamic kinetic energy systems are evaluated in this EA. These include EM launch, combustion light gas gun, and electrothermal-chemical.

Electromagnetic Launch – EM launch systems use electricity conveyed through coils (coilgun) or along electric conductive rails (railgun) to propel projectiles. While various EM launch technologies or railguns could be demonstrated at Fort Sill, there are two major technology paths currently under development in the U.S. Department of Defense (DoD). One system being developed by the Navy uses the magnetic field created by high electrical currents to accelerate a sliding metal arm between two rails to launch projectiles. Another alternate technology uses a high electrical current conducted along the rails to drive the projectile with plasma (ionized gas).

The high velocity of these projectiles and the large kinetic energy (energy relating to the motion of an object) allow the projectile to cause significant damage down-range without the need for high explosives. The high velocities also extend the range of these projectiles beyond the range possible with conventional propellants. Research and development of these technologies has occurred since the 1920s. The Office of Naval Research is in Phase II of its railgun development, which began in 2005. Demonstrations of the technology have occurred at Dugway Proving Grounds in 2009-2010 and are ongoing at the Naval Surface Warfare Center Dahlgren, Virginia. The ship variant of the Naval railgun is anticipated to deploy within two years.

Combustion Light Gas Gun – These systems are based on the replacement of the traditional solid propellant by low molecular weight, combustible gas mixes (e.g. hydrogen, oxygen). The gas mix is pumped into a chamber and then ignited using a small electrical ignition source. Research on the combustion light gas gun has been ongoing for more than 10 years and has shown that the technology provides a minimum of 30 percent more muzzle energy than advanced solid propellant guns. Other benefits of combustion light gas guns are the ability to manufacture propellant in the field and the ability to automatically adjust the propellant charge as needed. The combustion light gas gun is a scalable technology, with current working prototypes in 16, 45, and 155-millimeter (mm) bore sizes.



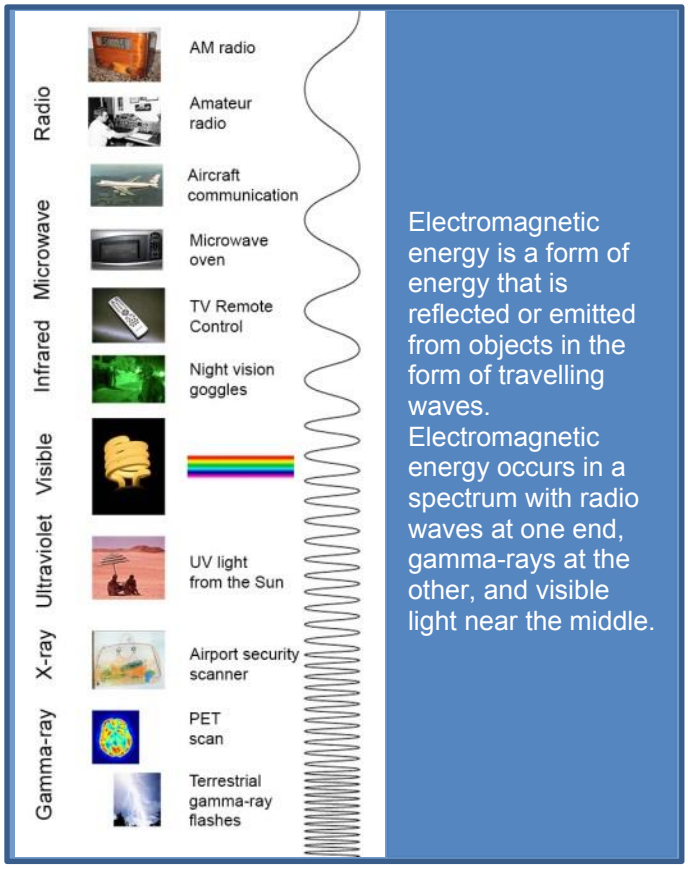
Artist rendering of an electrothermal-chemical gun. Photo credit: http://en.wikipedia.org/wiki/Electrothermal-chemical_technology.

Electrothermal-Chemical Gun – These systems are a solid propellant-based artillery weapon in which the conventional ignition system has been replaced with a plasma cartridge to ignite and control the ammunition's propellant. Electrical energy is used as a catalyst to start the ignition process. The use of plasma as an ignition source has the benefits of reduced ignition delay time, highly repeatable ignition time, and enhanced burning and combustion of the solid propellant.

2.3.1.2 Directed Energy Systems

Six types of directed energy systems are evaluated in this EA. These include acoustic, high power microwave, radio frequency, laser, particle beam, and laser-induced plasma channel.

Acoustic – The acoustic systems are based on audible warnings and deterrence. These systems use directed sound waves rather than directed energy. These directed sound systems allow military units to: issue highly intelligible, authoritative voice commands, with the option of broadcasting powerful deterrent tones to enhance response capabilities, as well as communicate in multi-lingual formats. The Long Range Acoustic Device (LRAD) has seen service in Iraq since 2010 with Military Police units.



High Power Microwave – High power microwave systems produce short bursts of microwave energy which can be lethal to electronics with no effects on personnel operating the equipment. The low collateral damage aspect of the technology makes high power microwave systems useful in a wide variety of missions in which avoiding civilian casualties is a major concern. The wide array of systems that fall into this category can focus on counter-electronics missions delivered via a high powered microwave dish. Such a system was demonstrated at Fort Sill in 2013 to exhibit the use of high-powered microwaves to degrade the electronic systems of an unmanned aircraft system (UAS). These systems could also be delivered via missile. A high powered microwave missile (Counter-Electronics High Power Microwave Advanced Missile Project [CHAMPS]) was tested at Dugway Proving Grounds in October 2012 to provide focused, high-powered microwave effects in specific environments (such as buildings), and the Air Force continues development of this missile for both air-to-air and air-to-ground roles.

The high powered microwave could also be used in crowd control situations. The Solid State Active Denial Technology is a system that has been deployed in Afghanistan since 2010. This system heats the top layer of human skin without penetrating further into the tissue, creating a burning sensation that ceases as soon as the person is outside the beam path or the microwave is turned off.

Radio Frequency – Similar to high powered microwaves, these systems use frequency outside the microwave bands of the EM spectrum. A high-energy radio frequency (HERF) is a directed-energy system used to disrupt digital equipment, such as computers. HERF works by blasting high-intensity radio waves at electronics, disrupting their operation.

Laser – Laser systems generate brief, high-energy pulses to degrade or destroy threats. Systems under development include the High Energy Laser Mobile Demonstrator, the High Energy Laser Liquid Area Defense System, and phased array laser weapon systems. The High Energy Laser Mobile Demonstrator completed a successful demonstration of a 10 kilowatt (kW) laser at White Sands Missile Range in December 2013. The High Energy Laser Liquid Area Defense System is scheduled to conduct demonstrations and tests at White Sands Missile Range in 2014 with a planned 150 kW laser. The coherent optical phased array lasers are currently under development by the Defense Advanced Research Projects Agency's (DARPA's) Excalibur program and anticipate the ability to demonstrate this technology in the fall of 2014. These lasers could potentially be used to defend against rocket, artillery, mortar, and UAS threats, as well as in a direct fire mode in ground combat vehicles.

The High Energy Laser Mobile Demonstrator successfully engaged more than 90 mortar rounds and several unmanned aircraft systems in flight during testing in 2013. The program is managed by the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command's Technical Center. Photo credit U.S. Army.

Particle Beam – These systems use a high-energy beam of atomic or subatomic particles to damage the threat by disrupting its structure. A particle-beam directs energy in a particular and focused direction using particles with negligible mass. Significant research and development occurred with this technology in the 1980s as part of the Strategic Defense Initiative program, and was recently revitalized by the Air Force at Kirtland Air Force Base in 2010.

Laser Induced Plasma Channels – These systems are based on the creation of a path through the atmosphere using a laser beam that is electrically conductive; this path then facilitates the delivery of a powerful electric current against the threat. In June 2012, engineers at Picatinny Arsenal demonstrated the potential weapon capability of a laser induced plasma channel system.

2.3.1.3 Loitering Aerial Munition Systems

The LAMS are guided munitions to counter both aerial and ground threats. These systems allow small infantry units the capability to engage threats beyond the range of current line-of-sight (LOS) weapons. LAMS have the capability to be launched, loiter over the battlefield, and then target objectives as needed. In 2013 the Army purchased the Switchblade, which is a small, self-contained, self-launched LAMS capable of being carried in a backpack and operated by a single user. Numerous other similar systems, such as Single Multi-Mission Attack Munition (SMAM), are being evaluated by the Army and other DoD branches. For the purposes of the analysis, all LAMS proposed to be demonstrated at Fort Sill would be electrically powered.

2.3.2 Demonstration Process at Fort Sill

Prior to the initiation of any demonstrations, detailed coordination and approval from numerous internal and external organizations would be completed to ensure compliance, safety, and protection of human health and the environment. Organizations involved in the coordination and

approval process include: U.S. Army Public Health Command, TCM-Ranges, Army Spectrum Management, the Federal Communications Commission (FCC), the FAA, and the Laser Clearing House. Agencies on the installation include: the Network Enterprise Center, Range Operations, Safety, Staff Judge Advocate, Environmental Quality Division (EQD), and other tenant units.

Planning to execute demonstrations would start months prior to the event with the initial identification of potential technologies relevant to the Fires community. Agreement documents between government, academia, and industrial partners would outline the roles and responsibilities of each party, information required to meet Range Operations procedures, and documentation of coordination with agencies outside of Fort Sill to gain approval as required. Each demonstration would typically last from four to six weeks. A representative timeline for demonstrations could include one and a half weeks to set-up at the range, one and a half weeks for demonstration, and one and a half weeks to remove all equipment from Fort Sill. However, each technological system would have unique timelines and requirements. The proposed demonstrations would occur approximately, but not limited to, six times per calendar year at Fort Sill.

In order to minimize the impact on current training requirements for existing units at Fort Sill, the proposed action would follow normal range scheduling and utilization protocols. The demonstrations would be conducted in accordance with all current Fort Sill safety and coordination requirements, as well as additional risk mitigation measures, as necessary.

Fort Sill Range Operations is responsible for the review and approval of the Army-approved safety zones associated with each system. The safety zones would be established to provide a graphical depiction of the potential hazard areas of each system proposed to be fired on the Fort Sill ranges. Consequently, each time a demonstration is conducted at Fort Sill, the Army must approve that specific system prior to the event as part of the required coordination.

2.4 ALTERNATIVE IDENTIFICATION

The alternative identification process for demonstrations of various Electric Fires and LAMS started with the development of criteria based on the FCoE Commander's guidance and the advanced technology mission of the FCoE. These criteria were then applied to a number of potential alternatives to narrow the alternatives to a reasonable range that could support the criteria.

This section establishes and describes the criteria used to evaluate the alternative against the purpose and need of the proposed action. Alternatives considered but not carried forward are explained in Section 2.5. A list of alternatives carried forward for analysis is described in Section 2.6.

2.4.1 Alternative Development

The Army determined that a reasonable alternative should meet the criteria listed as follows:

- **Increase the Training Capacity and Capability of Fort Sill.** The demonstrations conducted at Fort Sill would prepare the foundation for eventual training once these systems are acquired and determined to be a program of record. As Army systems of the future enter the force, and consistent with its training mission, Fort Sill would be better prepared to transition smoothly from demonstration into training for the Field Artillery, Air Defense Artillery, and Electronic Warfare Soldiers using these systems.

- **Facilitate Timely FCoE Awareness and Integration of Revolutionary Technology with Future Fires.** The FCoE mission includes a responsibility for timely identification of new concepts, technologies, and vulnerability identification as part of the continual Concepts Development Directorate (CDD), FBL, and FCoE Commander's synergistic force modernization process.
- **Minimize Cost.** Minimize facility cost through the enhancement of existing Fort Sill facilities, and minimize the process costs through the execution of demonstrations at Fort Sill, where the CDID is located. The ability to demonstrate these technologies at Fort Sill would minimize costs to the government. Additionally, with feedback from CDID as a demonstration participant, it is foreseeable that these technologies would be better postured to transition more efficiently into the Army acquisition process.
- **Avoid Proximity to Public Use Areas.** In order to ensure safety and security, the demonstrations need to occur in a location that minimizes potential exposure to non-participating personnel and members of the general public. This would include public use sites on or near Fort Sill, such as the main cantonment area, cemeteries, agricultural leases, and the Wichita Mountains National Wildlife Refuge (WMWR).
- **Provide Adequate Geographic Mitigation Measures.** The demonstration location needs to offer sufficient terrain, such as large hills, to serve as backstops to minimize system effects and avoid impacting existing electronic range systems.

2.5 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

During the early planning stages for the proposed action, the CDID considered the possibility of conducting demonstrations at locations other than Fort Sill. It was determined that the use of external locations for the demonstrations would not meet the requirements outlined in TRADOC Regulation 71-20 and would not enhance the training capability at Fort Sill. In addition, demonstrations at locations off Fort Sill would be more costly, less efficient, and less effective than demonstrations at Fort Sill. External locations would require additional financial and other resources to move Soldiers between classroom and field training sites. Coordinating calendars for the FCoE leadership to meet at an external location at a specific time is more difficult when travel factors would also have to be considered. Furthermore, the use of an external location prevents participation and support from the operational brigade and battalion commanders on Fort Sill. Historically, coordination of efforts between test facilities and doctrine centers has challenged the Army. Testing information and data transmitted electronically cannot provide the same impact on the concepts and requirements developers as personal observance of system capabilities. The physical separation of event location and CDID personnel would foster disconnects. Fort Sill would incur significant travel and billeting costs even if the calendars and timing were able to align. For these reasons, this alternative was considered but not carried forward for environmental analysis.

Alternate geographic locations on Fort Sill were also considered during the early planning stages of the proposed action. Locations at the East Range area and at the Quanah Range area were discussed with Range Operations as potential alternatives to the West Range area. The Quanah Range contains the Falcon Bombing Range, an Air Force Reserve facility used by all

military services. The Quanah Range was eliminated from further consideration due to incompatibility with the existing uses of that particular range area on Fort Sill.

2.6 ALTERNATIVES

Based on the alternative narrowing criteria, two action alternatives are carried forward for further analysis. These alternatives are listed below. The No Action Alternative is described in Section 2.2.

1) Conducting demonstrations in the West Range area at Fort Sill;
2) Conducting demonstrations in the East Range area at Fort Sill; and
3) No Action Alternative.

2.6.1 Alternative 1 – Demonstrations on West Range Area at Fort Sill

The West Range area at Fort Sill includes both the West Range and the training areas east of Highway 115 and west of I-44 on the installation (Figure 2.6-1). However, no demonstrations would occur east of Tower Two Road. Implementation of this alternative would mean that the demonstrations described in Section 2.3 and Table 2.3-1 would be carried out in the West Range area at Fort Sill.

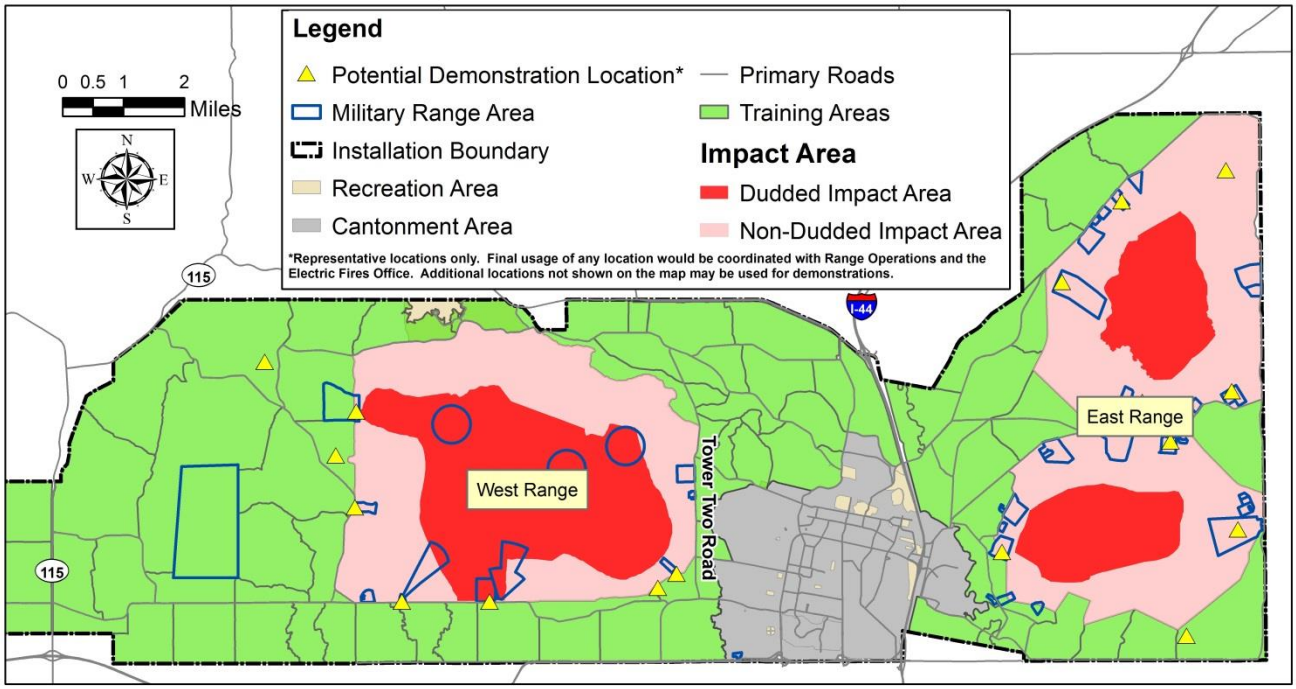


Figure 2.6-1. Alternative Locations on Fort Sill

Upon approval by Range Operations, demonstrations could occur on Firing Point 240E or ranges located in the West Range area. Representative locations that could potentially be used for demonstrations are shown on Figure 2.6-1. Demonstrations of a specific system or technology at a specific location would be dependent on range conditions, range scheduling, limitations of the location (e.g. lack of a suitable backstop, potential interference with electronic target systems, environmental constraints, etc.), and final approval of Range Operations. For example, the safe

use of electro-dynamic kinetic energy systems is dependent in part upon a suitable impact area that meets the safety zone requirements for that system. The demonstration location would require an appropriate firing location that fits the requirements of the pre-determined and approved safety zone. As described in Section 2.3, approval of system-specific safety zones would be part of the process required to demonstrate a specific technology at Fort Sill. In other cases, directed energy systems such as high powered microwave would not require an impact zone for safe firing but would not be able to fire in a direction that could potentially disrupt existing electronic systems in the West Range area.

The variables listed above are examples of the potential considerations that would be part of the process required to demonstrate a technology at Fort Sill. The final determination of whether a particular technology could be demonstrated, where the demonstrations could occur, and what additional procedures are required for an effective and safe demonstration would be finalized by CDID and Range Operations.

Implementation of Alternative 1 also includes improvements to Firing Point 240E in the West Range area. Firing Point 240E (Figure 2.6-2) is an existing improved artillery firing point with a gravel access road, gravel and concrete firing pads, and earth berms. Improvements at this location would include construction of a concrete pad (100 x 100 feet), conversion of 1,500 feet of utility line from aboveground to below ground, construction of one building (a 20 x 30 foot building with an observation deck), earth work to remove and flatten existing man-made berms (less than 0.2 acres), and construction of a gravel parking area (100 x 100 feet).

2.6.2 Alternative 2 – Demonstrations on East Range Area at Fort Sill

The East Range area at Fort Sill includes both the East Range and the training areas east of I-44 to the east boundary of the installation (Figure 2.6-1). The East Range area is comprised of the North Arbuckle Range and the South Arbuckle Range. The North Arbuckle Range is approximately 8,562 acres while the South Arbuckle Range is approximately 6,913 acres. Unlike Alternative 1, these ranges are geographically separated and not contiguous. Implementation of this alternative would be the same as that described for Alternative 1, with the exception of the improvements described for Firing Point 240E. No improvements would be required at any location in the East Range area.

2.7 SUMMARY COMPARISON OF ENVIRONMENTAL CONSEQUENCES

Table 2.7-1 summarizes the potential environmental consequences anticipated to result from implementation of each of the three alternatives. The consequences associated with implementing the proposed demonstrations at Fort Sill are presented for each environmental resource area, except those described in Section 1.8.

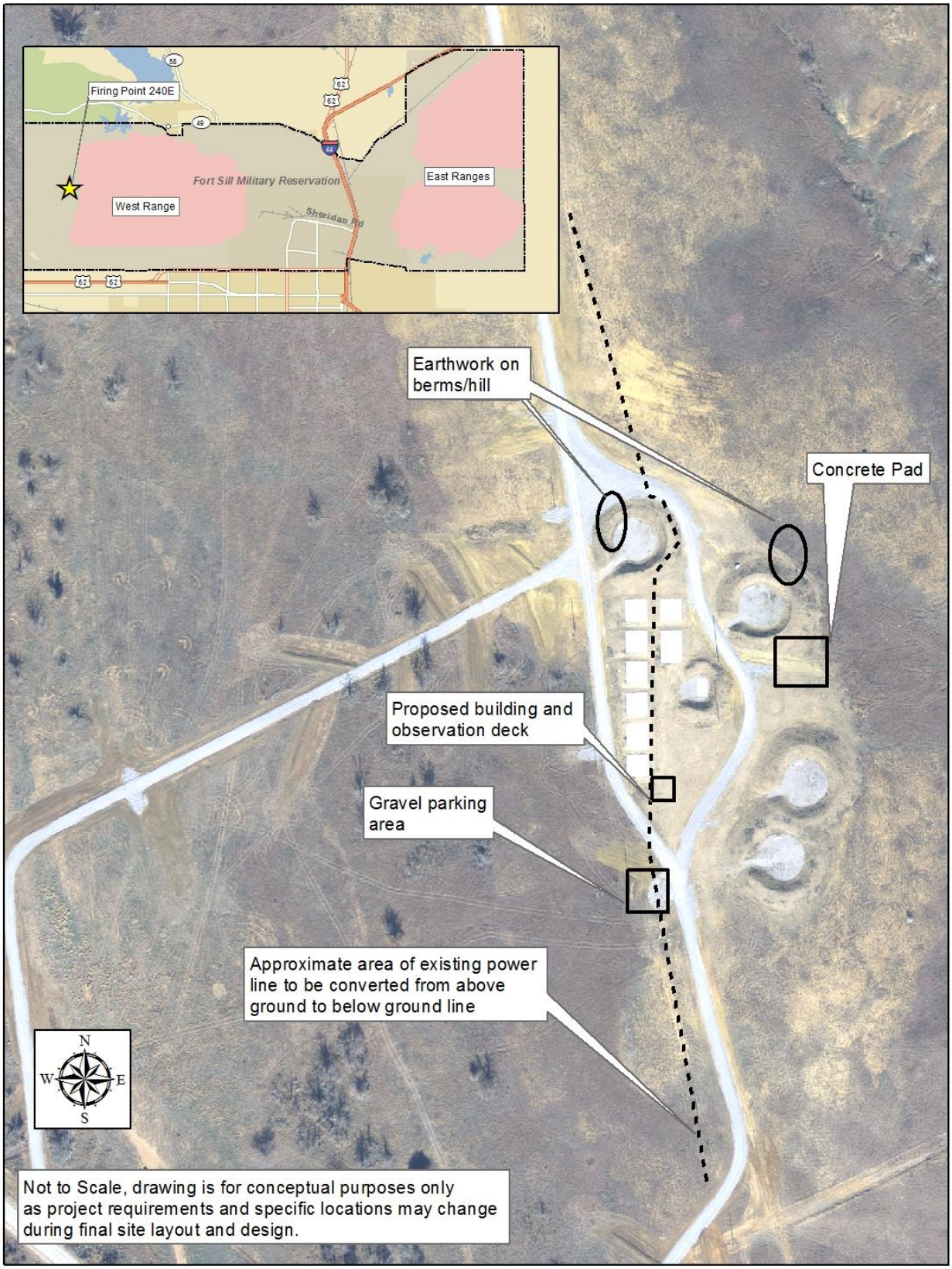


Figure 2.6-2. Firing Point 240E

Table 2.7-1. Summary Comparison of Environmental Consequence by Resource and Alternative

Environmental Resource	No Action	Alternative 1	Alternative 2
Land Use	Implementing the No Action Alternative would result in no changes or consequences at Fort Sill. The No Action Alternative would not provide areas to allow the demonstration of advanced technologies at the installation. In addition, implementation of the No Action Alternative would prevent the FCOE CDID from accomplishing their mission to bring concepts to Programs of Record.	Minor impacts associated with deconflicting range use. No significant impacts to land use at the installation. No impacts to land uses outside of the Fort Sill boundaries are anticipated.	Additional agricultural leases and high use of the East Range area by other units would result in slightly more minor impacts associated with deconflicting range usage. These impacts would not be significant. No impacts to land uses outside of the Fort Sill boundaries are anticipated.
Health and Safety	No Impacts	Strict adherence to the existing Fort Sill health and safety regulations and approval demonstrations by Fort Sill Range Operations would minimize the health and safety risks associated with demonstrations of all technologies. Demonstrations are anticipated to have no significant impacts on health and safety at Fort Sill.	Strict adherence to the existing Fort Sill health and safety regulations and approval demonstrations by Fort Sill Range Operations would minimize the health and safety risks associated with demonstrations of all technologies. Demonstrations are anticipated to have no significant impacts on health and safety at Fort Sill.
Air Quality	No Impacts	Increased emissions from construction and range improvements would result in only a short-term, temporary increase in emissions. Demonstration impacts would amount to less than one percent of the ROI's overall annual air emissions on a pollutant-by-pollutant basis for all pollutants except for sulfur oxide (SO_X). SO_X emissions would total 2.57 percent of the annual SO_X emissions for Comanche County. There would be no significant impact to local or regional air quality from implementation of Alternative 1.	No increased emissions from construction and range improvements would occur as implementation of Alternative 2. Demonstration impacts would amount to less than one percent of the ROI's overall annual air emissions on a pollutant-by-pollutant basis for all pollutants except for SO_X. SO_X emissions would total 2.57 percent of the annual SO_X emissions for Comanche County. There would be no significant impact to local or regional air quality from implementation of Alternative 2.
Noise	No Impacts	Noise levels associated with the demonstrations are comparable to noise levels generated by systems currently in use at Fort Sill. No significant impact to the noise environment is anticipated as a result of implementing Alternative 1.	Noise levels associated with the demonstrations are comparable to noise levels generated by systems currently in use at Fort Sill. No significant impact to the noise environment is anticipated as a result of implementing Alternative 2.

Table 2.7-1. Summary Comparison of Environmental Consequence by Resource and Alternative (Continued)

Environmental Resource	No Action	Alternative 1	Alternative 2
Biological	No impacts	Short-term, minor, adverse impacts to vegetation and wildlife would occur as a result of implementing Alternative 1. These impacts would not be significant. No impacts to the federally endangered black-capped vireo are anticipated to result from implementation of Alternative 1, as demonstrations would avoid nesting habitat for the vireo during the nesting season.	Short-term, minor, adverse impacts to vegetation and wildlife would occur as a result of implementing Alternative 2. These impacts would not be significant. No impacts to the federally endangered black-capped vireo are anticipated to result from implementation of Alternative 2, as nesting habitat for the vireo does not occur in the East Range area.
Cultural	No Impacts	No adverse impacts to cultural resources are anticipated to result from implementing Alternative 1.	No adverse impacts to cultural resources are anticipated to result from implementing Alternative 2.
Hazardous Materials and Waste	No Impacts	No significant impacts to hazardous materials use and management, hazardous waste generation and management, and hazardous waste disposal are anticipated to result from implementing Alternative 1.	No significant impacts to hazardous materials use and management, hazardous waste generation and management, and hazardous waste disposal are anticipated to result from implementing Alternative 2.
Cumulative Effects	No impacts	No significant cumulative impacts are anticipated to result from the implementation of Alternative 1.	No significant cumulative impacts are anticipated to result from the implementation of Alternative 2.

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3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 LAND USE

3.1.1 Affected Environment

3.1.1.1 Definition of the Resource

Land use describes the way the natural landscape has been modified or managed to provide for human needs. In developed and urbanized areas, land uses typically include residential, commercial, industrial, utilities and transportation, recreation, open space, and mixes of these basic types. Other uses such as mining, extractive activities, agriculture, forestry, and specially protected areas (such as larger monuments, parks, and preserves) are usually found on the fringes of or outside of urbanized areas. Plans and policies guide how land resources are allocated and managed to best serve multiple needs and interests. Federal, state, and local statutes, regulations, plans, programs, and ordinances define specific limitations on uses.

For the purposes of this land use analysis, the Region of Influence (ROI) for Alternatives 1, 2, and the No Action Alternative includes the land within and immediately surrounding Fort Sill.

Potential impacts on land use can result from actions that (1) change the suitability of a location for its current or planned use (e.g., noise exposure in residential areas); (2) cause conditions that are unsafe for range and training area usage and the public welfare; (3) conflict with the current and planned use of the area based on current zoning, amendments, agreements, regulatory restrictions, management, and land use plans; or (4) displace a current use with a use that does not meet the goals, objectives, and desired use for an area. The degree of land use effects (negligible, minor, moderate, or significant) is based on the level of land use sensitivity in areas affected by a proposed action, the magnitude of change, and the compatibility of a proposed action with existing or planned land uses.

3.1.1.2 Existing Conditions

3.1.1.2.1 Installation

Land use at Fort Sill is primarily for military training and operational purposes. The installation is divided into the cantonment area, maneuver training areas, live fire training ranges, artillery firing points, ordinance impact areas, and areas unsuitable for training. The cantonment area contains the administrative areas, medical facilities, the Henry Post Army Airfield, a cemetery, family housing, barracks, and other Soldier housing. The cantonment area and areas unsuitable for training (landfill, recreation area, cultural sites, ammunition supply point, etc.) comprise 8,312 acres. The maneuver training areas comprise 45,266 acres (heavy, 38,735 acres; light, 6,531 acres) and provide land for outdoor dismounted maneuver training and mounted heavy and light vehicle maneuver training. The remaining 39,991 acres consist of the four live fire training range impact areas (dudded and non-dudded) and other non-maneuver related training areas.

The three ranges at Fort Sill are the Quanah, West, and East Ranges. The ranges on Fort Sill are shown on Figure 1.2-1. The East Range is used primarily for small arms weapons training. The West Range is used for both artillery and live aircraft bombing training. The Quanah Range is

used primarily by the Air Force for air-to-surface munitions training and maneuvers (inert and training bombs, rockets, strafe, and laser) (Fort Sill 2005). As discussed in Section 2.5, the Quanah Range was eliminated as an alternative for demonstrations. All Fort Sill ranges are managed under the Army's Sustainable Range Program (SRP) core programs, the Range and Training Land Program (RTLP) and the Integrated Training Area Management (ITAM) Program. The RTLP provides central management, programming, and policy for the modernization of the Fort Sill Ranges and their day-to-day operations. The ITAM provides Fort Sill range officers with the capability to manage and maintain training and testing land by integrating mission requirements with environmental requirements and sound land management practices (AR 350-19). The regulations, policies, and procedures for scheduling, maintenance, and safe operations on Fort Sill's ranges and training areas are described in Fort Sill Regulation 385-1 (Fort Sill 2012). Department of Army Pamphlet (DA PAM) 385-63, *Range Safety*, provides additional applicable information on Fort Sill range safety and the standards and procedures for the safe firing of ammunition, demolitions, lasers, guided missiles, and rockets; and the delivery of bombs for training and target practice. Fort Sill is currently developing a Range Master Plan along with a Real Property Master Plan.

Endangered and threatened species habitats and management is also a land use at Fort Sill and within the West Range area. Portions of the installation and the West Range area are designated as nesting habitat for the black-capped vireo, a Federally listed endangered species (Figure 3.1-1). These black-capped vireo nesting areas are restricted to foot traffic during the nesting season (Fort Sill 2005). Additional information on the endangered and threatened species management at Fort Sill is located in Section 3.5.

Recreation areas (e.g. hunting and fishing) are also land uses at Fort Sill and within the West and East Range areas. With regard to hunting, the installation has been divided into hunter use compartments and areas. These divisions are based on habitat type and are available for use depending on the proximity to impact and training areas and their status of use. The hunting compartments and all West and East Range area ponds are only open to hunters and fisherman who have taken the Fort Sill Sportsman Safety Class (USAFACFS 2003). The responsibilities, procedures, and rules for hunters and fisherman utilizing Fort Sill's training areas are provided in Fort Sill Regulation 200-1 (Fort Sill 2009).

Additional land use within Fort Sill and the West and East range areas includes agricultural leases. These leases include cultivated fields, wildlife food plots, and mowed and hayed fields. These leased lands are within the maneuver areas and the non-dudded impact buffer zone, but are considered safe for agricultural purposes. These areas have been cleared, and the chance of a dud-related accident is remote (USAFACFS 2003). Agricultural use areas within the West and East ranges are considered off limits as training areas (Fort Sill 2012).

The black-capped vireo nesting habitat and the agricultural lease areas pose training and operational constraints in the West and East range areas. These constraints are shown on Figure 3.1-1.When active firing training and operations are occurring, the relevant surface danger zones (SDZs) also pose a constraint at Fort Sill and in the West and East range areas.

3.1.1.2.2 Surrounding Areas

Land use surrounding Fort Sill consists of sparsely populated residential areas and agricultural areas, except to the north and west where the WMWR is located (Fort Sill 2006). The WMWR

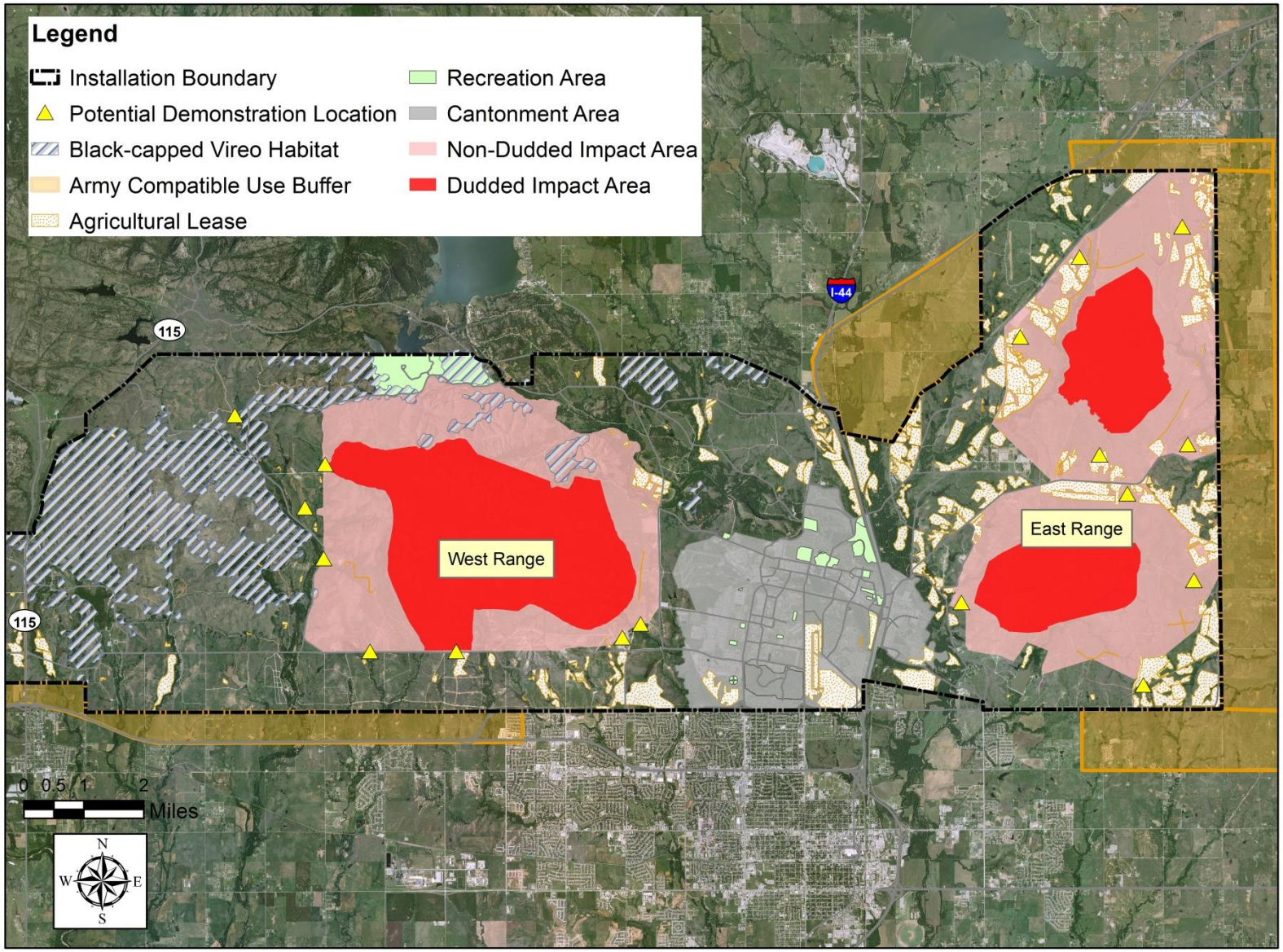


Figure 3.1-1. Fort Sill Land Use and Potential Constraints

comprises 59,020 acres and contains rare remnant mixed-grass prairie and a herd of Texas Longhorn cattle. This refuge was established to protect and restore wildlife species and provide habitat for large, native, grazing animals. WMWR offers wildlife watching, hunting, fishing, and other related activities (USFWS 2014a). Additionally, the Fort Sill cantonment area is located north of and adjacent to the City of Lawton, which is the only major metropolitan area near the installation (Figure 1.2-1). There are also several smaller communities near Fort Sill. These include Cache, Elgin, Indiahoma, and Medicine Park.

In 2004, Fort Sill obtained approval to purchase six Army Compatible Use Buffer (ACUB) zones, totaling 19,415 acres, along the northeastern, eastern, southern, and western boundaries of the installation (Figure 3.1-1). The purchase of these conservation easements is being completed in cooperation with Land Legacy Inc., an Oklahoma nonprofit corporation. These ACUB zones prevent encroachment on Fort Sill's ranges and training activities from non-compatible community development on land adjacent to the installation. ACUB zones do not increase the available training areas and ranges, but do help ensure that Fort Sill can use the full extent of its available training lands (Fort Sill 2004, Fort Sill 2006).

3.1.2 Environmental Consequences

3.1.2.1 No Action Alternative

Under the No Action Alternative, Alternative 1 or 2 would not be implemented and no construction or demonstrations of Electric Fires and LAMS would occur. Implementation of the No Action Alternative would have no effects on land use at Fort Sill.

3.1.2.2 Alternative 1 – Demonstrations on West Range Area

3.1.2.2.1 Installation

Implementation of Alternative 1 would result in minor construction at Firing Point 240E (Figure 2.6-2). The construction of a concrete pad, a building with an observation deck, gravel parking lot, as well as burying 1,500 feet of utility line and the modification of man-made berms would have negligible effects on land use at the West Range area of Fort Sill. Firing Point 240E would continue to be used for artillery and other training as well as the proposed demonstrations.

Implementation of Alternative 1 would include the demonstration of Electric Fires and LAMS in the West Range area of Fort Sill. These demonstrations would utilize the West Range area under the same or similar procedures as the current weapons systems (artillery, laser, Multiple Launch Rocket System [MLRS], small arms, etc.) used at Fort Sill. The majority of Electric Fires demonstrations would be conducted from an established firing point into a designated impact area and within an Army-approved safety zone. Systems such as high power microwave, radio frequency, and acoustic could fire outside the impact area. As with the current weapons systems utilizing the West Range area, Fort Sill Range Operations would review the parameters and safety zones for the system(s) to be demonstrated and approve a set of operating parameters through the Demonstration Support Worksheet (DSW) approval process explained in Section 3.2.2. CDID is currently working with Directorate of Public Works Master Planning and TRADOC to ensure firing locations are properly designated for each weapon system. Therefore, conducting these demonstrations would result in negligible to minor effects on land use.

Endangered and threatened species management in the West Range area at Fort Sill would not change or be affected by implementation of Alternative 1. Black-capped vireo nesting areas would continue to be restricted to foot traffic during the nesting season, and those areas would continue to be managed as described in Section 3.5. No directed energy systems with the potential to exceed human health exposure limits would be demonstrated over vireo habitat if the portion of the safety zone that exceeds human health requirements would intersect with that habitat. Recreational use (hunting and fishing) in the West Range area and at Fort Sill would continue in accordance with AR 200-1. Recreational activities such as hunting would be prohibited in the area during live demonstrations, resulting in minor impacts to the availability of the West Range area for recreational activities.

Implementation of Alternative 1 would also result in no change to the use and management of the leased agricultural fields located in the West Range area. These fields would remain off limits to training activities (Fort Sill 2012) and the proposed demonstrations.

3.1.2.2.2 Surrounding Area

Implementation of Alternative 1 would be consistent and compatible with the existing land uses at Fort Sill. Range Operations would allow demonstrations only in areas where there is no potential for off-installation impacts. Demonstrations of Electric Fires and LAMS on the West Range area is not anticipated to have any effects on land use, and is not anticipated to create land use incompatibilities with ACUBs or the region surrounding the installation.

3.1.2.3 Alternative 2 – Demonstrations on East Range Area

3.1.2.3.1 Installation

Implementation of Alternative 2 would mean that Electric Fires and LAMS would be demonstrated in the East Range area of Fort Sill. Conducting these demonstrations would result in minor effects on land use. Like the consequences associated with the implementation of Alternative 1 (see Section 3.1.2.2.1), actions associated with the proposed demonstrations would be consistent and compatible with the East Range and the sub-ranges within the East Range area. Although no construction would be required as part of this alternative, additional coordination with Range Operations would be required due to the volume of basic and small arms training activities that currently occur within the East Range area. Range Operations would schedule the demonstrations in accordance with current Fort Sill range use policies to prevent any competing uses. Additional coordination would also be required to avoid demonstration in areas with high public visibility. Demonstrations could also be limited in the East Range area due to the additional acres of agricultural leased lands and the proximity of the proposed LAMS demonstration areas relative to the existing small arms ranges (see Section 3.2.2.3).

3.1.2.3.2 Surrounding Area

Implementation of Alternative 2 would be consistent and compatible with the existing land uses at Fort Sill. Range Operations would allow demonstrations only in areas where there is no potential for off-installation impacts. Demonstrations of Electric Fires and LAMS on the East Range area is not anticipated to have any effects on land use, and is not anticipated to create land use incompatibilities with ACUBs or the region surrounding the installation.

3.2 HEALTH AND SAFETY

3.2.1 Affected Environment

3.2.1.1 Definition of the Resource

This section addresses health and safety for activities and operations on the ground and in the air that have the potential to affect members of the public and Fort Sill personnel. Protection of human health and the environment has and continues to be an integral part of the Army's mission at Fort Sill. Activities on Fort Sill comply with all applicable federal and state, DoD-, Army-, and installation-level occupational health, safety and environmental requirements to ensure that activities are conducted with no or minimal risk to persons or the environment, both on and off of Fort Sill.

The Fort Sill Installation Safety Office mission is as follows: "To fully support the command's mission while providing the best possible accident and injury prevention programs for all of Team Sill personnel". This mission is fully supported by the Army's Installation Management Command's (IMCOM) safety mission.

All ranges on Fort Sill are managed in accordance with Fort Sill Regulation 385-1. This safety regulation covers activities on the ground and in Fort Sill airspace up to an altitude of 40,000 feet and applies to Army, Air Force, Navy and Marine personnel and civilians utilizing the installation range complex outside the cantonment area. Further, this regulation establishes risk management (RM) as the Army's principal risk reduction methodology and ensures regulatory and statutory compliance. It provides for public safety relative to Army operations and activities. Fort Sill Regulation 200-1 governs the recreations use of range training areas on Fort Sill.

The ROI for health and safety is Fort Sill and surrounding areas including the associated airspace. Range Operations is responsible for the safe management and operation of ranges on Fort Sill. Range management involves the development and implementation of those processes and procedures required to ensure that Army ranges are planned, operated, and managed safely. The focus of range management is on ensuring the safe, effective, and efficient operation of ranges and safe and efficient use of Restricted Areas (RAs). The overall purpose of range management is to balance the military need to accomplish realistic testing and training with the need to minimize potential impacts of such activities on human health, the environment, and surrounding communities.

3.2.1.2 Existing Conditions

3.2.1.2.1 Army Health and Safety Regulations

The Army's policies, responsibilities, and procedures to protect Army personnel and property are contained in AR 385-10, *Army Safety Program.* The regulation provides for operational safety and safe and healthy work places, and assures compliance with applicable laws and regulations. DA PAM 385-24 establishes Army radiation safety guidance and direction. It provides guidance and direction to implement the requirements of AR 385-10. Regulations and guidance pertaining to the safe use of ranges on Army installations is contained in AR 385-63, *Range Safety*. This regulation covers range usage from live firing of small arms to rockets, guided missiles, and lasers, and provides guidance for minimizing the risk of using these weapons.

3.2.1.2.2 Fort Sill Health and Safety Regulations

Fort Sill also has its own health and safety regulations, contained in Fort Sill Regulation 385-1, *Post Range Regulation,* and Fort Sill Regulation 358-10, *Safety Regulation*. These regulations implement requirements of the Occupational Safety and Health Act (OSHA) of 1970 as implemented in EO 12196, Department of Defense Instruction (DoDI) 6055 Series, and AR 385-10. Fort Sill Regulation 385-1 establishes responsibilities, procedures, and rules for all personnel utilizing the Installation range complex by personnel assigned, attached, or transient to Fort Sill. Fort Sill Range Operations is responsible for range safety, controls weapons firing and the use of training facilities, and is responsible for the management of aerial operations within the range complex at Fort Sill. Fort Sill Range Operations also provides clearance for aircraft overflights of the RA.

Wide varieties of different weapon systems are currently used at Fort Sill on a daily basis. These systems range from small arms (12 gauge shotgun, M-16, M203, 50 caliber) to anti-tank guns such as the AT4 to larger field artillery such as the 155 mm Howitzer, the Avenger missile system and the High Mobility Artillery Rocket System (HIMARS). Fort Sill Range Operations is responsible for the management and operation of all the ranges to prevent conflicting uses and provide a safe training environment for Soldiers and the public.

Range operations require that the surface area encompassing the weapon safety footprints be protected by purchase, lease, or other restriction to ensure the safety of personnel, structures, and the public from expended rockets, missiles, or target debris and hazardous operations. The lands associated with the Fort Sill training ranges meet these requirements.

Public health and safety concerns associated with the Fort Sill airspace operations are largely associated with aviation and weapons safety. Range Operations continually assesses the risks associated with weapons employment and establishes mission parameters that minimize the potential safety hazards. Specific weapon safety footprints must be assessed against each intended target to ensure that they can be safely used. Range operations develops range management plans for the training ranges used and transient aircraft. In addition, Range Operations assigns responsibilities and provides direction regarding range scheduling, maintenance, explosive ordnance disposal (EOD), range decontamination, and debris disposal.

SDZs are a key aspect of providing safe ranges. SDZs are designed to make the probability of hazardous fragment or round escapement from installation boundaries unlikely and to minimize the danger to the public, installation personnel, facilities/equipment, and property. SDZs and associated exclusion areas are off-limits to non-participating personnel during active range use (DA PAM 385-63).

Wildfires are a growing natural hazard in most regions of Oklahoma and the Southwest, posing a threat to life and property, particularly where native ecosystems meet developed areas. Fort Sill maintains a Fire Mitigation Plan to help prevent and manage wildfires at the installation. Range Operations personnel monitor weather and fire conditions from resources available for fire intelligence information including the National Fire Danger Rating System website, and then provide recommendations to operations personnel. These recommendations address the need to alter flight or ground operations and, if the risk is excessive as determined on a situational basis,

impose restrictions on range operations. These restrictions could include limiting the type of ordnance used, or the complete curtailment of ordnance use or other range operations.

3.2.1.2.3 Electro-Dynamic Kinetic Energy Health and Safety

Safety issues related to electro-dynamic kinetic energy systems are primarily related to range safety. Other safety issues include the safety to personnel during the firing of these systems. Some electro-dynamic kinetic energy systems could generate strong electric and magnetic fields while other systems use potentially harmful materials. The DoD and Army's safety program provides policies, responsibilities, and procedures to protect Army personnel. In addition to the regulations mentioned above, DoDI 6055 provides permissible exposure limits for Army personnel that have occupational exposures to electric and magnetic fields.

3.2.1.2.4 Directed Energy Health and Safety

Effects of EM energy on people or other biological organisms have been well studied for more than 50 years. These effects are dependent upon a number of factors, including frequency, power settings, size and shape of a person, and a person's ability to dissipate the excess heat caused by energy being absorbed through normal biological functions. Higher frequencies (e.g., microwaves, radio) have less penetration depth due to the shorter wavelengths, which are susceptible to reflection and refraction based on the energy level, material composition (i.e., moisture content) and absorption rate.

In 2005, the Institute of Electrical and Electronic Engineers (IEEE) completely revised the Standard C95.1 Safety Levels with Respect to Human Exposure to Radio Frequency and Electromagnetic Fields. More than 1,000 documents were used in the revision of the standard. The standard uses the specific absorption rate (SAR), which was developed to measure the rate at which EM energy is absorbed in the human body. SAR is expressed in units of watts per kilogram (W/kg), and is used to determine the potential harmful effects to humans. Research, based in part on animal trials, has shown that a rate of 4 W/kg over a six minute time period has not revealed any harmful effects to humans (IEEE 2005). To further ensure the safety of personnel, the IEEE C95.1 Standard added a safety factor of 10 and determined the permissible occupational exposure limit to personnel at 0.4 W/kg. These absorption rates are often difficult to measure directly; therefore, C95.1 expresses exposure limits in terms of the power flux densities (watts per square centimeter [W/cm^2] or kilowatts per square centimeter [kW/cm^2]) of EM energy required to exceed the permissible SAR limit.

The exposure limit of 0.4 W/kg is just one safety factor relating to the exposure of personnel to EM energy. Other factors such as if the environment is controlled (i.e. personnel are aware of the exposure in a work environment); uncontrolled (areas where high levels of EM energy would not be expected); if the exposure is whole body or partial; or if the EM energy is pulsed or continuous determine different permissible exposure limits. These limits are explained in detail in IEEE C95.1. The DoD incorporates the current IEEE C95.1 by reference in DoDI 6055.11.

The majority of experimental data on EM energy have concluded that the effects on organisms are primarily related to the heating effect of this energy and the ability of the body to deal with the excess heat. Unlike ionizing radiation, exposure to EM energy does not result in cumulative effects. Once the source of the radio frequency is turned off or removed, exposure stops.

In addition to safety related to personnel, EM energy has the potential to impact fuel, ordnance, or create interference with devices that generate EM energy. High levels of EM energy can potentially ignite fuel or detonate nearby ordnance. For these reasons, the Army creates safety zones for fuel, ordnance, and EM interference around systems that emit high levels of EM energy.

A wide variety of different radio frequencies are currently in use at Fort Sill, all of which are closely regulated in compliance with AR 5-12, *Army Use of the Electromagnetic Spectrum*. The Fort Sill Frequency Manager (FM), as part of the Fort Sill Network Enterprise Center (NEC), is responsible for the management of all frequencies on Fort Sill. The Army Frequency Management Office (AFMO) in San Antonio, Texas, provides the FM with a set list of frequencies available for local distribution and use on Fort Sill. If a proponent requires the use of a frequency that is not on this list, the proponent is required to complete a Frequency Request Form (FRF). The FRF requires specific information about the frequency request, including technical parameters such as output power, emission designator types, type of antennae, and whether the source will be fixed or mobile. Upon receipt of the completed FRF, the FM coordinates with AFMO to initiate the frequency deconfliction process. As part of this process, the AFMO would coordinate with the entity that owns the requested frequency and obtain permission for frequency use. The timeline associated with the deconfliction process could vary depending on existing uses of that frequency, but could range between 45 and 180 days.

Lasers – Lasers are currently used on Fort Sill as pointers, markers, target designators, and for other purposes. All four classes of lasers are used. While Class 1 and 2 lasers can be used anywhere, Class 3 and 4 lasers can only be used in designated areas.

The U.S. Army Public Health Command Nonionizing Radiation Program (MCHB-IP-ONR) provides laser range specific technical expertise on laser hazards to personnel operating lasers. Fort Sill Regulation 385-1, Chapter 8, provides guidance for the safe use of tactical lasers, pointers, and markers on Fort Sill, excluding Falcon Range. Per this regulation, Fort Sill Range Operations will develop procedures for laser demonstrations on a case-by-case basis.

The Laser Range Safety Officer (LRSO) is responsible for the safe conduct of laser operations at lasing points. Army laser range safety guidance is described in DA PAM 385-63. The specific guidelines to ensure the proper control of hazardous laser energy are outlined in Military Handbook (MIL-HDBK)-828B, Chapter 8. Chapter 7 of DA PAM 385-24 identifies the training requirements for laser safety officers.

The use of lasers on Falcon Range is closely regulated by the provisions contained in Air Force Instruction (AFI) 13-212, Chapter 4, and AFI 48-139. The Falcon Range has been certified by the Air Force Research Laboratory for the safe use of most DoD-fielded, fixed-wing and man-portable laser systems. The most recent Air Force Research Laboratory optical radiation safety consultative letter, Falcon Range Laser Safety Survey, is maintained at Falcon Range and at 301st Operations Group Commander, Naval Air Station Fort Worth Joint Reserve Base, Texas, 76127-6200.

3.2.2 Environmental Consequences

Demonstrations of a specific system or technology at a specific location would be dependent on range conditions, range scheduling, limitations of the location (e.g. lack of a suitable backstop, potential interference with electronic targets, environmental constraints, etc.), and final approval of Range Operations.

As part of the preparation process for Electric Fires demonstrations at Fort Sill, the entity proposing the demonstration would complete the DSW contained in Appendix B. The DSW includes detailed information about the specific demonstration and mission specific information including success criteria, narrative descriptions of the demonstration process, equipment characteristics, target descriptions and characteristics and anticipated safety, frequency, security, communications, and medical requirements. The DSW also includes a signature line for the requesting entity and a signature line for the approval by the CDID representative. Receipt of the DSW by the Electric Fires Office initiates the demonstration approval process. Depending on the technology to be demonstrated, a variety of different internal and external organizations and agencies would be involved with review and approval of the demonstration.

Appendix B also contains the system approval process flowcharts that would be followed during the demonstration review and approval process. These flowcharts indicate the internal (Army Public Health Command, TCM-Range, Laser Clearinghouse, Staff Judge Advocate, Army Spectrum Management Office and others) and external (FAA and/or FCC) entities and agencies requiring review and approval of the demonstration along with the appropriate DD forms that would be required. For example, as part of the Department of Defense Spectrum Management Program compliance, Form DD 1494, would be required to minimize the potential for frequency interference during the fielding and employment of spectrum dependent equipment. The Deliberate Risk Assessment Worksheet, Form DD 2977, would also be prepared as part of the preparation process. The DSW approval timeline would be dependent on the system to be demonstrated but could be as long as 12 months.

The methodology for evaluating the potential impact to health and safety focuses on the downrange impacts of each technology and the potential impacts relating to the system and power source at the firing point. Downrange impacts include the dimension of the path the projectile or beam needs to reach the target, the target area and backstop, and additional area calculated for potential ricochet. Prior to any demonstrations occurring at Fort Sill, all participating personnel would be required to don personal protective equipment (PPE) appropriate to the system being demonstrated. For example, laser demonstrations would require appropriate eye protection and acoustic demonstrations would require appropriate hearing protection. As part of normal safe range operations, range use would be publicized through the public affairs office and roads would be blocked off during demonstrations as necessary. None of the systems evaluated in this EA would be intentionally directed at military or civilian personnel.

3.2.2.1 No Action Alternative

Implementation of the No Action Alternative would not provide the opportunity for demonstrations of the advanced technologies identified in Section 2.3 at Fort Sill. Training at the existing ranges on Fort Sill would continue under the direction and management of Range Operations.

3.2.2.2 Alternative 1 – Demonstrations on the West Range Area

Implementation of this alternative would include the demonstration of electro-dynamic kinetic energy systems, directed energy systems and LAMS at the West Range area of Fort Sill. Because of the inherent differences of each system relative to health and safety, each system is described separately.

3.2.2.2.1 Electro-Dynamic Kinetic Energy Systems

Electro-dynamic kinetic energy systems considered in this analysis are EM launch (railgun), combustion light gas gun, and electrothermal-chemical technologies. Each of these technologies uses a different system to propel a projectile toward a target. Current EM launch system technologies use either electrical energy to create a magnetic field that propels the projectile or plasma to propel the projectile. The combustion light gas gun uses an ignited combustible gas mix to propel the projectile towards the target. The electrothermal-chemical gun uses electrical energy and a plasma cartridge to ignite the projectiles propellant. These systems would be demonstrated against fixed targets within the impact area of the West Range at Fort Sill.

The safe use of electro-dynamic kinetic energy systems is dependent in part upon a suitable impact area that meets the safety zone requirements for that system. A representative example of electro-dynamic kinetic energy safety zones is illustrated on Figure 3.2-1. The demonstration location would require an appropriate firing location that fits the requirements of the pre-determined and approved safety zone. As described in Section 3.2.2, approval of system-specific safety zones would be part of the DSW process required to demonstrate a specific technology at Fort Sill.

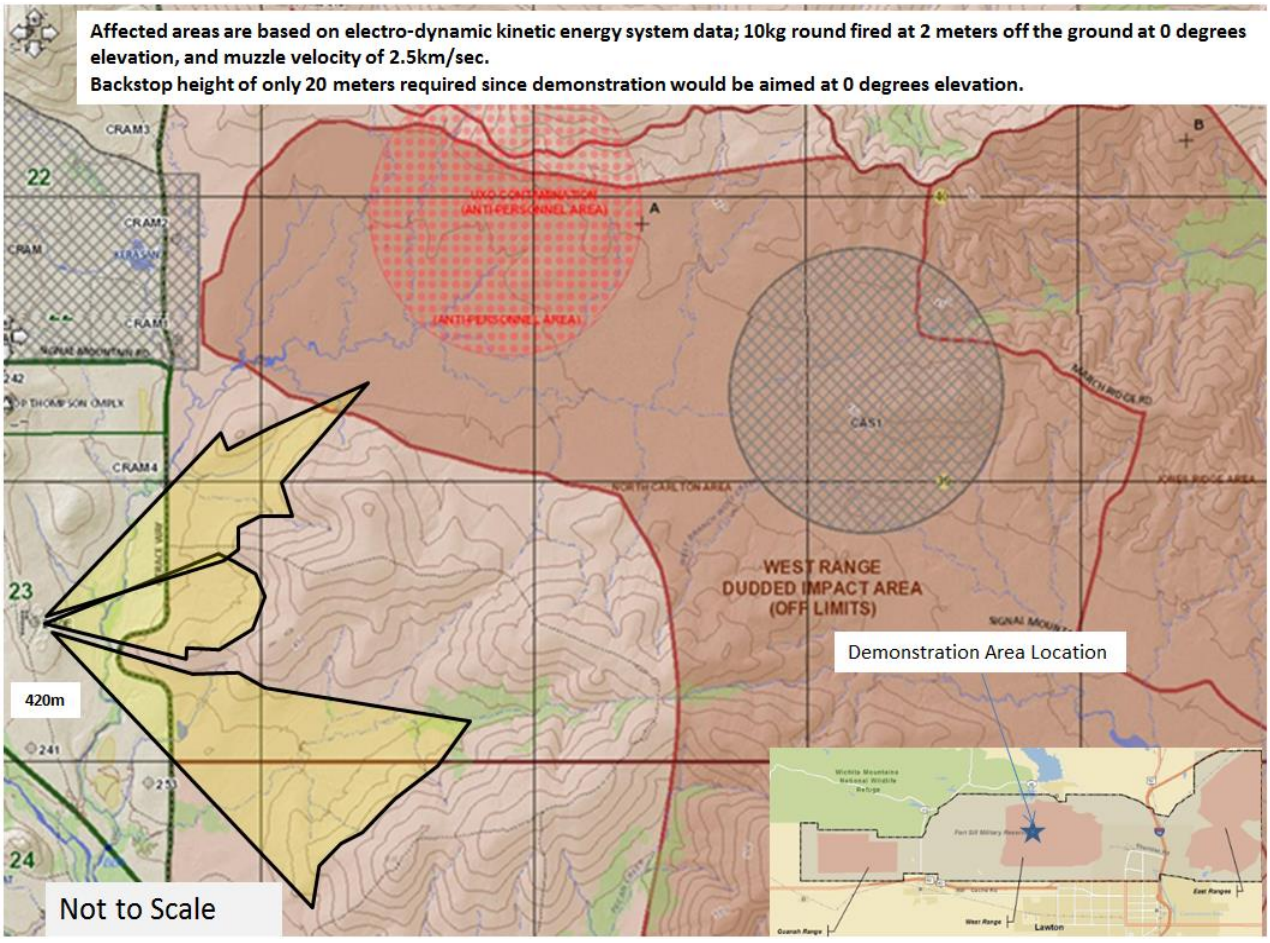


Figure 3.2-1. Representative Example of Electro-Dynamic Kinetic Energy Safety Zones in the West Range Area

Photograph of EM Railgun Prototype. Photo credit U.S. Navy photograph John F. Williams.

Electromagnetic Launch – As identified in other environmental analysis of railgun technology (Navy 2013a), magnetic and electrical fields are anticipated to result from the operation of the 32 megajoule (MJ) railgun. Studies of EM energy resulting from firing a 32 MJ railgun at Dahlgren indicated that EM levels at 80 feet from the railgun were well below IEEE C95.1 standards. The highest electric field recorded was 17 kilovolts per meter (kV/m), compared to the IEEE exposure limit of 100 kV/m. Depending on the operational power level of the railgun, the magnetic field strength generated at demonstrations could be intense enough near the launcher during firing that it could exceed IEEE C95.1 limits. All demonstrations would be evaluated and approved prior to use at Fort Sill and an exclusion or safety zone that keeps personnel at a safe distance would be based on the planned operational levels. Any demonstration personnel having an active implantable medical device, such as pacemakers and implantable cardioverter defibrillators, must coordinate their location with the on-site supervisor prior to firing of the railgun. No significant impacts to human health and safety are anticipated when demonstrations are conducted in accordance with all applicable safety regulations.

Combustion Light Gas Gun – Some demonstrations could use combinations of materials that pose some health risks if not properly handled. For example, current versions of the combustion light gas use liquid hydrogen and oxygen as propellants. Liquid hydrogen is a cryogenic liquid that poses a burn risk if it contacts the skin. Gaseous hydrogen is an asphyxiant. Hydrogen is also a fire/explosion hazard. Liquid oxygen is a cryogenic as well and leaks of oxygen in a confined environment can create high oxygen environments increasing the risk of fires. Both hydrogen and oxygen have a long history of safe usage for numerous industrial applications, and implementation of proper safety procedures would reduce the potential safety risks. Future systems that use hazardous materials would be handled in a similar manner as the combustion light gas gun, following all applicable safety regulations and procedures. No significant impacts to human health and safety are anticipated when demonstrations are conducted in accordance with all applicable safety regulations.

Electrothermal-Chemical – Current electrothermal-chemical systems are anticipated to have firing point and downrange health and safety concerns typical of any major large artillery gun. All applicable safety regulations would be followed during demonstration of this system, thus no significant impacts to health and safety are anticipated.

3.2.2.2.2 Directed Energy Systems

Directed energy systems use some form of EM energy (see Section 2.3.1.2) or acoustic energy to disrupt either mechanical systems or the target structure. These systems are demonstrated against fixed, surface mobile or aerial targets. Safety concerns would focus on the dimension of the path the energy wave requires to reach the target and the target area and backstop or the area beyond the target area.

Acoustic – Acoustic systems such as the LRAD use directed sound waves to transmit clear communications or issue deterrent warnings. When used for deterrence these systems produce loud sound levels that are intended as a deterrent without inflicting permanent harm. A legal review by the U.S. Department of the Army, Office of The Judge Advocate General found that the LRAD, "when used in the manner prescribed, would not cause permanent damage to the ear

or hearing loss" (Army 2010). No significant impacts to human health and safety are anticipated when demonstrations are conducted in accordance with all applicable safety regulations. During demonstrations of acoustic systems, all participating personnel would be required to wear hearing protection. Figure 3.2-2 illustrates a representative example of safety zones associated with acoustic system demonstrations in the West Range area.

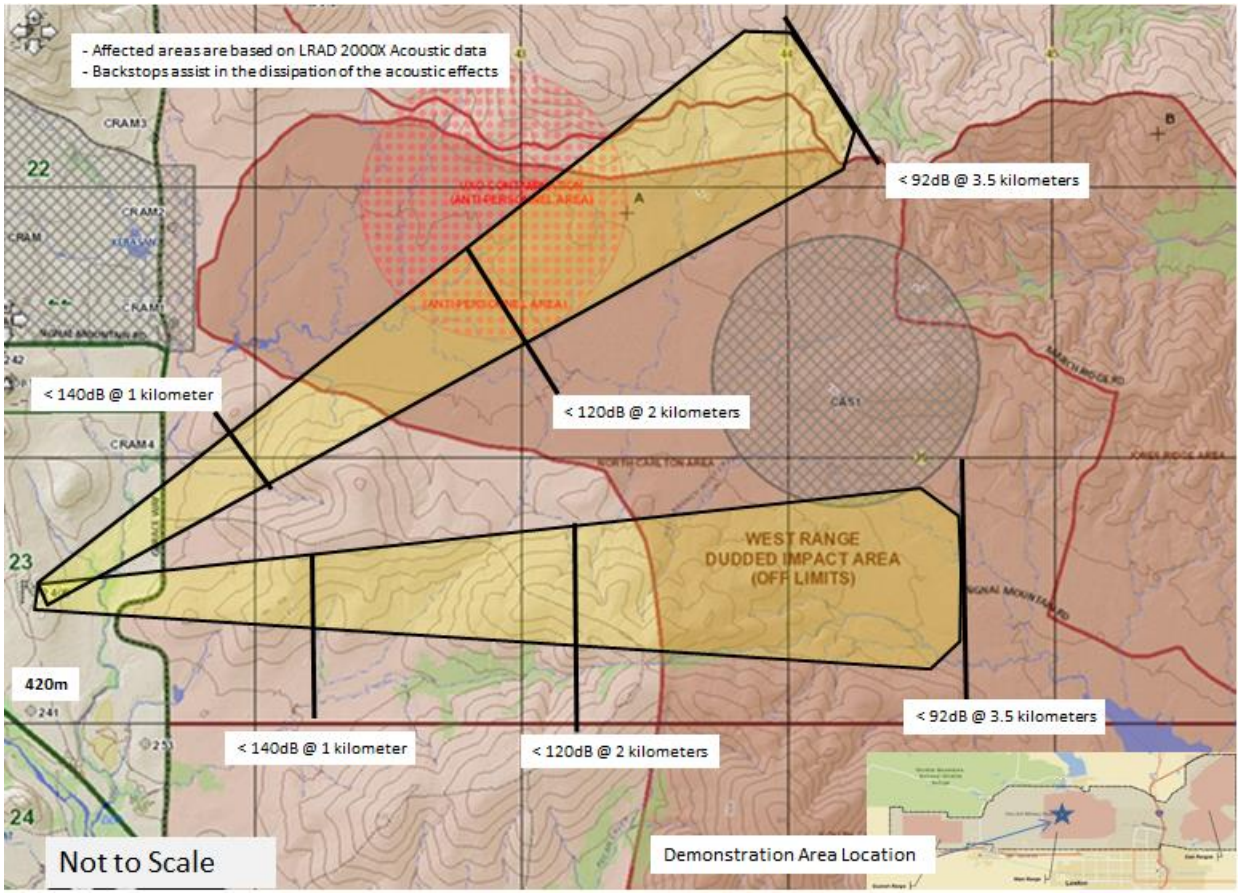


Figure 3.2-2. Representative Example of Acoustic System Safety Zones in the West Range Area

High Power Microwave/Radio Frequency – Prolonged exposure to certain power levels and EM frequencies has the potential for harmful impacts to humans. As described in Section 3.2.1.2.4, these impacts are primarily related to tissue damage resulting from excessive heating. All demonstrations at Fort Sill would undergo the DSW review and approval process to ensure compliance with health and safety procedures and regulations relative to high powered microwaves/radio frequency systems. Safety zones would be created for each type of demonstration system. These safety zones would account for the permissible exposure limits in DoDI 6055.11 and also consider potential impacts to electronic equipment, fuel sources, ordnance, and frequency interference. A representative example of a high power microwave/radio frequency safety zone is illustrated on Figure 3.2-3. In addition, certain types of high powered microwaves/radio frequency systems have the capability to generate ionizing radiation (e.g. x-rays) in the immediate vicinity of the power source. Any systems capable of generating ionizing radiation would be demonstrated in compliance with DoDI 6055. Electric hazards relating to the power source are also present in most high powered microwaves/radio frequency systems.

Personnel using these systems would be familiar with the potential hazards and recognize the conductive surfaces on the system capable of delivering electrical shock. Any demonstration personnel having an active implantable medical device, such as pacemakers and implantable cardioverter defibrillators, must coordinate their location with the on-site supervisor prior to demonstrating the high power microwave/radio frequency device.

The ADS is one example of a high-power microwave system.

The Active Denial System (ADS) is an example of a high power microwave system that uses a frequency of 95 GHz and is intended to be a non-lethal deterrent. This system has been successfully demonstrated at other military facilities and has been shown to be an effective deterrent that poses no long–term effects on its targets (LeVine 2009). Previous demonstrations and testing of the system have shown that exposure is limited to the outer 1/64th inch of skin; the principal effect is thermal; prolonged exposure, while unlikely (1/10th of 1 percent), can cause thermal injury; exposure to ADS is unlikely to initiate cancer or have deleterious effect on fetal development (Navy 2013b).

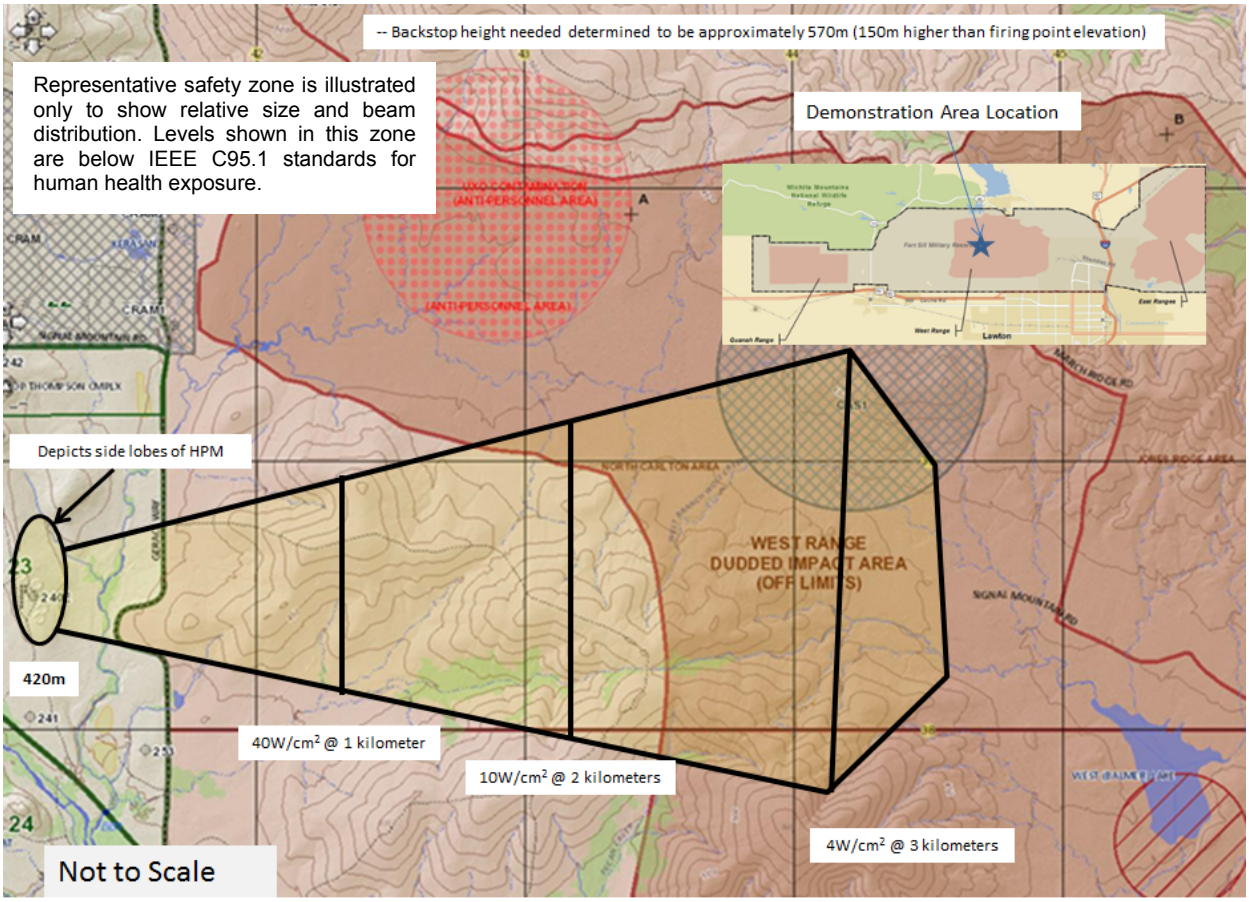


Figure 3.2-3. Representative Example of a High Power Microwave/Radio Frequency Safety Zone in the West Range Area

High powered microwaves/radio frequency systems capable of generating a beam with the potential to exceed human health standards downrange would have safety zones excluding all personnel. All system demonstrations would be closely coordinated with the Fort Sill Range Operations and would comply with Fort Sill Regulation 385-1. No significant impacts to health and safety are anticipated to result from implementation of high power microwave/radio frequency systems, because all demonstrations would be completed in compliance with the above-stated processes and regulations.

Laser – As referenced above, lasers are currently being safely used at Fort Sill. The proposed laser demonstrations would be conducted in accordance with existing regulations; stringent DoD policies specifically developed for laser activities; and management controls, plans, and procedures to include the development of laser safety zones. These procedures would minimize exposure to laser radiation that could cause damage to skin tissue or eyes. In addition to personnel exposure to lasers, the potential impact of laser beams to pilots, non-participating aircraft, and satellites is also of concern.

The laser safety zone would illustrate the minimum land and air requirements, to include terrain mitigation, necessary to safely demonstrate a given laser. While mechanisms for biological damage from lasers are similar to effects produced from absorption of energy from conventional light sources, lasers are of special concern because of their potential to project hazardous levels of energy over great distances. Laser hazards can span from temporary and permanent blindness to physically burning tissue.

All lasing activity would be directed into the impact area of the West Range. Safety zones would be established around laser corridors and the target or backstop based on calculations of the power being emitted by the laser. A representative example of laser safety zones is illustrated on Figure 3.2-4. These zones would be identified and demarcated to keep people at a safe distance during the brief time that the laser is demonstrated. During the lasing demonstration, much of the laser beam would be absorbed by the target with an appropriate backstop. Because backscatter could occur at the target location, an eye-safety hazard zone would be calculated around the target and backstop, and personnel shelters, if necessary, would be located well beyond the area where backscatter could pose risk to personnel. Target area selection will minimize the probability of a fire started by the laser.

If lasers are anticipated to be demonstrated without the use of a backstop (i.e., over the horizon), additional procedures would be required to eliminate the potential impact to pilots, non-participating aircraft, and satellites. Prior to any over the horizon laser demonstrations, Fort Sill Army Radar Approach Control (ARAC) would be contacted to verify the absence of non-participating aircraft in the airspace above and surrounding the demonstration location. If non-participating aircraft are identified within Fort Sill airspace during the demonstration, the demonstration would be aborted until proper assurance that laser demonstrations would not impact pilots or non-participating aircraft. Additionally, clearance for all over the horizon laser demonstrations would require Laser Clearing House and other agency approvals, which includes satellite de-confliction and specific demonstration times.

By implementing strict health and safety procedures for laser use, Fort Sill personnel would be located well beyond distances that could result in injury from the lasers and distance to the general public would be even farther away from the demonstration area. In addition to direct hazards to skin

tissue and eyes, there are potential non-beam hazards such as electrocution, fire, laser-generated air contaminants (LGACs) and collateral radiation as a result of lasing activities (Navy 2013b).

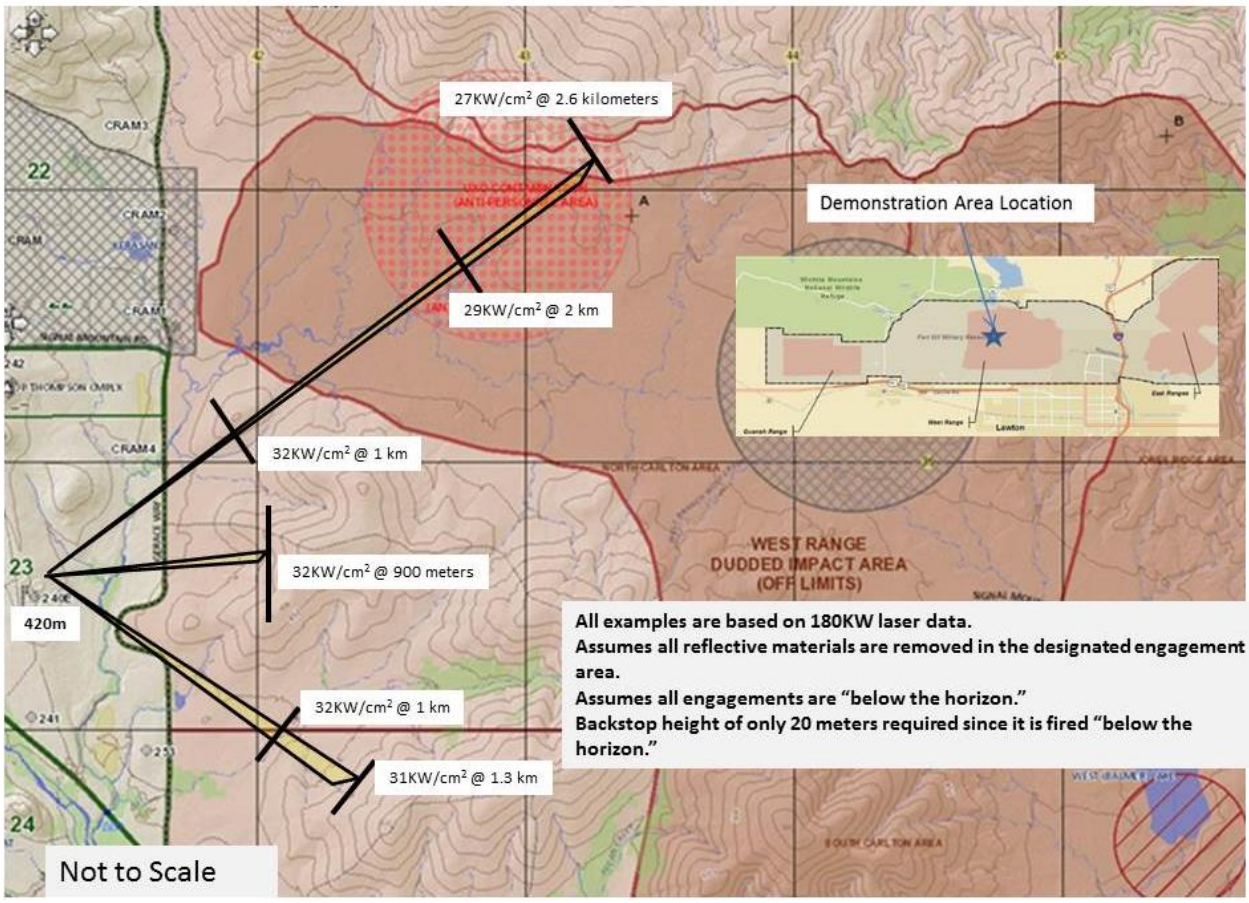


Figure 3.2-4. Representative Example of Laser Safety Zones in the West Range Area

LGACs could be generated when high power laser beams interact with metals, plastics, composites, etc. (ANSI 2007). Fort Sill personnel would ensure that appropriate industrial hygiene characterizations of LGAC exposure takes place in accordance with 29 *CFR* 1910.1000, Air Contaminants, so that no occupational over-exposures could occur.

Potential collateral radiation produced as a result of air breakdown at the laser/target interface would not present a hazard to personnel because no personnel would be in close proximity to the target in the impact area. Once lasing activities stop, all collateral radiation (if any) ceases and no residual collateral radiation remains (Navy 2013b). Strict adherence to the existing Fort Sill health and safety regulations and approval of laser use by Fort Sill Range Operations would minimize the health and safety risks associated with laser demonstrations. Laser demonstrations are anticipated to have no significant adverse impacts on health and safety at Fort Sill.

Particle Beam – Particle beam demonstrations would include the use of systems designed to direct high energy beams of atomic or subatomic particles at targets to disrupt the target structure. Particle beam systems have been researched for decades and are still under development in testing laboratories.

Particle beams are still in a developmental stage as a weapon system, thus the full range of potential health impacts may not be known. The potential safety impacts associated with particle beam systems are anticipated to be very similar to those of lasers, as previously described. Should future systems testing show potential health effects that are not controlled by safety zones and relevant safety standards, additional analysis may be required prior to demonstration at Fort Sill. As with lasers, implementation of particle beam systems in the West Range area is not anticipated to result in significant impacts to human health provided that all of the safety procedures and relevant regulations are followed prior to and during the demonstration. Particle beam demonstrations would be directed into the impact area of the West Range area. Safety zones would be established as part of the demonstration approval process and would be based on appropriate backstops for targets. The safety zones for particle beam demonstrations would be similar to lasers and would be developed and approved prior to initiation of demonstrations.

Laser Induced Plasma Channel – Laser Induced Plasma Channel systems are based on the creation of a path through the atmosphere using a laser beam that is charged with an electrical current. Because a laser is used as the vector for the energy transfer, the potential impacts to health and safety would be similar as those described for lasers above. Laser induced plasma demonstrations would be designed for short ranges with a maximum range of no more than 200 meters. A representative example of a safety zone associated with a laser induced plasma channel demonstration on the West Range area is illustrated on Figure 3.2-5.

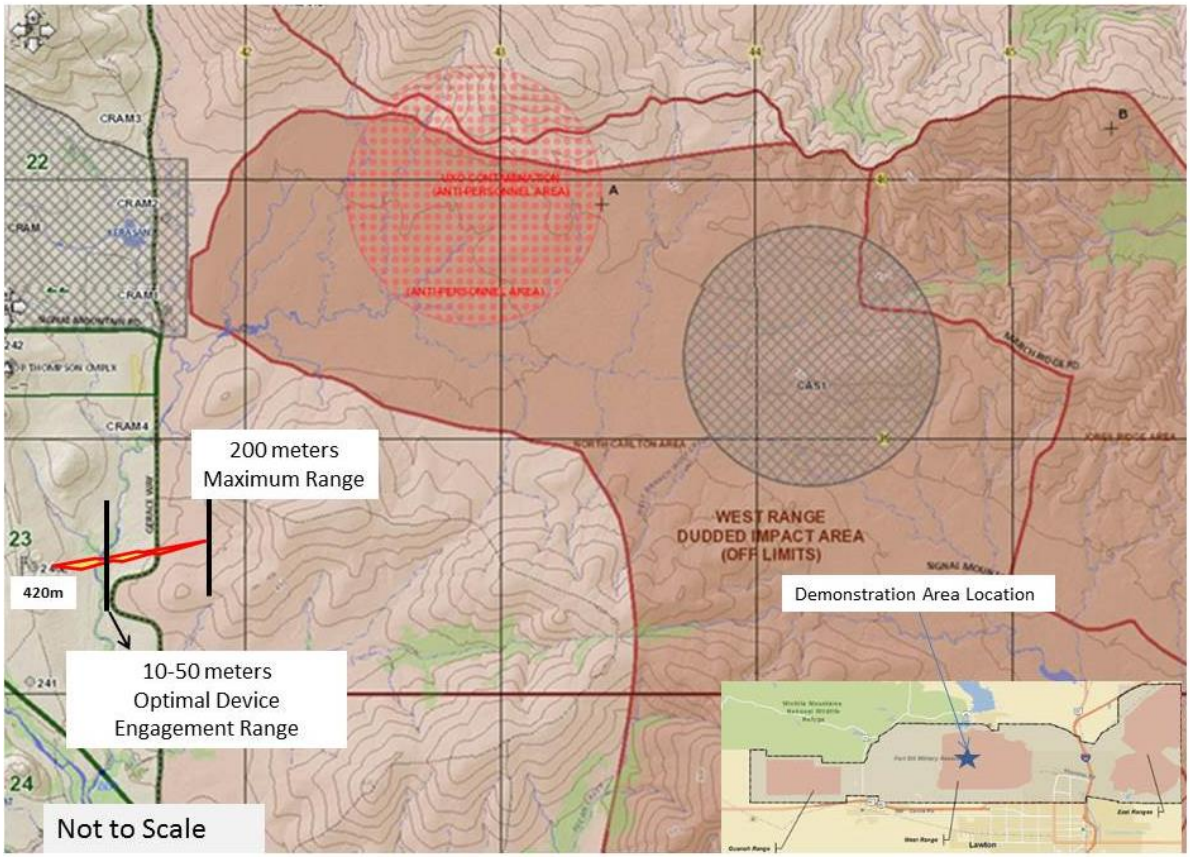


Figure 3.2-5. Representative Example of a Laser Induced Plasma Channel Safety Zone in the West Range Area

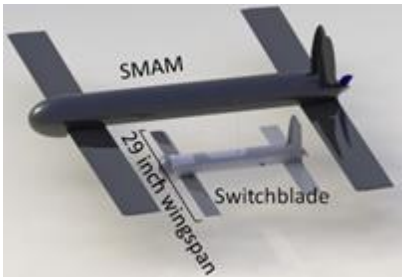
Potential health and safety concerns associated with laser induced plasma channels would also include risk of electrocution from the power source, risk of fire from implementation of the demonstration and EM interference with electronic or electric systems near the demonstration site.

Implementation of laser induced plasma channel demonstrations is not anticipated to result in significant impacts to health and safety provided that all health and safety procedures and relevant regulations are followed prior to and during the demonstration.

3.2.2.2.3 Loitering Aerial Munition Systems

LAMS are explosive guided munitions used to counter both aerial and ground threats. LAMS have the capability to be launched by a single Soldier, loiter over the battlefield and engage threats beyond the range of current LOS weapons. A variety of LAMS have been demonstrated at various locations. Most recently, during the summer of 2014, the Naval Air Warfare Center Weapons Division hosted the Black Dart 2014 counter unmanned aerial vehicle field demonstration at the Sea Test Range at San Nicolas Island in California.

The Switchblade and the Single Multi-Mission Attack Munition (SMAM) are representative of the types of LAMS that could be demonstrated at Fort Sill. SMAMs are a larger category of LAMS that have the capability of longer flight times, increased range, and increased munition payload. Representative examples of LAMS launch, flight, and target safety zones are illustrated on Figure 3.2-6.



The SMAM (top) and Switchblade (bottom) are two examples of LAMs.

The Switchblade, manufactured by AeroVironment, is one example of LAMS currently in use by the Army. In 2011, the Army purchased a small number of Switchblade systems and initial training occurred in early 2012. The Army is currently evaluating LAMS as a potential Program of Record. The primary safety concerns with LAMS are related to the onboard high-energy forward fragmentation munition and the fact that they are unmanned, controlled via a ground control station. The guided munition must remain in radio frequency LOS at all times during operation, but provisions account for lost link. Depending on the type of LAMS demonstrated, the contents of the munition portion of the LAMS could vary. Prior to the demonstration, the contents of the munition will be evaluated by EOD to ensure proper health and safety precautions are in place to recover or handle the munition as necessary.

In 2012, the U.S. Army Evaluation Center (AEC) at Aberdeen Proving Ground evaluated the Switchblade system and identified four hazards, one of which was listed as a serious risk and three of medium risk. The hazard listed as serious was related to incomplete software testing which caused the overall system to receive a serious hazard rating. The documentation associated with these determinations also provided safety zones for the Switchblade both during launch and flight (Army 2012). The launch, flight, and target safety zones must be clear of friendly forces and non-participating personnel.

If radio frequency LOS is lost during operation, all LAMS are programmed to transition to lost link mode. The guided munition loss of link altitudes would be unique to each LAMS. If the munition has been armed, the lost link mode safes the munition and the guided munition autonomously

begins to return to a pre-determined lost link waypoint orbit. If the radio frequency LOS is not restored, the munition is programmed to enter into an orbit, either until the radio frequency LOS is restored or the batteries are depleted. Upon battery depletion, the LAMS would descend to the ground without detonation (Army 2012). If any LAMS are deployed and the munition does not detonate, a minimum of 12 hours would be allotted for the batteries to be depleted and the LAMS would then be considered unexploded ordnance (UXO) and would only be recovered by EOD.

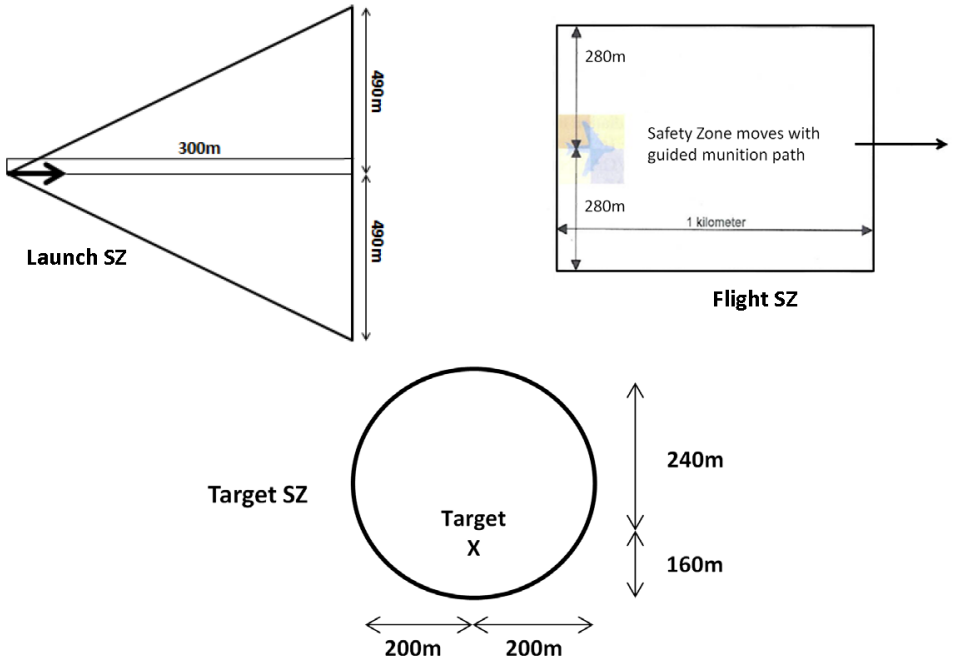


Figure 3.2-6. Representative Example of LAMS Safety Zones (Spears 2014)

Specific flight plans for demonstrations of LAMS would be completed and approved prior to conducting demonstrations. Examples of some of the requirements in the flight plans would include maintaining visual contact or having situational awareness with the guided munition's location, altitude, velocity, etc. at all times during the demonstration and having redundant certified guided munition operators available. All LAMS flight operations would be closely coordinated with Fort Sill ARAC within existing RA and over the existing impact areas.

To prevent the loss of a LAMS during demonstrations, the LAMS operator records global positioning system (GPS) coordinates at all times. After the demonstration has been completed, inert LAMS would continue to transmit GPS coordinates until the batteries are depleted. In addition, prior to launch, all LAMS would be equipped with a falcon bird tracker, which transmits low-power beeps and provides real-time locational information to a handheld directional receiver (Sarratt 2014).

Implementing demonstrations of LAMS is not anticipated to result in significant impacts to health and safety provided that all health and safety procedures and relevant regulations are followed prior to and during the demonstration.

3.2.2.3 Alternative 2 – Demonstrations on the East Range Area

Implementation of Alternative 2 would mean that Electric Fires and LAMS would be demonstrated in the East Range area of Fort Sill. Because the types of demonstrations proposed to occur in the East Range area would be the same as proposed under Alternative 1, the potential impacts to health and safety resulting from implementation of each of the systems listed in Table 2.3-1 would also be the same. The primary differences between the two alternatives are the juxtaposition of agricultural leases and the boundaries of Fort Sill relative to the proposed demonstration sites.

Conducting these demonstrations is anticipated to result in negligible to minor health and safety effects. Similar to the consequences associated with the implementation of Alternative 1, actions associated with the proposed demonstrations would be consistent and compatible with the East Range and the sub-ranges within the East Range area. Although no construction would be required as part of this alternative, additional coordination with Range Operations would be required due to the volume of basic and small arms training activities that currently occur within the East Range area. Range Operations would schedule the demonstrations in accordance with current Fort Sill range use policies to prevent any competing uses.

Additional coordination would also be required to avoid demonstration in areas with high public visibility. Demonstrations could also be limited in the East Range area due to the additional acres of agricultural leased lands and the fact that the Fort Sill boundaries are closer to the proposed demonstration sites. With specific regard to demonstrations of LAMS on the East Range area at Fort Sill, three of the proposed demonstration areas shown on Figure 2.6-1 would not be suitable for demonstration of LAMS due to the proximity of existing small arms ranges. The East Range area potential LAMS demonstration areas are identified on Figure 3.2-7.

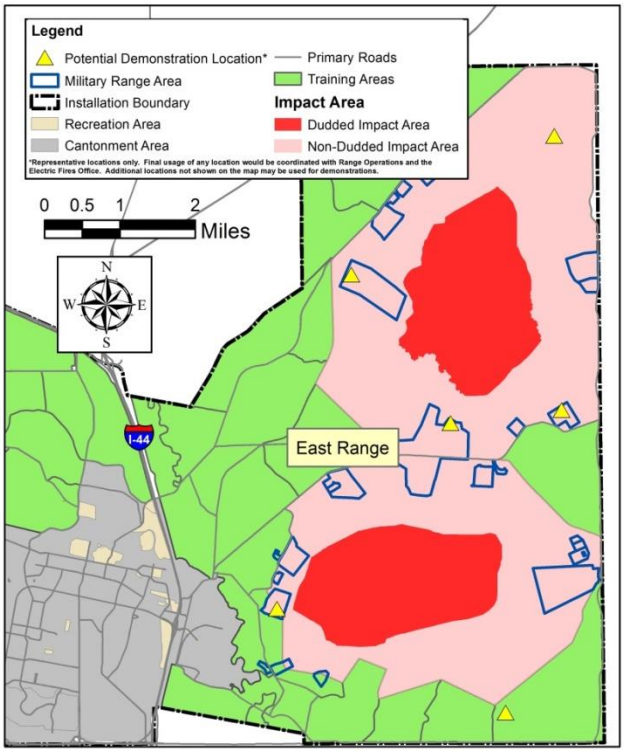


Figure 3.2-7. Potential LAMS Demonstration Areas in the East Range Area

Figures 3.2-8 through 3.2-12 illustrate representative examples of safety zones associated with implementation of demonstrations in the East Range area. As described in Section 2.6.2, the East Range area at Fort Sill is comprised of the North and South Arbuckle Ranges. The representative examples are shown for both the North and South Arbuckle Ranges. Representative examples of launch, flight, and target safety zones for LAMS are shown on Figure 3.2-6.

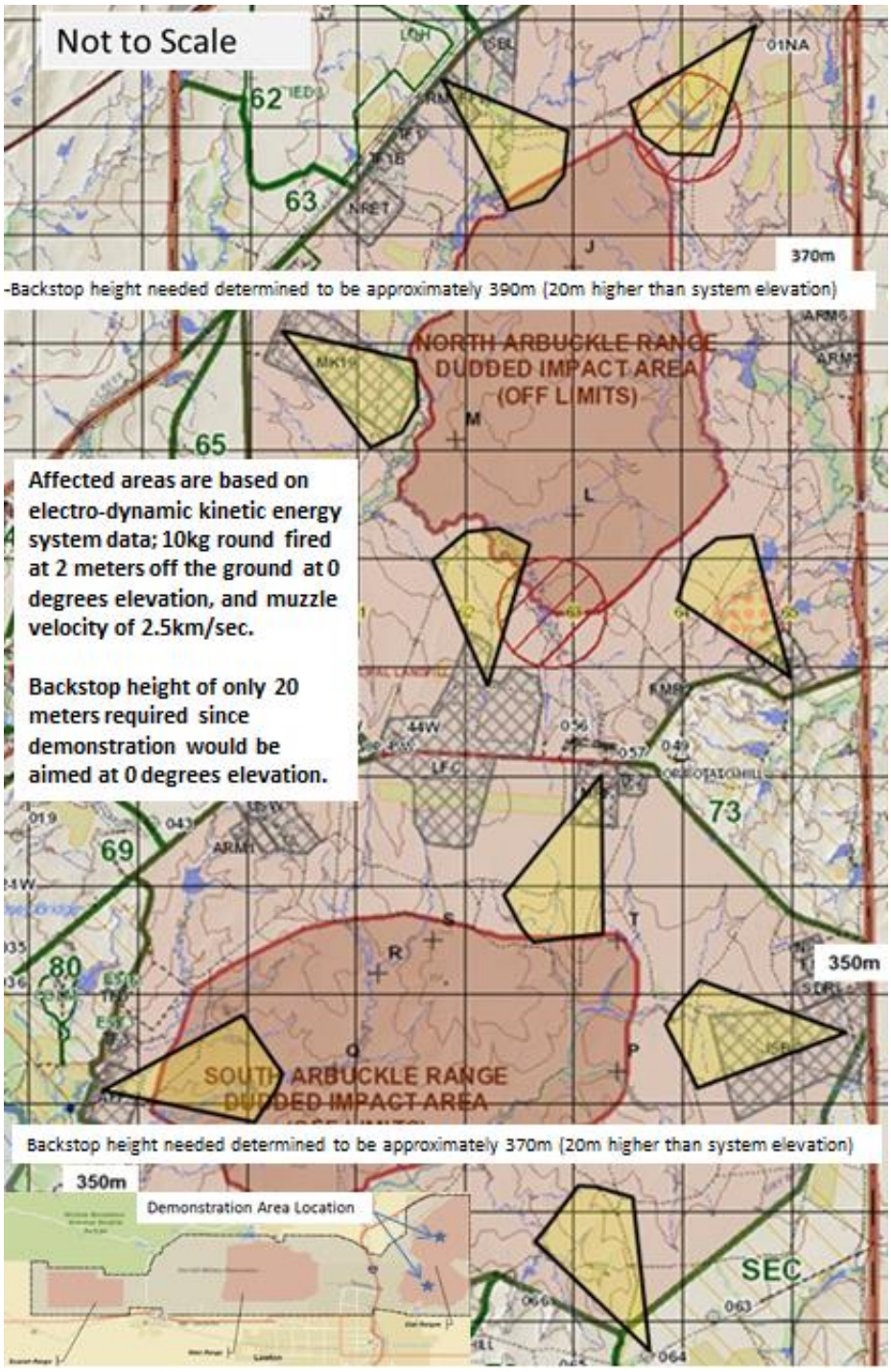


Figure 3.2-8. Representative Example of Electro-Dynamic Kinetic Energy Safety Zones in the East Range Area

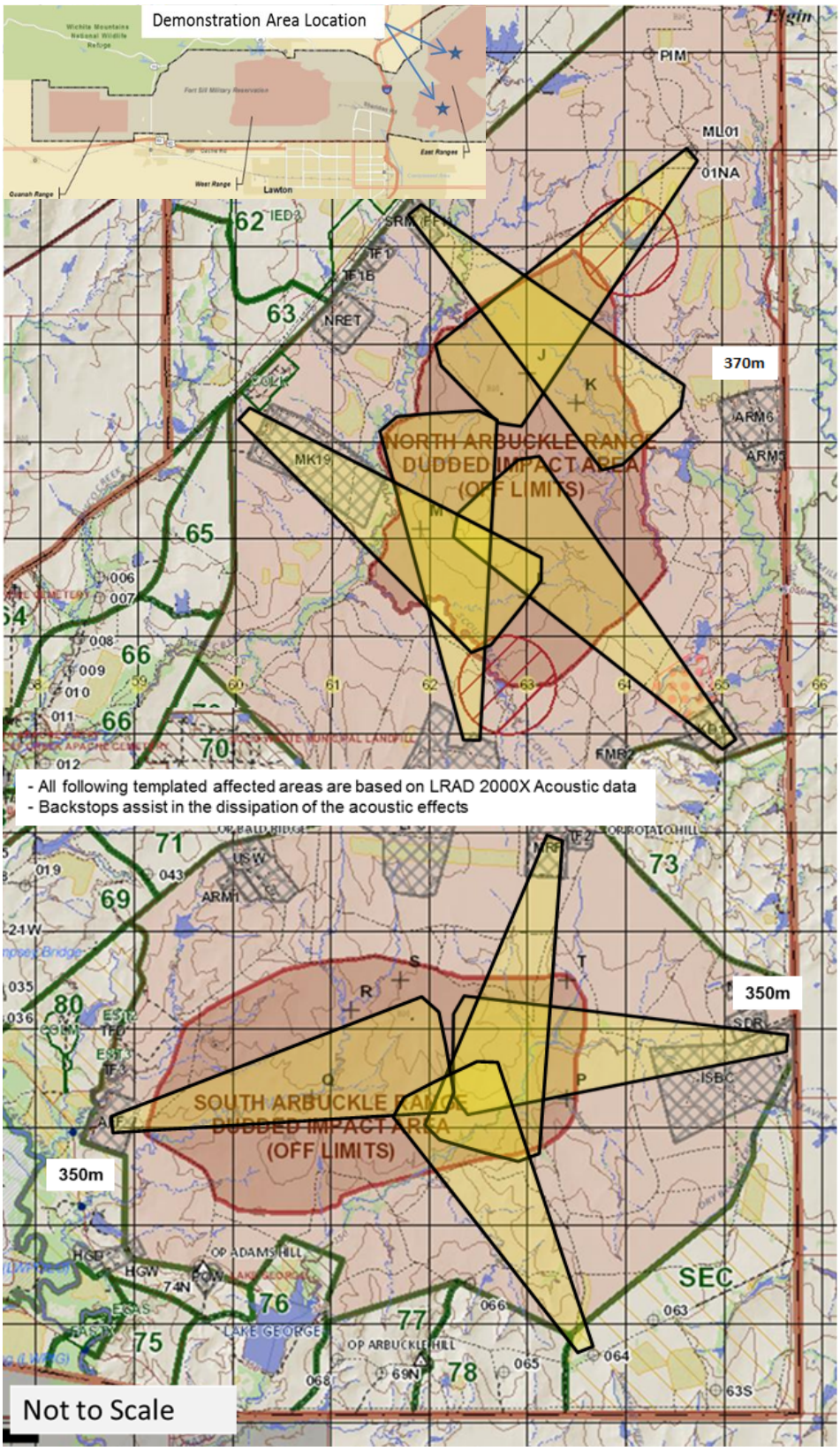


Figure 3.2-9. Representative Example of Acoustic System Safety Zones in the East Range Area

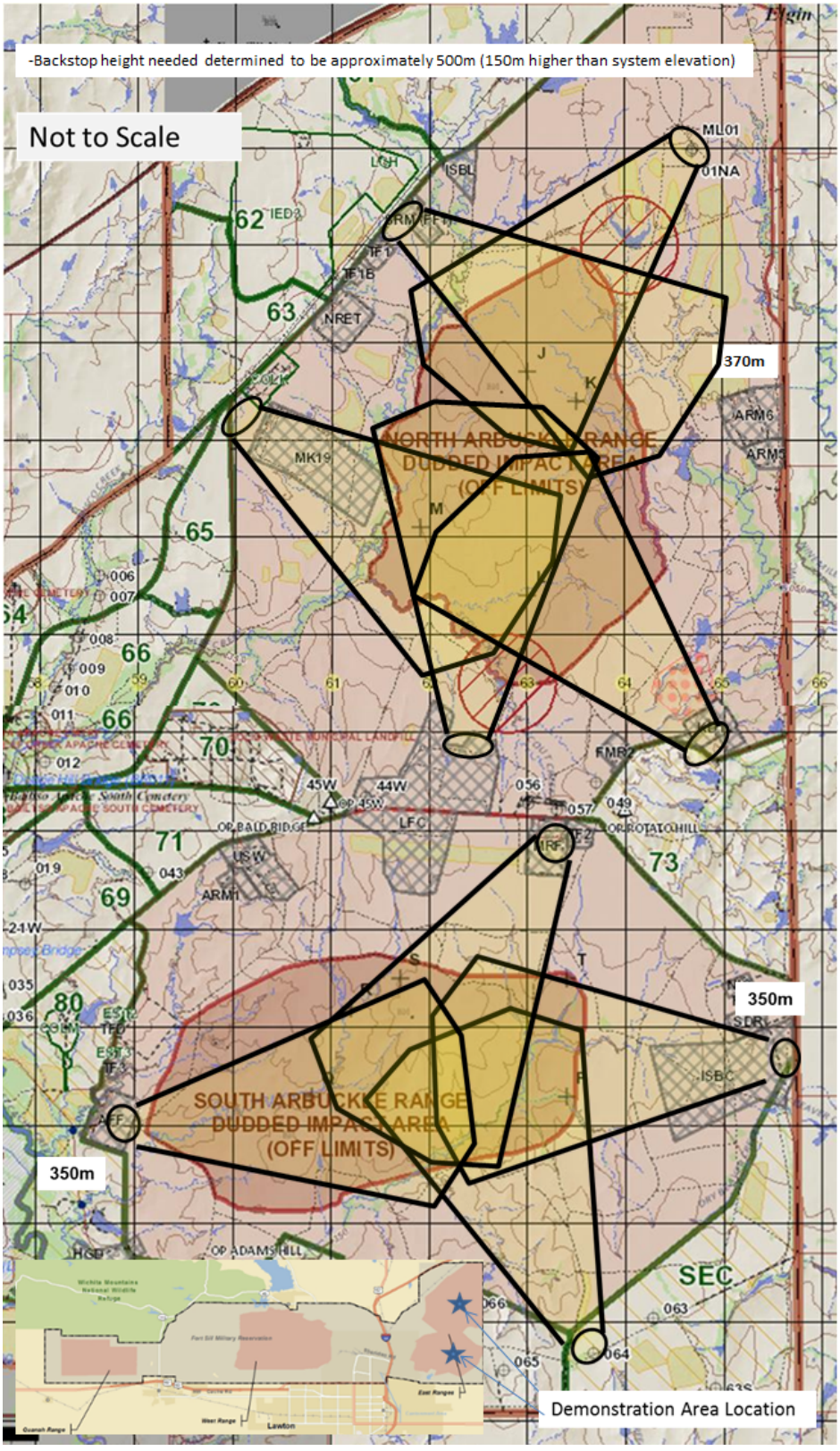


Figure 3.2-10. Representative Example of a High Power Microwave/Radio Frequency Safety Zone in the East Range Area

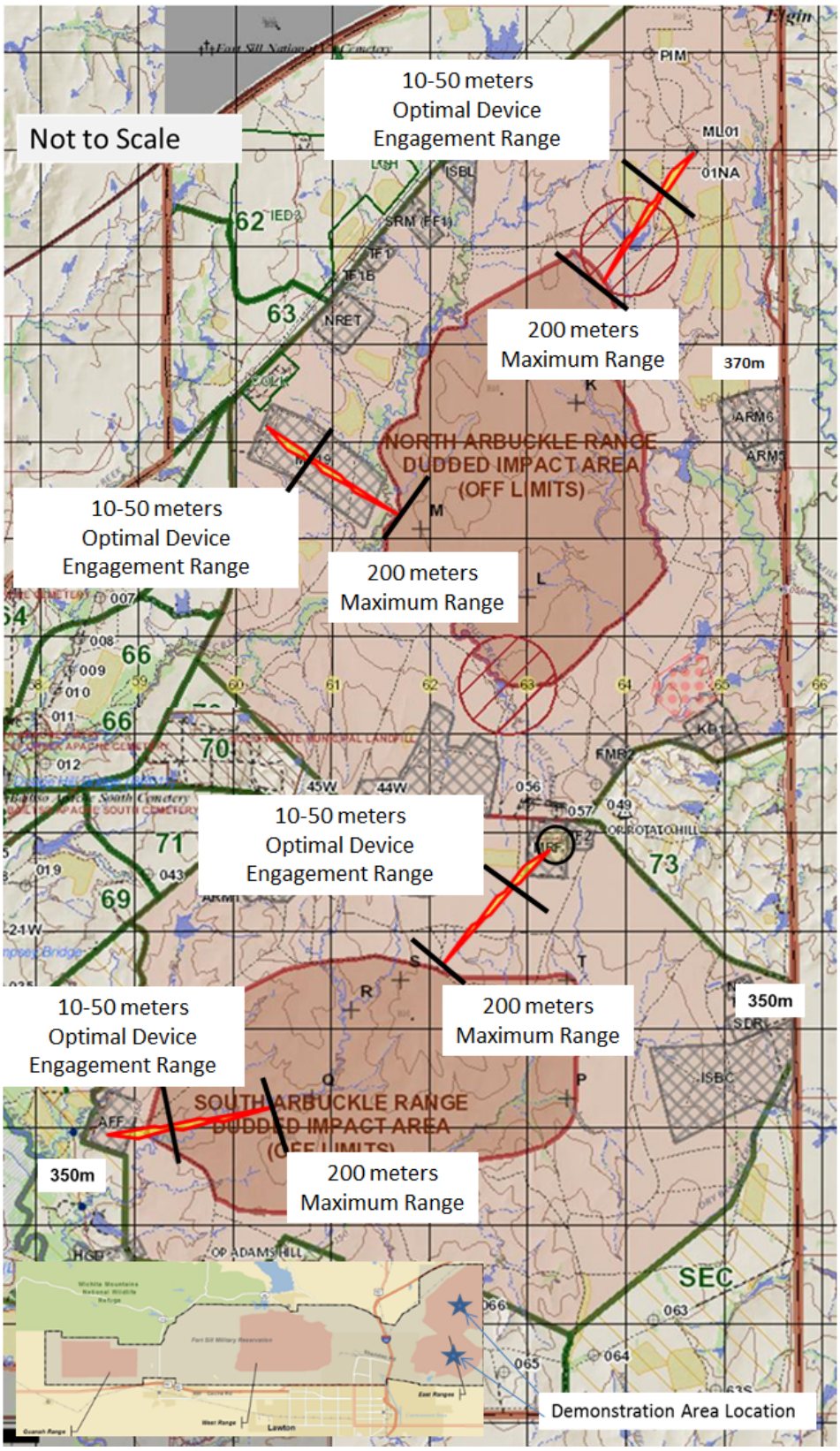


Figure 3.2-11. Representative Example of Laser Induced Plasma Channel Safety Zones in the East Range Area

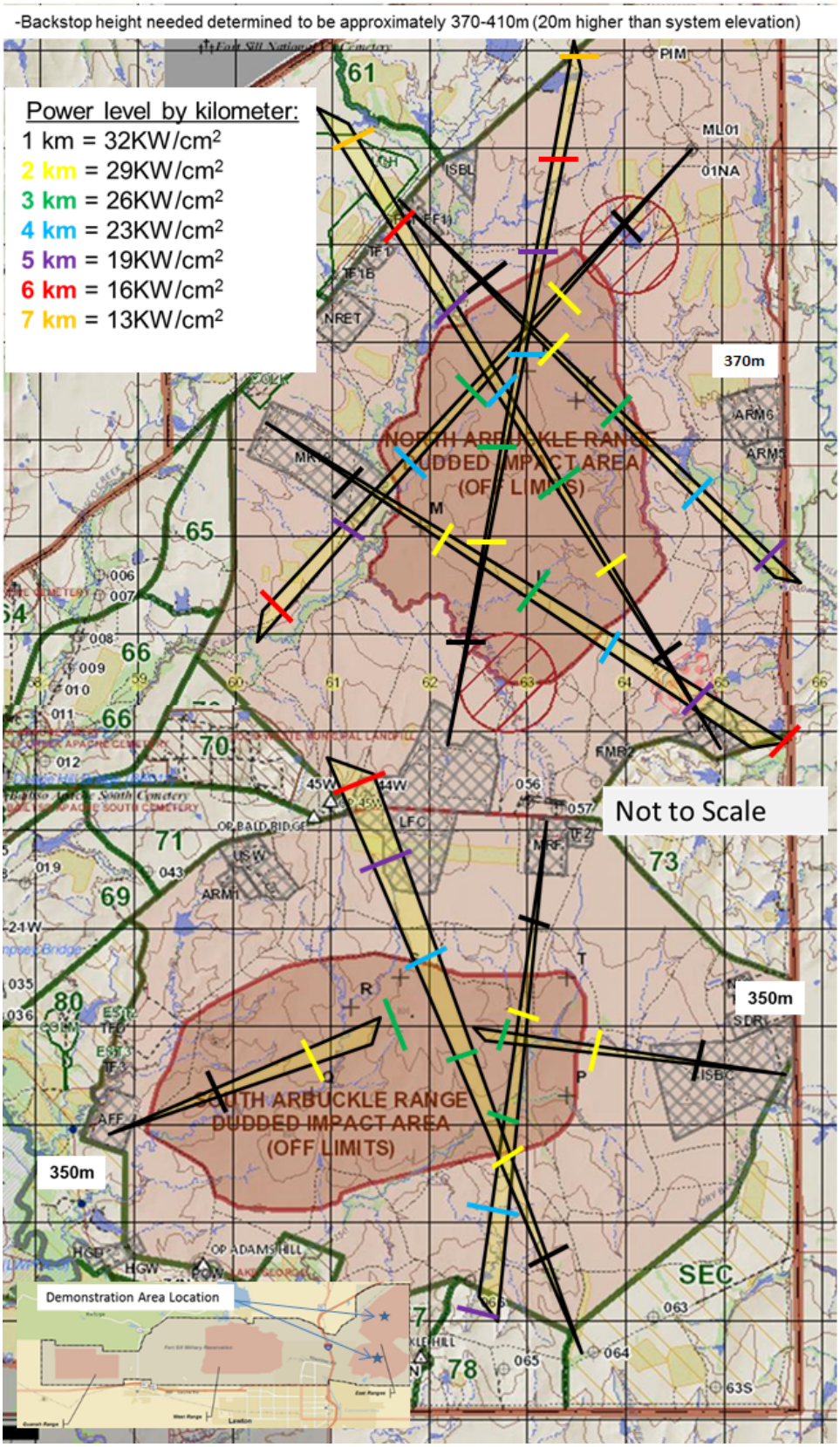


Figure 3.2-12. Representative Example of Laser Safety Zones in the East Range Area

3.3 AIR QUALITY

3.3.1 Affected Environment

3.3.1.1 Definition of the Resource

Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The levels of pollutants are generally expressed on a concentration basis in units of parts per million or micrograms per cubic meter.

The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards established under the Clean Air Act (CAA) of 1990. These standards represent the maximum allowable atmospheric concentration that could occur and still protect public health and welfare. The NAAQS provide both short- and long-term standards for the following criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter equal to or less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), ozone (O_3), and lead (Pb).

Under the CAA, it is the responsibility of the individual states to achieve and maintain the NAAQS. To accomplish this, states use the U.S. Environmental Protection Agency (USEPA)-required State Implementation Plan (SIP). An SIP identifies goals, strategies, schedules, and enforcement actions designed to reduce the level of pollutants in the air and bring the state into compliance with the NAAQS.

All areas of the United States are designated as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. Areas where there are insufficient air quality data for the USEPA to form a basis for attainment status are unclassifiable. Thus, such areas are treated as attainment areas until proven otherwise. “Maintenance areas” are those that were previously classified as nonattainment but where air pollution concentrations have been successfully reduced below the standard. Maintenance areas are subject to special maintenance plans to ensure compliance with the NAAQS.

Hazardous air pollutants (HAPs) are chemical pollutants and toxic chemical air pollutants for which occupational exposure limits have been established. Volatile organic compounds (VOCs), an ozone precursor, are included in this definition and include any organic compound involved in atmospheric photochemical reactions, except those designated by a USEPA administrator as having negligible photochemical reactivity. HAPs are not covered by the NAAQS but could present a threat of adverse human health or environmental effects under certain conditions.

3.3.1.2 Existing Conditions

3.3.1.2.1 Climate

Fort Sill is located within the interior climate region of southwestern Oklahoma, which is characterized as being humid subtropical. The average temperature for the year in Fort Sill is 62.1 degrees Fahrenheit (°F) (16.7 degrees Celsius [°C]). The warmest month, on average, is July with an average temperature of 83.5°F (28.6°C). The coolest month on average is January, with an average temperature of 39.4°F (4.1°C).

The average amount of precipitation for the year in Fort Sill is 30.9 inches (784.9 mm). The month with the most precipitation on average is May, with 5.0 inches (127 mm) of precipitation. The month with the least precipitation on average is January, with an average of 1.2 inches (30.5 mm). There is an average of 64 days of precipitation, with the most precipitation occurring in May and the least precipitation occurring in January. Average annual snowfall at Fort Sill is 3.9 inches (9.9 centimeters [cm]). The month with the most snow is January, with 1.4 inches (3.6 cm) of snow (Weatherbase 2014).

3.3.1.2.2 Air Quality

Fort Sill is located in Comanche County, Oklahoma, which is the ROI for the air quality analysis. According to the USEPA, Comanche County is in attainment for all criteria pollutants (USEPA 2014a), and a conformity determination would not be required.

Emissions that would be generated under Alternative 1, Alternative 2, and the No Action Alternative were compared with Comanche County emissions obtained from USEPA's 2011 National Emissions Inventory (NEI). NEI data are the latest available; these are presented in Table 3.3-1. The county data include emissions amounts from point sources, area sources, and mobile sources. *Point sources* are stationary sources that can be identified by name and location. *Area sources* are point sources from which emissions are too low to track individually, such as a home or small office building or a diffuse stationary source, such as wildfires or agricultural tilling. *Mobile sources* are any kind of vehicle or equipment with gasoline or diesel engine, an airplane, or a boat. Two types of mobile sources are considered: on-road and nonroad. On-road sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Nonroad sources are aircraft, locomotives, diesel and gasoline boats, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (USEPA 2014b).

Table 3.3-1. Baseline Criteria Pollutant Emissions Inventory for Comanche County, Oklahoma

Criteria Pollutant (tons/year)						
	CO	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOCs**
Comanche County	45,118	6,718	29,163	5,989	385	23,151

Source: USEPA 2014a

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_2 = sulfur dioxide; VOC = volatile organic compound

3.3.1.2.3 GHG Emissions/Baseline

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere; the accumulation of these gases in the atmosphere has been attributed to the regulation of Earth's temperature. Human activity in the past century is "very likely" (90 percent chance) the cause of the observed increase in GHG concentrations (Intergovernmental Panel on Climate Change 2007). Thus, regulations have been promulgated to inventory and decrease emissions of GHGs. On October 30, 2009, the USEPA published a rule for the mandatory reporting of GHGs from sources that in general emit 25,000 metric tons or more of carbon dioxide equivalent per year in the United States. The USEPA also recently promulgated the Prevention of Significant Deterioration and Title V GHG

Tailoring Rule, which will impose GHG permitting requirements on existing major sources with major modifications and certain new major sources. At this time, a threshold of significance has not been established for the emissions of GHGs.

The six primary GHGs, defined in Section 19(i) of EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and internationally recognized and regulated under the Kyoto Protocol, are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Each GHG has an estimated global warming potential (GWP), which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from Earth's surface. The GWP allows GHGs to be compared with each other by converting the GHG quantity into the common unit "carbon dioxide equivalent." Baseline GHG emissions for Comanche County, obtained from the USEPA's 2011 NEI, are summarized in Table 3.3-2.

Table 3.3-2. Baseline Greenhouse Gas Emissions Inventory for Comanche County, Oklahoma

Greenhouse Gases (tons/year)				
	CO_2	**N_2O**	**CH_4**	**CO_2e**
Comanche County	1,182,212	22	1,403	**1,223,843**

Source: USEPA 2014b

CH_4 = methane; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; N_2O = nitrous oxide

3.3.2 Environmental Consequences

3.3.2.1 Analysis Methodology

CAA Section 176(c), General Conformity, requires Federal agencies to demonstrate that their proposed activities would conform to the applicable state implementation plan for attainment of the NAAQS. General conformity applies only to nonattainment and maintenance areas. If the emissions from a Federal action proposed in a nonattainment area exceed annual *de minimis* thresholds identified in the rule, a formal conformity determination is required of that action. The thresholds are more restrictive as the severity of the nonattainment status of the region increases. The project region is designated as attainment for all criteria pollutants (USEPA 2014a). The criteria pollutants are compared with the emissions of Comanche County, which is in attainment for all criteria pollutants.

In order to evaluate air emissions and their impact on the overall ROI, the emissions associated with the project activities were compared with the total emissions on a pollutant-by-pollutant basis for the ROI's 2011 NEI data. Potential impacts to air quality are evaluated with respect to the extent, context, and intensity of the impact in relation to relevant regulations, guidelines, and scientific documentation. The CEQ defines significance in terms of context and intensity in 40 *CFR* 1508.27. This requires the significance of the action to be analyzed with respect to the setting of the proposed action and based relative to the severity of the impact. The CEQ NEPA regulations (40 *CFR* 1508.27[b]) provide 10 key factors to consider in determining an impact's intensity. To provide a more conservative analysis, the two counties were selected as the ROI instead of the USEPA-designated Air Quality Control Region, which is a much larger area.

The air quality analysis focused on emissions associated with construction emissions from range improvements and internal combustion generators, vehicle use, and LAMS emissions associated with demonstration activities. Construction-related sources include emissions from heavy construction machinery, semitractor-trailer rigs, and vehicle exhaust from contracted employees' personal vehicles.

For the purposes of this air quality analysis, the use of a 2-megawatt mobile diesel generator was anticipated to be required for demonstration of each of the technologies listed in Table 2.3-1. The emissions resulting from operation of the generator are summarized in Table 3.3-3.

Table 3.3-3. Emissions Resulting from Portable Diesel Generator Compared with Comanche County Emissions

	Emissions (tons/year)						
	CO	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOCs**	**CO_2e**
ROI Emissions	**45,118**	**6,718**	**29,163**	**5,989**	**385**	**23,151**	**1,182,212**
Generator emissions	4.25	18.54	0.54	0.00	0.31	0.54	910
Percent of County Emissions	*0.01%*	*0.28%*	*0.00%*	*0.00%*	*0.08%*	*0.00%*	*0.08%*

Source: USEPA 2014b

CO = carbon monoxide; CO_2e = carbon dioxide equivalents; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_x = sulfur oxides; VOC = volatile organic compound

GHGs are included in the analysis. The primary source of carbon dioxide emissions would be from vehicles operating on-site during construction and ongoing generator and aircraft emissions from demonstration activities. Construction equipment operation, worker commuting, and aircraft emissions would contribute to GHG emissions in the area. GHG emissions would be compared with the CEQ's minimum level of 25,000 metric tons (27,558 tons) as a level at which consideration would be required in NEPA documentation. Air quality calculations are provided in Appendix C.

3.3.2.2 No Action Alternative

The No Action Alternative would not result in any additional impacts to air quality beyond the scope of normal conditions and influences within the ROI.

3.3.2.3 Alternative 1 – Demonstrations on West Range Area

Under Alternative 1, short-term, temporary construction emissions would be generated by heavy equipment completing improvements to Firing Point 240E and worker trips while construction was ongoing. Operational emissions would be associated with generators providing external power to various Electric Fires systems and from military vehicles providing transportation to personnel and/or equipment during demonstrations. It is assumed that LAMS would be electric and therefore would have no associated criteria pollutant emissions. Any new activity not described in Chapter 2 or new technology that could have the potential to adversely impact air quality must be evaluated in accordance with 32 *CFR* 651. Likewise, demonstration activities would be required to follow the DSW Preparation Instructions (Appendix B). Individual demonstrations would then be evaluated by appropriate personnel and if the potential for adverse impacts to air quality exists, further NEPA and/or permitting would be required.

Emissions associated with Alternative 1 are calculated and summarized in Table 3.3-4. Construction emissions were calculated using DoD-developed Air Conformity Applicability Model Version 5.0 inputs. Calculations are described in Appendix C.

Impacts resulting from implementation of the demonstrations would amount to less than 1 percent of each of the criteria pollutants. Increases from construction and range improvements result in only a short-term, temporary increase in emissions. GHG emissions would be well less than 25,000 metric tons (27,558 tons).

Table 3.3-4. Construction and Vehicle Emissions Compared with Comanche County Emissions

	Emissions (tons/year)						
	CO	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOCs**	**CO_2e**
ROI Emissions	**45,118**	**6,718**	**29,163**	**5,989**	**385**	**23,151**	**1,182,212**
Construction emissions	**3.99**	**5.84**	**2.77**	**0.28**	**0.01**	**0.80**	**1,064**
Vehicle emissions	**0.40**	**0.07**	**0.00**	**0.00**	**0.00**	**0.05**	**36**
Total	4.39	5.91	2.77	0.28	0.01	0.85	1,100
Percent of County Emissions	*0.01%*	*0.09%*	*0.01%*	*0.00%*	*0.00%*	*0.00%*	*0.09%*

3.3.2.3.1 Electro-Dynamic Kinetic Energy Systems

Electromagnetic Launch **–** Emissions associated with EM launch under Alternative 1 are calculated and summarized in Table 3.3-3. The emissions are associated with an external generator used to power the system. Impacts would amount to less than one percent of the ROI's overall annual air emission on a pollutant-by-pollutant basis. The EM railgun does not require the use of a propellant. Firing of railgun projectiles generates small quantities of aluminum oxide (Al_2O_3) in the immediate vicinity of firing caused by the abrasion of aluminum components. The quantity and form of aluminum oxide that would be emitted is not considered toxic and would not require any additional safety measures.

Combustion Light Gas Gun **–** Emissions associated with the combustion light gas gun under Alternative 1 are calculated and summarized in Table 3.3-3. Emissions are associated with an external generator used to run the system. The system itself uses combustion light gases such as hydrogen or oxygen to propel projectiles. Combustion of these light gases produces no air pollutants. Impacts would amount to less than one percent of the ROI's overall annual air emission on a pollutant by pollutant basis.

Electrothermal-Chemical Gun – Emissions associated with the electrothermal-chemical gun under Alternative 1 are calculated and summarized in Table 3.3-3. Emissions are associated with an external generator used to run the system. Impacts would amount to less than one percent of the ROI's overall annual air emission on a pollutant by pollutant basis.

3.3.2.3.2 Directed Energy Systems

Emissions associated with the directed energy systems (acoustic, high power microwave, radio frequency, laser, particle beam, and laser induced plasma channel) under Alternative 1 are calculated and summarized in Table 3.3-3. Emissions are associated with an external generator

used to run the systems. Impacts would amount to less than 1 percent of the ROI's overall annual air emission on a pollutant-by-pollutant basis.

3.3.2.4 Summary

Emissions associated with Alternative 1 are summarized in Table 3.3-5. Emissions are associated with construction activities, vehicle operations, and external portable generators used to power the demonstrations. Impacts would amount to less than one percent of the ROI's overall annual air emissions on a pollutant-by-pollutant basis for all pollutants except for NO_x. NO_x emissions would total 2.57 percent of the annual NO_x emissions for Comanche County. There would be no significant impact to local or regional air quality from implementation of Alternative 1.

In accordance with Fort Sill regulations, portable generators would be those generators capable of being moved after shutdown and disconnect. Mobile refuelers or an approved refueling container (e.g., Jerry cans) would be used to refuel generators. No aboveground storage tanks or 55-gallon drums would be used for refueling. Spill kits would be available and readily accessible during portable generator refueling.

Table 3.3-5. Alternative 1 Emissions Summary Compared with Comanche County Emissions

	Emissions (tons/year)						
	CO	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOCs**	**CO_2e**
ROI Emissions	**45,118**	**6,718**	**29,163**	**5,989**	**385**	**23,151**	**1,182,212**
Construction emissions	3.99	5.84	2.77	0.28	0.01	0.80	1,064
Vehicle emissions	0.40	0.07	0.00	0.00	0.00	0.05	36
Generator emissions	38.24	166.84	4.87	0.00	2.81	4.90	8,190
Total	42.62	172.75	7.63	0.28	2.82	5.75	9,290
Percent of County Emissions	*0.09%*	*2.57%*	*0.03%*	*0.00%*	*0.73%*	*0.02%*	*0.79%*

Source: USEPA 2014b

CO = carbon monoxide; CO_2e = carbon dioxide equivalents; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_x = sulfur oxides; VOC = volatile organic compound

3.3.2.5 Alternative 2 – Demonstrations on East Range Area

Under Alternative 2, no construction would be necessary, so there would be no construction equipment emissions generated. As with Alternative 1, operational emissions would be associated with portable generators providing external power to various Electric Fires demonstrations and from military vehicles providing transportation to personnel and/or equipment during demonstrations. Emissions associated with vehicle operations and generator use would be the same under Alternative 2 as under Alternative 1.

Emissions associated with Alternative 2 are summarized in Table 3.3-6. Impacts would amount to less than one percent of the ROI's overall annual air emission on a pollutant by pollutant basis for all pollutants except for NO_x. NO_x emissions would total 2.48 percent of the annual NO_x emissions for Comanche County. There would be no significant impact to local or regional air quality from implementation of Alternative 2.

Table 3.3-6. Alternative 2 Emissions Summary Compared with Comanche County Emissions

	Emissions (tons/year)						
	CO	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOCs**	**CO_2e**
ROI Emissions	**45,118**	**6,718**	**29,163**	**5,989**	**385**	**23,151**	**1,182,212**
Vehicle emissions	0.40	0.07	0.00	0.00	0.00	0.05	36
Generator emissions	38.24	166.84	4.87	0.00	2.81	4.90	8,190
Total	38.64	166.91	4.87	0.00	2.81	4.95	8,226.00
Percent of County Emissions	*0.09%*	*2.48%*	*0.02%*	*0.00%*	*0.73%*	*0.02%*	*0.70%*

Source: USEPA 2014b

CO = carbon monoxide; CO_2e = carbon dioxide equivalents; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_x = sulfur oxides; VOC = volatile organic compound

3.4 NOISE

3.4.1 Affected Environment

3.4.1.1 Definition of the Resource

Noise is considered unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. Sound levels in this document are stated in decibels (dB), a logarithmic scale used to simplify communication of a very wide range of audible sound pressure levels. At distances of about three feet, normal human speech ranges from 63 to 65 dB, loud kitchen appliances (e.g., blender) range from about 83 to 88 dB, and rock bands can approach 110 dB.

The frequency (i.e., pitch) of a sound is also important in determining how the sound will be perceived. Unless otherwise noted, noise levels in this document have been adjusted to emphasize frequencies heard best by the human ear, a process known as "A-weighting." Large-arms munitions firing generates sounds that are felt as well as heard. With this type of noise, energy in frequency bands not heard well by the human ear could have substantial impacts. Large-arms munitions noise levels are often C-weighted, an adjustment that de-emphasizes extremely low- and high-frequency sounds to a lesser extent than A-weighting. Peak level decibels (dBP) is often used when describing noise from small-arms ranges. Peak level is the maximum instantaneous sound level that occurs during an acoustic event. Another analysis used for assessing explosive noise is PK 15 (met) peak noise levels. Risk of complaint is considered low for a PK 15 (met) < 115 dB, moderate for levels of 115-130 dB, and high for levels >130dB.

For noise impacts, the ROI for the proposed action and the No Action Alternative includes the West and East Range areas and the surrounding area where potential noise impacts are anticipated.

3.4.1.2 Existing Conditions

The noise environment at Fort Sill consists primarily of three types of noise: transportation noise from aircraft and vehicles, noise from firing at small-arms ranges, and noise from large caliber weapons firing and military explosives operations. The existing noise contours for Fort Sill for both small-arms and large caliber weapons and explosive noise are shown on Figure 3.4-1.

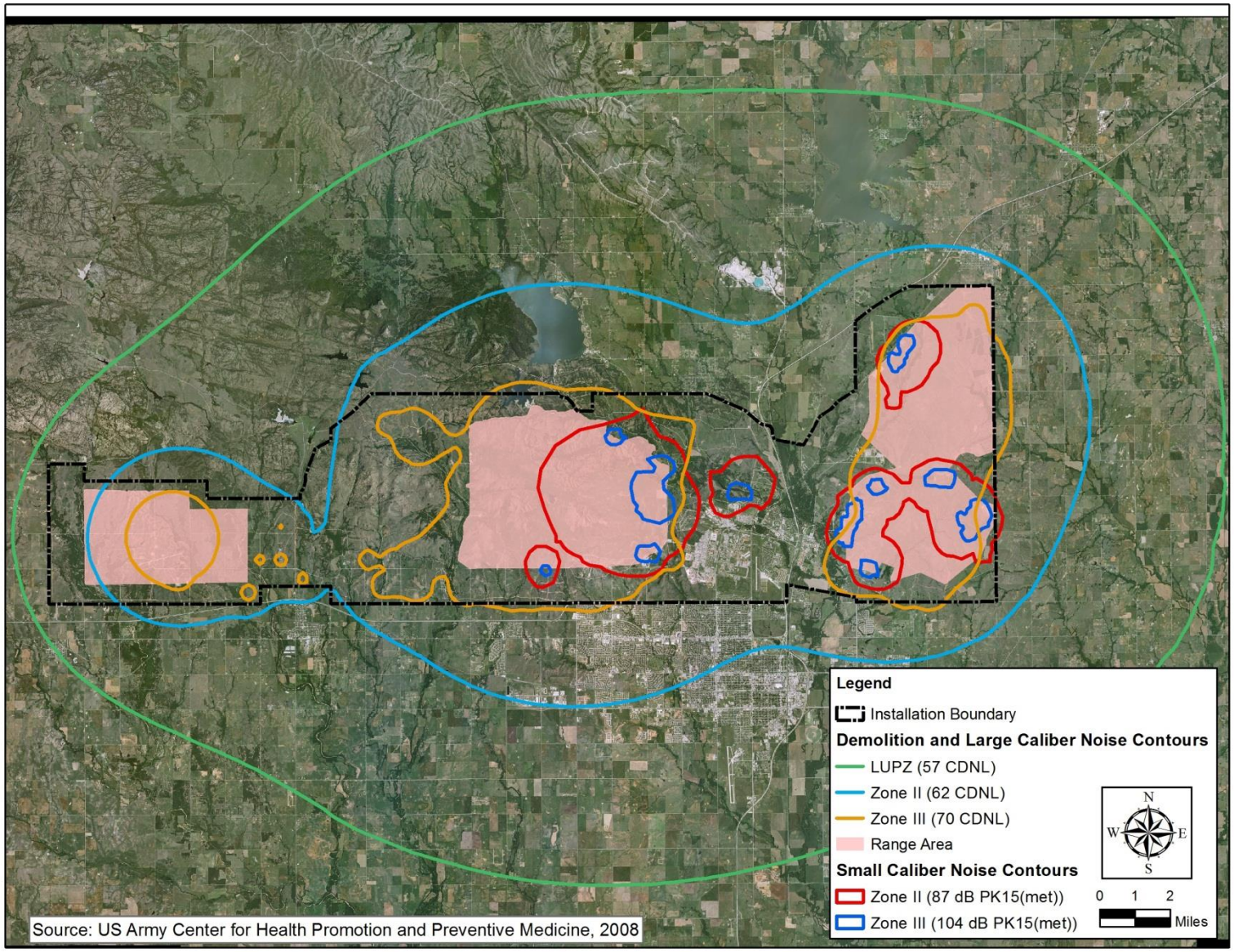


Figure 3.4-1. Existing Noise Contours at Fort Sill

AR 200-1, *Environmental Protection and Enhancement,* defines recommended noise limits from Army activities for established use of land with respect to environmental noise. These include:

- **Land Use Planning Zone (LUPZ):** Zone used to better predict noise impacts associated with increased levels of operations at airfields or with large caliber weapons ranges. This zone is used to provide communities with additional information regarding land use decisions.
- **Zone 1:** Typically compatible with most noise-sensitive (housing, schools, medical facilities) land uses.
- **Zone 2:** Normally incompatible with most noise-sensitive land uses. Exposure to noise in this zone may be considered significant. Without additional mitigation, land uses are normally limited to industrial-related activities.
- **Zone 3:** Incompatible with noise-sensitive land uses. Noise levels are generally considered severe, thus noise-sensitive land uses should not be considered in this zone.

While the noise contours for large caliber weapons extend off of the installation boundary, the majority of noise associated with small-arms fire only impacts areas within the installation boundary.

3.4.2 Environmental Consequences

3.4.2.1 No Action Alternative

Implementation of the No Action Alternative would result in no changes to the noise environment at Fort Sill. Under this alternative, there would be no demonstrations and noise levels would remain consistent with baseline conditions.

3.4.2.2 Alternative 1 – Demonstrations on West Range Area

Construction activities in support of the Firing Point 240E improvements would occur in the context of an active Army post near the West Range impact area where artillery and other loud explosions are a normal part of the environment. Construction activities would generate localized increases in noise qualitatively different from noise associated with a firing range. For example, a typical backhoe, dozer, and crane generate up to approximately 78, 82, and 81 dB, respectively, at a distance of 50 feet (FHWA 2006). Construction noise would be temporary and intermittent, lasting only the duration of the project. No significant impacts to the noise environment would be anticipated to result from construction activities.

Noise levels resulting from implementation of Alternative 1 would vary depending upon the type of system being demonstrated. As shown in Table 3.4-1, noise levels resulting from the majority of the directed energy systems are negligible. Acoustic systems would produce noise levels in the 120-170 dB range, but the nature of these systems is such that the noise is highly focused and limited to the specific target area. Noise levels resulting from the electro-dynamic kinetic energy systems and the LAMS range from 166-192 dB. Noise associated with these systems is comparable to existing artillery systems in use at Fort Sill in that the noise levels are high intensity but for a short duration. The dB levels associated with these systems are also similar to existing systems at Fort Sill (Table 3.4-1). As with current range operations, hearing protection

would be required during demonstrations as necessary. Up to six demonstrations of various technologies would occur at Fort Sill on an annual basis. This level of demonstration is not anticipated to result in significant impact on the noise environment at Fort Sill.

Table 3.4-1. Sounds Levels and Hearing Effects Resulting from Proposed Electric Fires and Loitering Aerial Munition System Demonstrations and Existing Army Weapon Systems

System	Sound Level (dB)	Hearing Effects
EM Launch	180-192	High Intensity, Short Duration
Combustion Light Gas Gun	180-192	High Intensity, Short Duration
Electrothermal-Chemical	180-192	High Intensity, Short Duration
Acoustic	120-170	Localized, focused target area
High Power Microwave	Negligible	Could produce slight clicking or buzzing sound at certain frequencies
Radio Frequency	Negligible	Could produce slight clicking or buzzing sound at certain frequencies
Laser	Not applicable – visible light only	None
Particle Beam	Negligible	High Intensity, Short Duration
Laser Induced Plasma Channel	Negligible	High Intensity, Short Duration
LAMS	166	High Intensity, Short Duration
Noise Levels for Existing Army Systems		
M3 MAAWS Recoilless Rifle	190	High Intensity, Short Duration
M72A3 Light Antitank Weapon	182	High Intensity, Short Duration
Paladin 155 MM Self-propelled howitzer	166	Sound experienced by gunner in open firing compartment
105 MM towed howitzer	183	High Intensity, Short Duration

*Source/credit FBL

3.4.2.3 Alternative 2 – Demonstrations on East Range Area

No construction activities would occur as a result of implementing Alternative 2 and there would be no construction related noise impacts. Noise impacts associated with demonstrations in the East Range area would be the same as those described for Alternative 1. No significant noise impacts would be anticipated.

3.5 BIOLOGICAL

3.5.1 Affected Environment

3.5.1.1 Definition of the Resource

For purposes of this EA, sensitive and protected biological resources include plant and animal species that are federally (U.S. Fish and Wildlife Service [USFWS]) or state (Oklahoma Department of Wildlife Conservation [OKDWC]) listed for protection. Identifying which species occur in an area affected by an action might be accomplished through literature reviews and

coordination with appropriate federal and state regulatory agency representatives, resource managers, and other knowledgeable experts.

For the purposes of this biological resources analysis, the ROI for Alternative 1, Alternative 2, and the No Action Alternative includes the land within and immediately surrounding Fort Sill.

3.5.1.2 Existing Conditions

3.5.1.2.1 Vegetation

Fort Sill lies within an ecological transition area where tall-grass prairie merges with short-grass prairie, and soil variation has created diverse plant communities. Grassland communities constitute more than 70 percent of Fort Sill. Tall grasses like big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), and Indian grass (*Sorghastrum nutans*) dominate sites with deep soils. Native legumes and other forbs are also numerous in these areas. Medium and short grasses like blue grama (*Bouteloua gracilis*) and sideoats grama (*Bouteloua curtipendula*) occupy more droughty hardland and slickspot soils. Medium and short grasses like hairy and sideoats grama (*Bouteloua spp.*) and fall witchgrasses (*Leptoloma cognatum*) are abundant on very shallow rocky soils.

In addition to grassland communities, vegetation within Fort Sill includes a mix of dense woodland, riparian areas, oak savannah, and agricultural lease lands. Dense woodlands include bottomland forest and cross timbers. Principal trees in the bottomland forest are elm (*Ulmus spp.*), pecan (*Carya illinoensis*), and hackberry (*Celtis occidentalis*). Trees in the cross timbers include blackjack oak (*Quercus marilandica*), post oak (*Q. stellata*), hickories (*Carya spp.*) and elms. Riparian areas are primarily vegetated with elm, pecan, hackberry, and various species of oak. Oak savannah includes various species such as red oak (*Quercus shumardii*), blackjack oak, bur oak (*Quercus macrocarpa*), post oak (*Quercus stellata*), and white oak (*Quercus alba*). Invasive mesquite (*Prosopis glandulosa*) and eastern red cedar (*Juniperus virginiana*) are also present. Mesquite and oak thickets have encroached grassland prairie areas and compete with native short-, medium-, and tall-prairie grasses. Eastern red cedar has encroached in wooded and prairie areas where fire has been controlled.

Agricultural lease areas are located in both the West and East Range areas of Fort Sill and contain a variety of vegetation including cultivated fields, alfalfa crops, and mowed and hayed fields. Invasive grass species include Johnson grass (*Sorghum halepens*e), three awn (*Aristida adscensionis*), and gumweed (*Grindelia sp.*) (USAFACFS 2003).

3.5.1.2.2 Wildlife

Mammals **–** The diversity of natural environments at Fort Sill provides suitable habitat for a wide variety of mammal species. Frequently encountered mammal species include coyote (*Canis latrans*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), cottontail rabbit (*Sylvilagus floridanus*), fox squirrel (*Sciurus niger*), beaver (*Castor canadensis*), opossum (*Didelphis virginiana*), prairie vole (*Microtus ochrogaster*), deer mouse (*Peromyscus maniculatus*), and white-footed mouse (*P. leucopus*). Less frequently encountered are large herbivores such as mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*), and large carnivores such as mountain lions *(Felis concolor).* Bison (*Bison bison*) inhabit the WMWR and

have on occasion been found on Fort Sill (USAFACFS 2003). Game species include white-tailed deer (*Odocoileus virginianus*), elk, raccoons, feral pigs (*Sus scrofa*), and coyotes. Bat species potentially occurring on Fort Sill include silver-haired bat (*Lasionycteris noctivagans*), Mexican free-tailed bat (*Tadarida brasiliensis*), eastern red bat (*Lasiurus borealis*), and the hoary bat (*Lasiurus cinereus*) (USAFACFS 2003).

Birds – The State of Oklahoma is within the Central Flyway migration corridor. This migration corridor is utilized by over 400 avian species. Fort Sill provides suitable stopover or resident habitat for many of these species. Bird species commonly observed at Fort Sill include American crow (*Corvus brachyrhynchos*), black-capped vireo (*Vireo atricapillus)*, common grackle (*Quiscalus quiscula*), European starling (*Sturnus vulgaris*), turkey vulture (*Cathartes aura*), bobwhite quail (*Colinus virginianus*), mourning dove (*Zenaida macroura*), pheasants (*Phasianus colchicus*), and several species of swallows (*Hirundo* spp.). Avian game species on the installation include bobwhite quail, mourning dove, pheasants, and waterfowl species such as mallard, teal, and Canada and snow geese. Several natural areas providing habitat and refuge for birds, as well as many other wildlife species, have been established on the installation.

Fish – Aquatic habitat within Fort Sill includes several creeks and associated tributaries and ponds. Common fish species that could inhabit these waters include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), green sunfish (*L. cyanellus*), channel catfish (*Ictalurus punctatus*), and others.

Reptiles and Amphibians – A herpetological survey documenting species observations for the installation was performed at Fort Sill in 1991. A total of 45 species were either collected or verified by sightings (USAFACFS 2003). Reptile species with potential to occur within Fort Sill could include a wide variety of turtles, lizards, and snakes. Amphibians could also be present, including salamanders, frogs, and toads.

3.5.1.2.3 Special Status Species

Special status plant and wildlife species are subject to regulations under the authority of federal and state agencies. The Endangered Species Act (ESA) (16 United States Code [U.S.C.] 1532 et seq.) of 1973, as amended, was enacted to protect and recover imperiled species and the ecosystems upon which they depend. The USFWS maintains a list of special status species considered endangered, threatened, or candidate.

"Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future. Candidate species include plants and animals that have been studied and proposed for addition by the USFWS to the federal endangered and threatened species list. All federal agencies are required to implement protection programs for endangered and threatened species and to use their authority to further the purposes of the act.

The Migratory Bird Treaty Act (MBTA) prohibits actions resulting in the pursuit, capture, killing, and/or possession of any protected migratory bird, nest, egg, or parts thereof. The USFWS maintains a list of designated migratory birds occurring in various regions of the

United States. The USFWS regulations allow for the incidental take of migratory birds for military readiness activities.

USFWS and OKDWC special status species lists, by county, were obtained to identify species with the potential to occur within Comanche County (USFWS 2014b, OKDWC 2014). Five federally listed migratory bird species were identified and include: piping plover (*Charadrius melodus*); American peregrine falcon (*Falco peregrinus anatum*); whooping crane (*Grus americana*); red knot (*Calidris canutus rufa*); and the black-capped vireo (Table 3.5-1). No state-listed species were identified.

Additionally, the USFWS Critical Habitat Portal was accessed to determine if designated critical habitat was present on or near Fort Sill. No critical habitat for these species is present in Comanche County (USFWS 2014c).

Table 3.5-1. Special Status Species with Potential to Occur in Comanche County, OK

Common Name	Scientific Name	Protection Status[a]	Habitat	Potential to Occur within Fort Sill
Birds				
Piping Plover	*Charadrius melodus*	Threatened	Found on mudflats, sandy beaches and shallow wetlands with sparse vegetation. Might be found along the margins of lakes and large rivers where there is exposed (bare) sand or mud.	Rare migrant
American Peregrine Falcon	*Falco peregrinus anatum*	Delisted due to recovery	Resident in sand shinnery oak communities. Nest in cliffs and tall, man-made structures surrounded by open landscapes with nearby riparian areas.	Rare migrant
Whooping Crane	*Grus americana*	Endangered	Pass through Oklahoma during spring and fall migration. Stopover habitat includes shallow wetlands, marshes, margins of ponds and lakes, sandbars, and shorelines of shallow rivers, wet prairies and crop fields near wetlands. Critical habitat for the whooping crane is located approximately 150 miles north of Fort Sill near the Oklahoma/Kansas border.	Rare migrant
Red Knot	*Calidris canutus rufa*	Threatened	Migrates annually between its breeding grounds in the Canadian Arctic and wintering regions, including the southeast United States, the northwest Gulf of Mexico, northern Brazil and the southern tip of South America. Might pass through Oklahoma during migration.	Rare migrant
Black-capped Vireo	*Vireo atricapillus*	Endangered	Low brushy thickets comprised of deciduous trees such as oaks, redbuds, and plums. Documented occurrence in Wichita Mountains of northern Comanche County.	Yes

Table 3.5-1. Special Status Species with Potential to Occur in Comanche County, OK (Continued)

Common Name	Scientific Name	Protection Status[a]	Habitat	Potential to Occur within Fort Sill
Fish				
Arkansas River Shiner	*Notropis girardi*	Threatened	Inhabits the shallow braided channels of wide sandy prairie rivers in the Arkansas River system. Nearly all remaining Oklahoma populations occur in the Canadian River. A small population might persist in the Cimarron River. Critical habitat for the Arkansas River shiner is located approximately 65 miles northeast of Fort Sill in two streams near Oklahoma City.	No
Leopard Darter	*Percina pantherina*	Threatened	Live within rocks and cobble on the bottom of clear, swift-flowing small rivers. In Oklahoma, three isolated populations are known to occur within the Little River watershed. Critical habitat for the leopard darter occurs in the eastern part of the state, over 175 miles away from Fort Sill.	No

[a] Federal.
Source: USFWS 2014b, 2014d; OKDWC 2011a, 2011b, 2011c, 2011d, 2011e.

Of the five federally listed migratory bird species with potential to occur in Comanche County, only the black-capped vireo is known to nest at Fort Sill. The piping plover and whooping crane, have been observed within Comanche County during migration periods, but have not been documented at the installation. The American peregrine falcon has been observed from Fort Sill during migration (Wampler 2014a). The red knot could potentially migrate through Comanche County; however, there are no known nesting sites or stopover habitat within Oklahoma (Stubbs 2014). The red knot has not been observed at Fort Sill (Wampler 2014b).

The Arkansas River shiner was historically widespread and abundant throughout the western portions of the Arkansas River basin in Kansas, New Mexico, Oklahoma, and Texas; however, it is now almost entirely restricted to approximately 510 miles of the Canadian River in Oklahoma, Texas, and New Mexico. The population nearest to Fort Sill is located 65 miles northeast of the installation. A small remnant population could persist in the Cimarron River (Oklahoma-Kansas). Hatchery propagation is being carried out at the Tishomingo National Fish Hatchery in Oklahoma; propagated fish are to be released into protected habitats (OKDWC 2011e).

In Oklahoma, the leopard darter currently lives in three isolated populations within the Little River watershed. The population nearest to Fort Sill is located in the Glover River approximately 175 miles east of Fort Sill. The other populations occur in the Little River above Pine Creek Reservoir and in the Mountain Fork River above Broken Bow Reservoir (OKDWC 2011f).

Black-Capped Vireo **–** Black-capped vireos nest in an early-successional, deciduous scrub community. This habitat is generated as the result of various disturbances, including wildfire or mechanical removal of woody top growth. Good nesting habitat for black-capped vireos includes a wide diversity of hardwoods in a patchy, low-growing pattern with open, grassy spaces between patches of woody vegetation. Throughout the range of the species, the black-capped

vireo is threatened by cowbird nest parasitism and by habitat loss from browsing animals (goats, deer, and exotics), fire suppression, and urban development (USFWS 2007, Fazio and Grzybowski 2011).

The black-capped vireo was placed on the federal list of endangered species in October 1987 (Ratzlaff 1987). The recorded occurrence of the black-capped vireo dates back to 1943 at Fort Sill and to 1929 in the adjacent Wichita Mountains (Fazio and Grzybowski 2011). A study to fully document the current status of the vireo was initiated by the Army in 1988 (Tazik and Grzybowski 1988), and monitoring efforts continue at the installation. Annual reports are completed to evaluate the distribution, abundance, dispersal, minimum survival, habitat requirements, and reproductive success of vireos on Fort Sill (Tazik and Grzybowski 1993). Through this effort, long-term monitoring of vireo success and habitat management of territories to assist in species recovery is achieved.

In accordance with Chapter 4 of AR 200-1, Fort Sill has prepared an Endangered Species Management Plan (ESMP) (Fort Sill 1999) and an Integrated Natural Resource Management Plan (INRMP) (USAFACFS 2003), which provide guidelines for maintaining and enhancing populations and habitats of the black-capped vireo on Fort Sill while maintaining mission readiness consistent with Army and federal environmental regulations. In managing the species on the installation, Fort Sill also complies with the MBTA, which prohibits harming the birds, their nests, or their eggs.

Fort Sill continues to comply with the reasonable and prudent measures and associated terms and conditions outlined in the *Biological Opinion on Military Activities at Fort Sill* (USFWS 1998). These measures include:

Annual Survey

- Annually survey and monitor for presence and territories to develop and maintain viable and secure populations while providing the appropriate protection.

Military Training

- Minimize training use of black-capped vireo nesting habitat areas during the nesting season (April-July).
- Areas designated as black-capped vireo territories must not contain points used as destinations by troops involved in training. From April-July these areas are limited use areas.
- Continue designation of no off-road maneuver for vireo areas.

Cowbird Removal

- Implement control efforts to include trapping, shooting, and cowbird egg and nestling removal. An annual report of trapping results must be submitted to the USFWS.

3.5.1.2.4 Natural Resource Area of Concern

The USFWS Information, Planning, and Conservation (IPaC) system was accessed to identify any National Refuge lands, Coastal Barrier Resource Units, and invasive species management

practices with potential to be affected by the alternatives. The IPaC system identified the WMWR as a Natural Resource Area of Concern (USFWS 2014e). The National Wildlife Refuge System, managed by the USFWS, is the nation's premier system of public lands and waters set aside to conserve America's fish, wildlife, and plants.

Wichita Mountains National Wildlife Refuge – The 59,020-acre WMWR is located directly northwest of Fort Sill (see Figure 1.2-1). The WMWR provides mixed-grass prairie habitat to more than 50 mammal species, 240 bird species, 64 reptile and amphibian species, 36 fish species, and 806 plant species (USFWS 2014a).

The endangered black-capped vireo is one of the more heavily monitored species found in the WMWR. This migratory bird, which overwinters in Mexico, comes to the WMWR in late April and early May of each year to find mates, establish nests, and raise young. It remains through August, when it returns to its wintering grounds. The bird is endangered due to loss of habitat in areas other than the WMWR, as well as nest predation by the brown-headed cowbird. The WMWR black-capped vireo population is currently estimated at 5,000 birds, which is the largest breeding colony in the state of Oklahoma.

Bald eagles utilize WMWR lakes for feeding and secluded WMWR sites for roosting during winter months. The number of wintering eagles, both bald and golden, varies from three to six in most years. Refuge management for this species is primarily protection from harassment, providing habitat, and active fishery management to ensure an adequate food supply for the eagles. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act, which prohibits "take" of individual birds and their parts (feathers, skins, etc.), eggs, or nests.

3.5.2 Environmental Consequences

3.5.2.1 No Action Alternative

Under the No Action Alternative, no impacts to biological resources would be expected. Baseline conditions at Fort Sill would continue.

3.5.2.2 Alternative 1 – Demonstrations on West Range Area

3.5.2.2.1 Vegetation and Wildlife

Construction activities associated with the implementation of Alternative 1 could result in minor adverse impacts to vegetation and wildlife resources at Firing Point 240E. Impacts would be minor as this area is already utilized as a firing point for artillery and has been previously disturbed in the past. There is no unique habitat in this area and the impacts resulting from the earth work to remove and flatten existing man-made berms, construction of a gravel parking area and new facilities, increased ground disturbance, additional personnel, and from the slight increase in equipment and military training activities would be minor. These impacts are not anticipated to be significant or have long-term effects on population viability.

Demonstrations of electro-dynamic kinetic energy systems and LAMS associated with the implementation of Alternative 1 could result in minor adverse impacts to vegetation and wildlife resources in the West Range area. Impacts would primarily be related to the effects of projectiles

or explosives in the impact area. However, this area is currently impacted by projectiles on a regular basis through normal range operations.

According to a noise analysis conducted in 2008 (U.S. Army Center for Health Promotion and Preventative Medicine 2008), Fort Sill annual operations include the use of over 138,000 demolition and large caliber events at the installation. For the purposes of this analysis an assumption was made that the existing 138,000 demolition and large caliber weapons used at the installation occur equally among the Quanah, West, and East Ranges. A conservative estimate was made that all six proposed annual demonstrations would be electro-dynamic kinetic energy systems/LAMS and that each event would use up to 100 rounds. Using these measures, it would be anticipated that demonstrations of electro-dynamic kinetic energy systems/LAMS would account for 600 events or 0.01 percent (600/46,000) of the current demolition and large caliber usage at the West Range area. This minimal increase of events is not anticipated to have a significant impact on vegetation or wildlife in the West Range area.

In addition to potential effects related to the damage caused by projectiles certain electro-dynamic kinetic energy systems (e.g. railguns) might produce strong electric or magnetic fields. These fields are limited to the immediate vicinity of the system. The IEEE C95.1 standards for human health were based on known effects to animals with conservative factors added to minimize potential impacts to human health (IEEE 2005). Therefore, no impacts to wildlife are anticipated from the EM fields associated with the power levels for the electro-dynamic kinetic energy systems proposed for demonstrations in the West Range area of Fort Sill.

Directed energy system demonstrations associated with the implementation of Alternative 1 could result in minor adverse impacts to wildlife resources in the West Range area. These systems are anticipated to have negligible impacts on vegetation. The specific impacts to wildlife from directed energy systems would be related to the type of system used (acoustic, laser, and high power microwave/radio frequency) and are discussed below.

Acoustic – Acoustic systems use directed sound waves to either communicate warnings or broadcast deterrent tones. These systems focus sound along a relatively narrow beam. Potential impacts to wildlife would be due to exposure to the high decibel levels that these systems are capable of producing. Long-term exposure to high decibel levels could cause hearing loss if wildlife do not move and are consistently exposed to these sound levels.

The potential for wildlife exposure would be minimized by the standard range operating procedures to minimize impacts to wildlife (Fort Sill 385-1). Prior to a demonstration, all non-participating personnel and visible wildlife would be cleared from the demonstration area, and the demonstration would cease if non-participating personnel or any wildlife would happen to enter the demonstration area. The system would only remain on for the time necessary to accomplish the purpose of the demonstration. No significant impacts are anticipated to wildlife as a result of acoustic demonstrations at Fort Sill.

Laser, Particle Beam, Laser Induced Plasma Channel – Potential impacts to wildlife from lasers are mainly related to potential damage to vision as a result of directly viewing the laser. The highest power lasers could cause direct damage to skin and eyes and have the potential to damage vision from indirect reflections of the laser beam. The system would only remain on for

the time necessary to accomplish the purpose of the demonstration. Prior to a demonstration, all personnel and visible wildlife would be cleared from the demonstration area and the demonstration would cease if people or wildlife approached the laser corridor. As described in Section 3.2, Fort Sill currently has a rigorous safety program for the use of lasers which further reduces the likelihood of direct and indirect laser impacts.

While particle beam and laser induced plasma channel systems are still undergoing development in laboratories, impacts to wildlife from these systems are expected to be minimal. These systems are designed to target and disrupt electronic systems, and impacts would be similar to those of lasers. Should future applications of these technologies achieve levels that could be potentially harmful to wildlife and the probability of impacts to wildlife increase beyond that discussed below, additional evaluation of these systems would be required.

The probability of a bird or other wildlife straying into a beam during a demonstration is considered low due to the short duration of a laser, particle, or laser induced plasma channel beam and the small area represented by these beams. Therefore, impacts to wildlife resulting from these demonstrations would be considered short-term minor adverse impacts. No significant impacts to wildlife are anticipated as a result of these demonstrations in the West Range area of Fort Sill.

High Power Microwave/Radio Frequency **–** The hazards of EM fields associated with demonstrations of high power microwave and radio frequency are associated with the heating effects related to the amount of energy absorbed by the body. Exposure to low-frequency EM energy (<100 kilohertz) does not typically result in significant levels of energy absorption and therefore does not result in increases in body temperature (ICNIRP 1998). Prolonged exposure to high frequencies (>100 kilohertz) can lead to significant absorption of energy, resulting in an increase in body temperature and detrimental impacts to an organism if this increase in temperature is more than the organism can regulate.

Section 3.2 discusses the IEEE standards for human exposure to radio frequency and EM fields. As explained in the IEEE C95.1 standard (IEEE 2005) Annex C, these standards for human health were based on known effects (not necessarily adverse effects) to animals with conservative factors added to eliminate or minimize impacts to human health. Therefore human health limits represent an initial point for comparison to determine potential impacts to animals. However, the conservative factors used to determine human health impacts also imply that actual effects to animals would occur at levels higher than human health limits.

Demonstrations at Fort Sill would include exclusions zones where levels would exceed the human health safety limits. These zones would be established to protect personnel and provide a conservative approach to protect wildlife. Personnel are excluded from zones where the potential exposure would exceed the relevant IEEE C95.1 (IEEE 2005 or most current version) and DoD standards (DODI 6055.11). Since physical exclusion is not always feasible for wildlife, the safety zones would be monitored for visible wildlife in accordance with Fort Sill Range Regulations (Fort Sill 358-1). As described in the above paragraph, impacts to wildlife are not anticipated but in accordance with Fort Sill regulations, any wildlife observed in these zones would be removed prior to a demonstration. Should wildlife wander into a zone during a demonstration, the demonstration would cease.

The following factors further minimize the risk and impacts of wildlife being struck by a high power microwave or radio frequency beam. The pulsed short duration of beam length (fractions of a second) and the focused beam size (see Section 3.2) make it unlikely that wildlife would stray into the beam during a demonstration. Demonstrations would require clear LOSs between the directed energy system and the target of the demonstration. These sight lines would be clear of vegetation that could potentially hide wildlife. Also the power levels from high powered microwave and radio frequency demonstrations dissipates quickly so that the maximum power levels generated near the source of the demonstration would not extend down range. Table 3.5-2 shows a comparison of EM levels by distance for a potential directed energy system at Fort Sill. This table shows that EM energy levels generated during demonstration of a 10-GW system would not exceed human limits and are thus not anticipated to be harmful to wildlife. No significant impacts to wildlife are anticipated to result from high powered microwave or radio frequency demonstrations in the West Range area of Fort Sill. Table 3.5-2 shows a comparison of EM levels by distance for a potential 10 GW 1.442 GHz high power microwave directed energy system at Fort Sill designed for 26 pulse operations at 100 nanoseconds (ns) each.

Table 3.5-2. Representative Demonstration Using a 10-Gigawatt High-Powered Microwave

Distance From Fire Point (km)	EM Power Flux Density At Location (kW/cm^2)	Human Health Limit (kW/cm^2)*	Comment
0	650	665	No effect -under the limit.
1	0.04	665	No effect. Far under limit.
2	0.01	665	No effect. Far under limit.
3	0.004	665	No effect. Far under limit.

3.5.2.2.2 Special Status Species

In addition to MBTA compliance, Fort Sill would continue to operate under the terms and conditions outlined in the ESMP to ensure population and habitat enhancement of special status species located within the installation.

The demonstration of electro-dynamic kinetic energy systems and LAMS would always be directed into the impact area at the West Range. No habitat for the vireo has been recorded in the impact area. Therefore, no significant impacts to the black-capped vireo or vireo habitat are anticipated as a result of these demonstrations.

Vireo nesting habitat occurs in the West Range training areas (Figure 3.1-1). During the vireo nesting season (April-July), directed energy systems would not be demonstrated into or over known vireo nesting territories if the systems have the potential to exceed the current IEEE standards for human health. Compliance with the requirements of the Biological Opinion would ensure that no significant impacts to the black-capped vireo would occur as a result of implementation of Alternative 1.

For the reasons described in Section 3.5.2.2.1, the potential for migratory birds to be impacted by Alternative 1 is minimal. No significant impacts to migratory bird species are anticipated.

3.5.2.2.3 Natural Resource Area of Concern

Implementation of Alternative 1 would have no significant impacts to natural resource areas of concern. The Electric Fires Office has implemented the DSW process to ensure thorough review of all demonstrations at Fort Sill (see Appendix B). Part of this review process includes the creation of an approved safety zone for the system being demonstrated. Should any portion of the proposed safety zone extend into a natural resource area of concern, the demonstration would not be completed at that location.

3.5.2.3 Alternative 2 – Demonstrations on East Range Area

Implementation of Alternative 2 would mean that Electric Fires and LAMS would be demonstrated in the East Range area of Fort Sill. Because the types of demonstrations proposed to occur in the East Range area would be the same as proposed under Alternative 1, the potential impacts to biological resources resulting from implementation of each of the systems listed in Table 2.3-1 would also be very similar or the same. The primary differences between the two alternatives is the juxtaposition of habitat, agricultural leases (could focus wildlife) and the boundaries of Fort Sill relative to the proposed demonstration sites.

No construction-related impacts would occur as a result of the implementation of Alternative 2. Implementation of Alternative 2 could result in minor, short-term impacts to biological resources. These impacts for vegetation, wildlife, natural resource areas, and migratory birds would be the same as those described for Alternative 1.

No black-capped vireo habitat is known to occur in the East Range area; therefore, no impacts to this endangered species are anticipated as a result of implementation of Alternative 2.

3.6 CULTURAL

3.6.1 Affected Environment

3.6.1.1 Definition of Resource

For cultural resources, the ROI is the area of proposed construction at Firing Point 240E within the West Range area.

The National Historic Preservation Act (NHPA) was passed into law in 1966 to help stop the inadvertent loss of historic properties significant to our heritage. The NHPA includes provisions for the Department of Interior (DOI) to maintain the National Register of Historic Places (NRHP). The NRHP is composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture. The DOI is responsible for designating the "Keeper of the Register" (Keeper). Per 36 *CFR* 60.3(f), the Keeper is the individual who has been delegated the authority by DOI to list properties and determine their eligibility for the NRHP.

As defined by Fort Sill, and as used in the 2014 Integrated Cultural Resources Management Plan (ICRMP) (Fort Sill 2014), "cultural resources consist of and include the following:

- Historic properties as defined in 36 *CFR* 800.16(l) pursuant to the NHPA (16 U.S.C. 470 et seq.) and including artifacts, records, and material remains related to such resources;
- Archeological resources as defined in the Archaeological Resources Protection Act (ARPA) (16 U.S.C. 470aa-mm) and the Archeological and Historic Preservation Act (AHPA) (16 U.S.C. 469-469c-2);
- Archeological artifact collections and associated records as defined in 36 *CFR* 79;
- Sacred sites under EO 13007 and the American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996 and 1996a); and,
- Native American remains, objects of cultural patrimony, and cultural items as detailed in the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 et seq.)."

The management of cultural resources is guided by Chapter 6 of AR 200-1. As outlined in AR 200-1, the cultural resources management program at Fort Sill has responsibility for compliance with Sections 106 and 110 of the NHPA, as well as the ARPA, AHPA, NAGPRA, AIRFA, and EOs 13007 and 13175. Responsibilities of the Fort Sill cultural resources management program are outlined in the ICRMP, which covers a wide diversity of cultural resources on the installation in compliance with Army regulations, federal legislation, and applicable guidelines.

Three broad category types of cultural resources have been identified at Fort Sill. Category 1 consists of archeological sites, including prehistoric (pre-1500), protohistoric (1500-1719), and historic period (post-1719) sites. Category 2 includes architectural/historic resources, including buildings, structures, landscapes, objects, and historic districts. Category 3 is restricted to NAGPRA-related remains, objects, and items. Sacred sites and Traditional Cultural Properties (TCPs) are not identified as separate categories, as these resources generally fall within Category 1 or 2.

3.6.1.2 Existing Conditions

Evaluating known cultural resources has been a major focus at Fort Sill in the recent past. As of September 2013, all standing buildings and structures constructed prior to 1967 and nearly 200 archaeological sites have been evaluated for NRHP eligibility. The archaeological site evaluations are ongoing and the structures will continue to be evaluated as they meet the 45-year age requirement for NRHP evaluation (RCG&A 2013).

There are currently nine properties on Fort Sill listed in the NRHP and more than 400 NRHP-eligible properties (consisting of 36 archaeological sites; 19 individual architectural/historic buildings, structures, and sites; and 10 historic districts containing approximately 368 standing resources).

EO 13007 identifies Native American sacred sites as special floral and faunal and mineral areas that contain resources used in religious ceremonies, among other natural and cultural resources. Confidentiality and access to these sites is mandated by this EO and the AIRFA. For these reasons, no maps or descriptions are publicly available.

Fort Sill consults with Native American tribes to provide access to sacred sites (including plants, animals, and landscapes considered sacred) located on Fort Sill; however, in accordance with AR 200-1, the Garrison Commander could impose reasonable restrictions and conditions on access to sacred sites on Fort Sill for the protection of health and safety or for reasons of national security (RCG&A 2013).

There are no cultural resource sites in the immediate vicinity of Firing Point 240E. The closest site is located over 1,000 feet south southwest of the site and is not NRHP-eligible.

3.6.2 Environmental Consequences

3.6.2.1 No Action Alternative

Under the No Action Alternative, there would be no construction related activities and no impacts to cultural resources.

3.6.2.2 Alternative 1 – Demonstrations on West Range Area

Implementation of the proposed action is not anticipated to result in adverse impacts to cultural resources. Construction related impacts and land disturbance would be limited to the immediate area around Firing Point 240E (Section 2.6.1 and Figure 2.6-2). There are no known cultural resource sites at this location. In compliance with Section 106 of the NHPA, Fort Sill is coordinating with the SHPO and affiliated Tribes for concurrence on a finding of no effect to cultural resources as a result of implementing the proposed action.

The demonstration of electro-dynamic kinetic energy systems would be conducted in accordance with the same regulations and procedures applicable to existing projectile systems at Fort Sill. Projectiles would be fired into the existing impact areas and no impacts to cultural resources are anticipated. The demonstration of directed energy systems such as acoustic, high power microwave, and radio frequency systems would have no potential to impact cultural resources at Fort Sill. Directed energy systems such as the laser, particle beam, or laser induced plasma channel would also be demonstrated into the impact areas, and no impacts to cultural resources are anticipated to result from these systems.

Although the potential for undiscovered resources is low, inadvertent discoveries are protected and maintained in accordance with the NHPA, ARPA and NAGPRA. If cultural resources are discovered during military training or other activities, all work with the potential to impact the discovery immediately stops, reasonable effort is taken to protect cultural resources from further impact, and the Fort Sill Cultural Resources Officer (CRO) is to be immediately contacted. If the CRO determines the presence of cultural items in accordance with the NAGPRA, the CRO follows the NAGPRA compliance procedures. If cultural items in accordance with the NAGPRA are not present, the CRO determines if the discovery is an isolated find or an archeological site. The discovery is documented according to the CRO's determination of type discovery. The appropriate parties are then informed and/or consulted concerning a determination of NRHP eligibility and the proposed actions to avoid, minimize, or mitigate adverse effects to cultural resources. The CRO permanently maintains all documentation related to the discovery in his/her files (RCG&A 2013).

3.6.2.3 Alternative 2 – Demonstrations on East Range Area

No construction would occur with the implementation of Alternative 2 and there is no potential for adverse impacts to cultural resources.

3.7 HAZARDOUS MATERIALS AND WASTE

3.7.1 Affected Environment

3.7.1.1 Definition of the Resource

The terms "hazardous materials" and "hazardous waste" refer to substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristic, could present substantial danger to public health or the environment when released into the environment. Products containing hazardous materials that could result in the generation of hazardous waste include fuel, adhesives, sealants, corrosion preventative compounds, hydraulic fluids, lubricants, oils, paints, polishes, thinners, and cleaners.

The key Federal regulatory requirements related to hazardous materials and waste include:

- Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.)
- Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001-11050)
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601-9675)
- Community Environmental Response Facilitation Act of 1992 (42 U.S.C. 9620)
- Asbestos Hazard Emergency Response Act (15 U.S.C. 2651)
- Spill Prevention, Control and Countermeasure Rule (40 *CFR* 112)
- USEPA Regulation on Identification and Listing of Hazardous Waste (40 *CFR* 261)
- USEPA Regulation on Standards for the Management of Used Oil (40 *CFR* 279)
- USEPA Regulation on Designation, Reportable Quantities, and Notification (40 *CFR* 302)
- EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*
- Toxic Substances Control Act of 1976 (40 *CFR* 700–766)
- Clean Air Act of 1970, including the 1990 Clean Air Act Amendments (40 *CFR* 61)

The Army policy for hazardous material and waste management is contained in AR 200-1, *Environmental Protection and Enhancement*.

For the purposes of this hazardous materials and waste analysis, the ROI for Alternatives 1, 2, and the No Action Alternative includes Fort Sill where these substances are used, stored, transported, or disposed.

The qualitative assessment of impacts from hazardous materials and waste management focuses on how (context) and to what degree (intensity) each alternative could affect hazardous materials usage and management, hazardous waste generation and management, and hazardous waste disposal. Potential impacts related to hazardous materials and wastes were analyzed for the following five effects:

1. Generation of hazardous material/waste types or quantities could not be accommodated by the current management system.
2. Increased likelihood of an uncontrolled release of hazardous materials that could contaminate the soil, surface water, groundwater, or air.
3. Non-compliance with applicable Federal and state regulations as a result of the proposed action.
4. Disturbance or creation of contaminated sites, resulting in adverse effects on human health and/or the environment.
5. Established management policies, procedures, and handling capacities could not accommodate the proposed action.

3.7.1.2 Existing Conditions

3.7.1.2.1 Installation

Fort Sill is a Large Quantity Generator as defined by the USEPA with an USEPA identification number of OK4213720846. Hazardous materials and wastes on Fort Sill are managed according to the Fort Sill *Hazardous Material and Waste Management Plan* (Fort Sill 2013a). This plan lays out the responsibilities, policies, and procedures for managing hazardous materials and wastes on the installation and ensures compliance with applicable federal, state, and local laws and regulations. The *Hazardous Material and Waste Management Plan* applies to all organizations and activities located on or occurring at Fort Sill (Fort Sill 2013a).

Fort Sill manages hazardous substance spills and releases through the implementation of its Installation Spill Contingency Plan (ISCP) (Fort Sill 2011a). The ISCP is a complement to the installation's Spill Prevention, Control, and Countermeasure (SPCC) Plan (Fort Sill 2011b) and serves to minimize the impacts to human health and the environment, including waters resources and wildlife, caused by spills of hazardous materials and wastes at Fort Sill. The SPCC Plan and ISCP establish the responsibilities, duties, procedures, and resources to be used to contain, mitigate, and clean-up oil products and hazardous material or waste spills on the installation (Fort Sill 2011a and b).

3.7.2 Environmental Consequences

3.7.2.1 No Action Alternative

Under the No Action Alternative, Alternative 1 or 2 would not be implemented and no construction or the demonstrations of Electric Fires and LAMS would occur. Fort Sill would continue to use, manage, and dispose of hazardous materials and waste as described in Section 3.7.1.2, Existing Conditions. There would be no effects on management, use, or generation of hazardous materials and waste.

3.7.2.2 Alternative 1 – Demonstrations on West Range Area

Implementation of Alternative 1 includes the improvement of and construction at Firing Point 240E. No asbestos-containing materials, poly-chlorinated bi-phenols, or lead-based paint would be used or are anticipated to be encountered. During the proposed improvements and construction, no site contamination or UXO is anticipated to be encountered. During these improvement and construction activities, the construction contractor would be responsible for properly handling, storing, transporting, and disposing of potentially hazardous materials and wastes (paints, fuels, oils, lubricants, etc.) in accordance with Fort Sill *Hazardous Material and Waste Management Plan* (Fort Sill 2013a) and applicable federal, state, and local laws and regulations.

Under Alternative 1, demonstrations of Electric Fires and LAMS would also occur at the West Range, Firing Point 240E, and the other sub-ranges in the West Range area. As described in Section 2.3.2, these demonstrations would be of a relatively short duration (4-6 weeks) and occur approximately six times per year. Demonstrations of the various Electric Fires and LAMS (see Section 2.3.1) could require the use of hazardous materials and could potentially produce hazardous waste. Should hazardous materials be needed or hazardous waste generated during any demonstrations of Electric Fires or LAMS, the material or waste would require Fort Sill EQD approval, and be tracked and managed according to the Fort Sill *Hazardous Material and Waste Management Plan* (Fort Sill 2013a).

Examples of hazardous materials or wastes used or generated during the demonstrations are listed in Table 3.7-1. This list is not intended to be comprehensive and as the technologies evolve, the list of associated hazardous materials and wastes could change. Any hazardous material used or waste generated as a result of the implementation of Alternative 1 would be the responsibility of the entity performing the demonstration and disposed of in accordance with applicable federal, state, and local laws and regulations.

Table 3.7-1. Hazardous Material or Waste Potentially Associated with the Current Electric Fires and Loitering Aerial Munition System Technologies[a]

Technology[b]	HAZMAT/WASTE	Volume	Purpose/Notes
Electro-Dynamic Kinetic Energy Systems			
EM Launch (Railgun)	N/A	N/A	N/A
Combustion Light Gas Gun	hydrogen, oxygen	various	propellant
Electrothermal-Chemical Gun	cyclotrimethylenetrinitramine (RDX)	various	solid explosive propellant
All	gun cleaners, mineral spirits, hydraulic fluid, grease/moly, break free, etc.	various small quantities	weapons maintenance
	diesel	various	component backup power sources

Table 3.7-1. Hazardous Material or Waste Potentially Associated with the Current Electric Fires and Loitering Aerial Munition System Technologies[a] (Continued)

Technology[b]	HAZMAT/WASTE	Volume	Purpose/Notes
Directed Energy Systems			
Acoustic (Example: LRAD)	Absorbed Glass Mat (AGM) battery pack (sealed lead acid)	21 Amp-Hour, various	portable power pack
High Power Microwave (Examples: ADS, CHAMP, Phaser, etc.)	lubricants and oils	various	high-voltage insulation, heat transfer fluid
	lithium ion batteries	various	component backup power source
Radio frequency	lubricants and oils	various	high-voltage insulation, heat transfer fluid
	lithium ion batteries	various	component backup power source
High Energy Laser (Examples: Mobile Demonstrator, Solid State Lasers, etc.)	lithium ion batteries	various	component backup power source
	lubricants and oils	various	high-voltage insulation
Particle Beam	lubricants and oils	various	high-voltage insulation, heat transfer fluid
	lithium ion batteries	various	component backup power source
Laser Induced Plasma Channel	same as laser	various	same as laser
All	diesel	various	component backup power sources
Loitering Aerial Munition Systems			
Examples: Switchblade, BattleHawk, Terminator, etc.	lithium ion batteries	various	power source
	BKNO3 Fines, Diphenylamine, Nitrocellulose	various (~3.0 grams)	igniter squib
	Explosive munition	various	munition/payload

a – This table is not intended to be complete or comprehensive and as the technologies evolve, the list of associated hazardous materials and wastes could change.
b – Technologies located on or associated with a mobile platform, vehicle(s), and/or power generator(s) would also utilize the associated hazardous materials (fuels, oils, lubricants, coolants, etc.).
N/A – not applicable

In the event of an accidental hazardous material or waste release during the construction or proposed demonstrations, the proper notifications and actions would be taken in accordance with the Fort Sill ISCP and SPCC Plan (Fort Sill 2011a, 2011b). Spill kits would be available and accessible during portable generator refueling.

Therefore, there would be negligible impacts to hazardous materials and waste management associated with the implementation of Alternative 1. Implementation of this alternative would not affect the generator status or negatively affect the hazardous materials and waste program.

3.7.2.3 Alternative 2 – Demonstrations on East Range Area

Under Alternative 2, demonstrations of Electric Fires and LAMS would occur at the East Range area and, depending upon the type of demonstration, at various sub-ranges in the East Range

area. However, there would be no construction or improvements to any firing point(s) or other range infrastructure. The environmental consequences associated with the implementation of Alternative 2 would be the same as those for Alternative 1, minus the construction, as discussed in Section 3.7.2.2.

3.8 CUMULATIVE

According to CEQ regulations, cumulative effects analysis should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 *CFR* 1508.7).

Cumulative effects could occur when there is a relationship between a proposed action or alternative and other actions expected to occur in a similar location or during a similar time period. This relationship might not be obvious at the time of implementing the proposed action. The effects could then be incremental and result in cumulative impacts. The scope of the cumulative effects analysis involves both the geographic extent of the effects and the timeframe in which the effects could be expected to occur.

In this EA, the Army has made an effort to identify actions in or near the ROI that are under consideration and in the planning stage at this time. These actions are included in the cumulative impacts analysis to the extent that details regarding such actions exist and the actions have a potential to interact with the proposed action or alternatives outlined in this EA. Although the level of detail available for those future actions varies, this approach provides the decision maker with the most current information to evaluate the consequences of the alternatives. This EA addresses cumulative impacts to assess the incremental contribution of the proposed action to impacts on affected resources from all factors.

The analysis first describes past actions, events, and circumstances that are relevant to the environments associated with the demonstration of Electric Fires and LAMS at Fort Sill. Following is a discussion of other actions that, when combined with the proposed actions, could result in incremental impacts. However, if the analysis indicates that there would not be any anticipated impacts to the resources described in the EA, there would be no chance cumulative impacts could occur to those resources.

3.8.1 Past, Present, and Reasonably Foreseeable Actions

Recent past and present military and civilian actions in the region were considered as part of the baseline or existing conditions in the ROI (Table 3.9-1). Numerous construction-related activities occur continuously at Fort Sill. On an annual basis, the Fort Sill EQD reviews approximately 450 construction-type actions ranging from construction maintenance, building demolitions, renovations or alterations to the installation of signs or displays and rang upgrades. However, as this project would not include significant construction, cumulative impacts related to construction are not anticipated.

The only recent change in the vicinity of the West and East Range areas was the designation of adaptable use zones (AUZs). This change was implemented for planning purposes and to streamline environmental reviews for projects in the AUZs. It is not anticipated that the AUZs

would have any cumulative impacts associated with implementation of the proposed demonstrations under Alternatives 1 or 2.

Table 3.8-1. Past, Present and Reasonably Foreseeably Actions at Fort Sill and Lawton

Project Name	Project Descriptions	Construction/ Implementation
AUZs	Designated areas used for planning purposes and streamlining NEPA.	2014
Fort Sill RA	Creation of new RA to the north of the installation boundaries.	~2015
Various Construction and Demolition Projects	Numerous construction projects are planned for upcoming years. Focus of construction is the cantonment area. See Programmatic EA for the Fort Sill Mission (Fort Sill 2013b) for additional information.	Various
Conversion of a Portion of the Quanah Range Buffer Area (QRBA)	Project includes conversion of a portion of the QRBA from dudded impact area to maneuver area heavy.	2015
Infantry Squad Battle Course	Firing range in South Arbuckle (East Range) by the eastern Fort Sill boundary.	2010
UAS and Aviation Training Facility	Construction of a UAS and Aviation Training Facility consisting of a maintenance building, a 3,500-foot dirt runway, a latrine, a covered hardstand, and bleachers. Project is planned for the East Range, Frisco Ridge.	Ongoing
Agricultural Lease Renewal	Agricultural leases at Fort Sill are due to expire in the next 2 to 3 years.	Multi-year
ACUB	Purchase of permanent easements to ensure appropriate training buffer and conservation purposes.	Ongoing
Electric Fires and LAM Demonstrations	Demonstrate various Electric Fires and LAM systems at Fort Sill Firing Point 240E or other locations at Fort Sill.	2015
Fire Mitigation Plan	Fort Sill is in the process of updating and implementing a new installation Fire Mitigation Plan. Full implementation is anticipated in 2015.	2015
American Water Enterprises Lagoon Expansion	American Water Enterprises is proposing to expand their lagoon in the northern portion of the West Range area. Environmental analysis of this project is ongoing and there might be a potential for the project to impact vireo habitat.	2015
Serco Incorporated	A leading provider of professional, technology, and management services primarily to the federal government moved into Lawton in 2013 and currently employs approximately 400 people.	2013
Phase 2 Downtown Revitalization	Development of additional job programs, creation of a tax-increment-financing district and office space.	2014
East Range Landfill	Fort Sill's East Range Landfill is anticipated to reach capacity in the year 2022. The landfill is being evaluated to determine viability after this date. Details on the proposed solution are not clear at this time, but could include expansion, construction of a new landfill, or taking waste off-post. Additional NEPA documentation will occur for this project as more information is acquired.	Ongoing
Army Force Reduction	The Fiscal Year 13 defense budget directs an end strength reduction from 562,000 to 490,000. Although actual numbers are not known, the 2020 Force Structure EA indicated that Fort Sill could lose up to 6,842 Army positions (6,022 Soldiers and 820 Army civilians).	Unknown

3.8.2 Cumulative Effects Analysis

As described in Chapter 1 of this EA, the proposed action would produce no impacts to airspace, soil and water, aesthetics and visual resources, surface transportation, utilities, socioeconomics,

or environmental justice and the protection of children. Therefore, no cumulative impacts to any of these resources would be anticipated as a result of implementing either of the action alternatives in conjunction with past, present, or reasonably foreseeable projects in the ROI.

No additional cumulative impacts are anticipated should the demonstrations occur in the West Range or East Range areas of Fort Sill. Where applicable, environmental analysis was or will be completed on the other projects included in Table 3.8-1. Of those that have been completed, no significant impacts were identified, with the exception of the potential force reductions. The Army 2020 Force Structure Realignment EA identified the potential for significant impacts to socioeconomic resources should the force reductions occur (Army 2014). Implementation of demonstrations at the West or East ranges is not anticipated to incrementally compound these impacts. Therefore, the incremental effects of the action alternatives, in combination with potential impacts associated with reasonably foreseeable future actions, would not be expected to create significant or adverse cumulative effects to regional resources beyond those described in the environmental consequences sections of Chapter 3.

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5. RELEVANT ENVIRONMENTAL LAWS, REGULATIONS, AND POLICIES

This EA has been prepared in consideration of and compliance with relevant environmental laws, regulations, and policies. These include, but are not limited to, federal laws, regulations, and EOs; and military regulations and instructions (e.g., AFIs, DoDIs, and Army and Fort Still Regulations) listed herein.

5.1 FEDERAL LAWS AND REGULATIONS

Federal Laws

- American Indian Religious Freedom Act (AIRFA) – 42 U.S.C. 1996 and 1996a
- Archaeological Resources Protection Act (ARPA) – 16 U.S.C. 470aa-mm
- Archeological and Historic Preservation Act (AHPA) – 16 U.S.C. 469-469c-2
- Asbestos Hazard Emergency Response Act – 15 U.S.C. 2651
- Clean Air Act (CAA) – 42 U.S.C. 7401 et seq.
- Clean Water Act (CWA) – 33 U.S.C. 1251 et seq.
- Community Environmental Response Facilitation Act of 1992 – 42 U.S.C. 9620
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) – 42 U.S.C. 9601-9675
- Emergency Planning and Community Right-to-Know Act (EPCRA) – 42 U.S.C. 116
- Endangered Species Act (ESA) – 16 U.S.C. 1532 et seq.
- Migratory Bird Treaty Act (MBTA) – 16 U.S.C. 703-712
- National Environmental Policy Act (NEPA) – 42 U.S.C. 4321 et seq.
- National Historic Preservation Act (NHPA) – 16 U.S.C. 470 et seq.
- Native American Graves Protection and Repatriation Act (NAGPRA) – 25 U.S.C. 3001 et seq.
- Resource Conservation and Recovery Act (RCRA) – 42 U.S.C. 6901 et seq.
- Toxic Substances Control Act (TSCA) – 15 U.S.C. 2601-2692

Federal Regulations

- Title 29 *CFR* 1910.1000: Air Contamination
- Title 32 *CFR* 651: Environmental Analysis of Army Actions
- Title 36 *CFR* 60: National Register of Historic Places
- Title 36 *CFR* 79: Curation of Federally-Owned and Administered Archaeological Collections
- Title 36 *CFR* 800: Protection of Historic Properties
- Title 40 *CFR* 112: Oil Pollution Prevention
- Title 40 *CFR* 261: Identification and Listing of Hazardous Waste

Federal Regulations (Continued)

- Title 40 *CFR* 279: Standards for the Management of Used Oil
- Title 40 *CFR* 302: Designation, Reportable Quantities, and Notification
- Title 40 *CFR* 1500-1508: Council on Environmental Quality

Executive Orders

- EO 12196, *Occupational Safety and Health Programs for Federal Employees*
- EO 12372, *Intergovernmental Review of Federal Programs*
- EO 13007, *Indian Sacred Sites*
- EO 13175, *Consultation and Coordination with Indian Tribal Governments*
- EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*

5.2 MILITARY REGULATIONS AND INSTRUCTIONS

Army and Fort Sill Regulations

- AR 5-12, *Army Use of the Electromagnetic Spectrum*
- AR 5-22, *The Army Force Modernization Proponent System*
- AR 73-1, *Test and Evaluation Policy*
- AR 200-1, *Environmental Protection and Enhancement*
- AR 350-19, *The Army Sustainable Range Program*
- AR 385-10, *Army Safety Program*
- AR 385-63, *Range Safety*

- DA PAM 385-24, *The Army Radiation Safety Program*
- DA PAM 385-63, *Range Safety*

- TRADOC Regulation 71-20, *Concept Development, Capabilities Determination, and Capabilities Integration*

- Fort Sill Regulation 200-1, *Recreational Use, Management, Harvest, and Protection of Natural Resources*
- Fort Sill Regulation 385-1, *Post Range Regulation*
- Fort Sill Regulation 385-10, *Safety Regulation*

Air Force and Department of Defense Instructions

- AFI 13-212, *Range Planning and Operations*
- AFI 48-139, *Laser and Optical Radiation Protection Program*

- DoDI 6055 Series, *DOD Safety and Occupational (SOH) Program*
- DoDI 6055.11, *Protecting Personnel from Electromagnetic Fields*

- MIL-HDBK-828B, *Department of Defense Handbook, Laser Safety on Ranges and in Other Outdoor Areas*

6. LIST OF CONTACTED AGENCIES, NATIVE AMERICAN TRIBES, AND GOVERNMENT OFFICALS

6.1 FEDERAL AND STATE AGENCIES

Federal Agencies

- Bureau of Indian Affairs, Southern Plains Regional Office
- U.S Army Corps of Engineers
- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

State Agencies

- Oklahoma Archeological Survey
- Oklahoma Biological Survey
- Oklahoma Department of Environmental Quality
- Oklahoma Department of Wildlife Conservation
- Oklahoma State Historic Preservation Office
- Oklahoma Water Resources Board

6.2 NATIVE AMERICAN TRIBES

- Apache Tribe of Oklahoma
- Caddo Nation
- Cheyenne and Arapaho Tribes of Oklahoma
- Chickasaw Nation
- Comanche Nation of Oklahoma
- Delaware Nation
- Fort Sill Apache Tribe of Oklahoma
- Kiowa Tribe of Oklahoma
- Wichita and Affiliated Tribes

6.3 FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

Federal Government Officials

- Tom Cole, U.S. House of Representatives
- James Lankford, U.S. Senate
- Jim Inhofe, U.S. Senate

State and Local Government Officials

- Ann Coody, Oklahoma House of Representatives
- Jeff Coody, Oklahoma House of Representatives
- John Michael Montgomery, Oklahoma House of Representatives
- Scooter Park, Oklahoma House of Representatives
- Don Barrington, Oklahoma Senate
- Randy Bass, Oklahoma Senate

State and Local Government Officials (Continued)

- Comanche County Commissioners
- Lawton City Manager
- Mayor of Cache
- Mayor of Elgin
- Mayor of Lawton
- Mayor of Medicine Park

7. LIST OF PREPARERS

Government Agency Development Team	
Name/Title	**Role**
Environmental Quality Division	Environmental Planning/Lead EA Development
Electric Fires Office	Proponent

Contractor Development Team			
Name/Title	**Project Role**	**Subject Area**	**Qualifications**
Brad Boykin Environmental Scientist M.S. Biotechnology B.S. Biomedical Science	Section Author	Air Quality	7 years environmental science
Sarah Bresnan Conservation Ecologist B.S. Plant Biology, Environmental Science and Ecology	Section Author	Biological Resources	8 years environmental science
Dennis Chambers, CHP, RRPT Certified Health Physicist BSAST Radiation Protection	Project Support	Health Physics, Safety	>30 years health physicist
Tom Daues, PMP Biologist M.S. Natural Resources B.S. Biology	Project Manager, Editor	Cumulative Impacts, Safety	23 years environmental science
Denise DeLancey Electronic Publishing Specialist B.A. English/Communications	Document Production	Document Production	13 years document production
Dave Dischner Senior Environmental Analyst B.A. Urban Affairs	Section Author	Safety	37 years environmental science
Anthony Finley Electronic Publishing Specialist B.A. English	Document Production	Document Production	6 years document production
Nathan Gross, CHMM Environmental Scientist B.S. Wildlife and Fisheries Management	Section Author	Hazardous Materials and Waste, Land Use	13 years environmental science
Brian Tutterow Environmental Scientist B.S. Biology	Section Author	Cultural Resources, Biological Resources, Noise	15 years environmental science

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Appendix A

Public Outreach

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Announcing: Comment Period for the Draft Environmental Assessment for Demonstrations of Various Electric Fires and Loitering Aerial Munition Systems, Fort Sill, OK in compliance with The National Environmental Policy Act
Formal Comment Period: December 21, 2014 - January 22, 2015

The Draft Environmental Assessment (EA) addresses the potential environmental consequences resulting from the demonstration of various electric fires and loitering aerial munition systems (LAMS) at Fort Sill. Electric Fires is a conceptual term used by the Army to identify systems that use electromagnetic energy to destroy, degrade, and deny enemy threats. Examples of electric fires systems include rail guns, high powered microwave and high powered laser systems. The LAMS are explosive guided munitions used to counter aerial and ground threats. The public is invited to review the Draft EA and provide comments.

An electronic copy of the Draft EA is available at http://sill-www.army.mil/USAG/dpw/Environmental.html, the Draft EA is located under the "Public Review Tab" on the webpage. Hardcopies of the Draft EA will also be available at the following local libraries:

Lawton Public Library
110 SW 4th Street
Lawton, OK 73501
580-581-3450

Nye Library
1640 Randolph Road
Fort Sill, OK 73503
580-442-3806

Substantive written comments and questions will be addressed in the Final EA. To be included in the Final EA, substantive comments and questions must be received prior to the close of the formal comment period on January 22, 2015. Comments and questions about the Draft EA or the comment process can be directed to:

Ms. Sarah Sminkey, NEPA Coordinator
Fort Sill DPW-EQD
2515 Ringgold Road
Fort Sill, Oklahoma 73503
Phone: 580-442-2849
e-mail: sarah.e.sminkey.civ@mail.mil

chilly swearing-in ceremo-
the front steps of the state
with her fellow statewide
lican officeholders. Tem-
res were in the low 30s, but
winds dropped the wind
to the teens.

held on the Capitol's grand front entrance, which has been closed to visitors for two years because pieces of limestone and mortar have been falling from the building's facade. Makeshift scaffolding erected to protect visitors

SEE FALLIN, 2A

AP

Oklahoma Governor Mary Fallin, right, takes her oath of office with her husband, Wade Christensen, left, at her side, at the state Capitol in Oklahoma City, Monday.

ccused family killer to prison

RAINS
OKNEWS.COM

ıncan teen accused of gun-
own his family will await tri-
ıose charges in prison as he
to serve time for another
tion.

Hruby, 19, was moved Fri-
ım the Stephens County Jail
state Department of Correc-
Lexington facility to begin
g a three-year sentence for
gust 2013 felony charge of
the credit card of another — his
nother, court records indicate. He received the sentence during a Dec. 4 hearing in Stephens County District Court.

HRUBY

Hruby had been in the Stephens County Jail since October after he was arrested in connection with the Oct. 9 killing of his father John, 50; mother Joy "Tinker," 48; and sister Katherine, 17. He has been charged with three counts of first-degree murder and faces the prospect of either a life sentence, a life sentence without parole or the death penalty.

The teen is accused of stealing his father's handgun and then on Oct. 9 awaiting the family at their home at 1217 Bent Tree,

SEE HRUBY, 2A

ıaw becomes county's
t female judge in decades

ALBIN
KNEWS.COM

Shaw made history
y morning when she
orn into office as the
ɔman to be a judge in
che County since the

took her oath of of-
the Comanche Coun-
ciate district judge in
y assembly room of
ıanche County Cour-
from her predeces-
ired Associate Dis-
ıdge William Strat-
h Comanche County
Judge Mark Smith
ıg over the ceremo-

STEVE MILLER/STAFF

Comanche County District Judge Mark Smith, presiding judge of the Southwest Judicial Administrative District, oversees as Lisa Shaw takes her oath of office from retired Comanche County Associate District Judge William Stratton Monday morning. Shaw — the first woman to be a judge in Comanche County since the 1960s — was elected in November 2014 to take Stratton's vacated position.

was elected to fill
ancy left by Strat-
tirement in the No-
2014 election. She
l primarily with ju-
ustice, custody, and
urt cases.

comes to the bench
ving spent 22 years as prosecutor of juvenile justice cases for the Comanche County District Attorney's Office. Before practicing law, Shaw spent two years as a school teacher at John Adams Elementary.

After taking the oath, Shaw thanked everyone who supported her, starting with her parents, Rex and Muriel Polone; her husband, Jeff Shaw; her adult daughters, Rachel and Meredith Shaw; and her mother-in-law, Rose Marie Shaw.

SEE SHAW, 2A

Comment sought on new types of Fort Sill munition

BY MITCH MEADOR
STAFF WRITER
MMEADOR@SWOKNEWS.COM

A 30-day public review and comment period for a "Draft Environmental Assessment for Demonstrations of Various Electric Fires and Loitering Aerial Munition Systems at Fort Sill" will end Jan. 22.

The environmental assessment was developed in accordance with the National Environmental Policy Act (NEPA) of 1969. It yielded a "finding of no significant impact" for the preferred alternative, alternative 1.

The 146-page draft environmental assessment may be found online at http://tinyurl.com/kjt9usv. Hard copies may be found at the Lawton Public Library, 110 SW 4th in Lawton, and Nye Library, Building 1640, Randolph Road, Fort Sill.

Letters or other written or oral comments provided to the U.S. Army at the Fort Sill garrison will be published in the final environmental assessment and made available to the public. To be included, substantive comments and questions must be received prior to the close of the formal comment period on Jan. 22.

Comments and questions about the draft EA or the comment process can be directed to Sarah Sminkey, NEPA coordinator, Fort Sill DPW-EQD, 2515 Ringgold Road, Fort Sill, OK 73503. You may also phone 442-2849 or email sarah.e.sminkey@mail.mil.

According to the Fort Sill Public Affairs Office, comments may be made online via either the Federal Register or the Army Environmental Command website. There will be no public listening session as there was with the drafts of the Programmatic Environmental Assessment (PEA) in April 2013 or the Supplemental Programmatic Environmental Assessment (SPEA) on Dec. 9. Lt. Col. Rory Crooks, Fort Sill's director of strategic communications, said those are only for "big things with a large impact, like losing 6,800 people."

The purpose of the proposed action is to demonstrate concepts and capabilities that have the potential to change the way the Army conducts operations in the future. The demonstrations are proposed to examine or develop solutions and determine which solutions, if implemented, would result in the highest level of capability, effectiveness and efficiency to the force.

SEE SILL, 2A

SILL: Alternatives include using east or west ranges to test new technologies

CONTINUED FROM 1A

The need for the proposed action is a direct result of the requirement for the Capabilities Development and Integration Directorate (CDID) to develop and integrate new technologies to defend the nation and its interests.

Electric fires and loitering aerial munition systems (LAMS) are both new technologies that promise advances in the ability of the warfighter to communicate, defend against enemy weapons and destroy enemy threats with levels of speed, accuracy and safety not possible with current conventional weapons.

LAMS are guided munitions, while electric fires technologies are grouped into two categories: electrodynamic kinetic energy and directed energy. Examples of the former are electromagnetic launch (rail gun), combustion light gas gun and electrothermal-chemical. Examples of the second group are acoustic, high-power microwave, radio frequency, laser, particle beam and laser-induced plasma channel.

These revolutionary technologies could be linked to any specific platform, such as tanks, aircraft or trucks, and would eventually replace gunpowder-based systems of today.

Three alternatives were considered: the no action alternative; alternative 1, demonstrations on the West Range area; and alternative 2, demonstrations on the East Range area.

No demonstrations of electric fires or LAMS would occur under the "no action alternative."

Alternative 1 would mean that the demonstrations would be conducted in the portion of the West Range west of Tower Two Road. No demonstrations would occur east of Tower Two Road as part of this alternative. Alternative 1 was selected as the preferred alternative for a number of reasons, including ease of access to the training area, fewer potential conflicts with existing range uses (for example, fewer agricultural fields and less interference with the basic and small arms training activities) and greater topographic relief increasing the potential number of areas with suitable backstops for demonstrations.

Potential impacts of alternative 2 would be similar to those for alternative 1, with the exception of improvements to Firing Point 240E. No improvements would be required at any location in the East Range area and the LAMS would only be demonstrated at certain subranges. Although not significant, implementation of this alternative would result in slightly more minor impacts associated with deconflicting range usage due to the additional agricultural leases and the high use of the East Range by other units.

Implementation of alternative 1, the preferred alternative, "has the potential for minor impacts to land use, air quality, noise and biological resources. These impacts would not be significant. No impacts to human health and safety, cultural resources or hazardous materials and waste are anticipated to result from implementation of alternative 1," the draft environmental assessment states.

SHAW: No big changes planned

CONTINUED FROM 1A

She also thanked her campaign chairman, Clay Hillis, and Stratton, whom she praised for his excellent reputation in juvenile justice circles.

Shaw said becoming a judge has been a long-term goal for her. She believes her extensive background as a prosecutor of juvenile cases will aid her in working for the best interests of young people as a judge.

"I think that's kind of cool," Shaw said when asked what being the first female judge in the county since the 1960s means to her.

She added that the last

STEVE MILLER/STAFF

From left, Comanche County District Judge Mark Smith, presiding judge of the Southwest Judicial Administrative District, administers the oath of office to Comanche County District Judges Emmit Tayloe, Keith B. Aycock and Gerald Neuwirth Monday. Smith, Aycock and Neuwirth were re-elected to four-year terms without opposition; Tayloe, who was appointed last year to fill an open seat, won election in the November general election.

at the age of 95. She was a

n't plan any changes for the

and court reporter Michelle

FALLIN: Lower oil price may mean trouble

CONTINUED FROM 1A

from falling rock was removed last week ahead of the inaugural ceremonies.

In her address, Fallin touted her accomplishments during her first four years in office, including a state economy that has roared back from the recession with lower unemployment, increasing personal incomes and a record $530 million in the state's Rainy Day Fund.

"I believe the story of the last four years will be a story of an economy lifted out of its deepest recession," Fallin said.

Fallin also charted a course for her second term. She said her top priorities

where they can join gangs and acquire criminal networks," Fallin said.

While Oklahoma's economy has improved, initial projections show state legislators will have about $300 million less to spend on next year's budget, a hole that could grow deeper if oil prices remain depressed. Much of the shortfall is due to numerous one-time funding sources that were used for the current year's budget.

The Legislature will convene on Feb. 2, when Fallin will deliver her State of the State speech and present lawmakers with her executive budget proposal.

During the ceremony, noted Oklahoma sculptor Paul

Council amends car wash regulations

Study committee also looking at water conservation policy

BY KIM MCCONNELL
STAFF WRITER
KMCCONNELL@SWOKNEWS.COM

MICHAEL D. POPE/STAFF

The Lawton City Council recently amended regulations governing city car washes. Beginning Jan. 14, anyone who builds a car wash must install and use a water recycling system that captures and re-uses at least 50 percent of the facility's wash and rinse water.

The City of Lawton has begun to implement changes that are calculated to lessen demand on its existing raw water supply.

City Council members voted in mid-January to implement an immediate change to building code requirements for commercial car washes, the first recommendation to come out of a four-member council study committee that is looking at city code and actions they might take to help Lawton cope with a history-making drought. That committee continues to work with city staff to draft changes in the four-stage water conservation policy that sets increasingly stricter requirements on how residents and businesses may use water outdoors as the region moves further into the drought that has taken the elevations of some area lakes to dangerously low levels.

The first action was one council members discussed months ago: new construction requirements for commercial car washes. The new regulation, which came with an emergency clause that put it into effect the morning after the council approved it, specifies that beginning Jan. 14, anyone who builds a car wash must install and use a water recycling system that captures and re-uses at least 50 percent of the facility's wash and rinse water.

Public Works Director Jerry Ihler told the council that recycled water is becoming the norm for car washes, saying that some water-efficient models in California use only 15 gallons of "new" water per vehicle, meaning that for the total amount of water used to wash a vehicle, only 15 gallons comes from the city's potable water supply. New water is mixed with recycled water, meaning wash and rinse water that is captured, then cleaned and put back into the system for reuse.

Ward 8 Councilman Doug Wells, a member of the council water committee, said a car wash owner's motivation for recycled water goes beyond protecting the environment. Because business owners will have to buy less potable water, they will cut their utility bills and those cost-savings will eventually cover the cost of installing the recycled water technology, Wells said.

Those savings could be substantial, depending on the car wash and how much water it uses per vehicle. Industry reports vary, estimating as few as 35-60 gallons of water used per vehicle, to as much as 120 gallons per vehicle for high-pressure tunnel facilities.

"Most upscale car washes have this technology," Wells said.

Existing facilities exempt

Facilities that already exist and those that held building permits issued before Jan. 14 are exempt from the new ordinance. Those who receive building permits on or after Jan. 14 must comply, as will the owners of existing car washes who plan remodel or renovation projects, when the cost of that remodel/renovation equals at least half of the value of the facility they are upgrading. That means any significant upgrades to existing car washes would make that facility fall under the new ordinance, Public Works officials said.

To protect the public water system, facilities with recycling systems must keep that system separate from the city's potable water system, via use of a positive back flow prevention device (which prevents recycled water from entering the city's potable water system).

Wells said the study committee also is continuing to work on the city's water conservation policy, set out in Chapter 22 of City Code (available via the City of Lawton web site at www.cityof.lawton.ok.us).

That four-stage policy sets restrictions on most outdoor water use, with each stage depending on the combined total usable storage (usable storage means the water that can be withdrawn from city lakes by their water transfer systems, not the total amount of water in the lake).

Work done on water stage policy

Stage 1 is voluntary conservation, meaning water users are asked to adhere to a policy that sets outdoor water use for every other day, between midnight and 9 a.m. for most of the year (it is 11 a.m. to 3 p.m. during winter months). Stage 2 makes those regulations mandatory. Stage 3, where Lawton has been since summer 2014, allows outdoor water use only on Wednesdays and Saturdays. Stage 4, as now written, is a restriction that hasn't been seen in Lawton in decades: A ban on all outdoor water use, with only four exceptions. As now written, Stage 4 goes into effect when the combined usable water total in lakes Lawtonka, Ellsworth and Waurika hits 40 percent, and Lawton has been hovering just above that figure for most of winter, city engineers say.

The restrictive nature of that final stage has prompted council members to explore additional exemptions or perhaps add an additional stage.

Fifth stage explored

Wells said discussions now under way include a fifth stage, which would mean limiting outdoor water use to once a week under Stage 4, then setting a total ban for Stage 5, when total usable storage reaches 30 percent.

"We'd still cut it (outdoor water use) off completely at 30 percent," Wells said, of a proposal that is expected to be taken to the full council in February.

Wells said other discussions include surcharges on water, and the existing proposal would apply surcharges to water used in excess of 8,000 gallons per month (which he says is the average monthly consumption for a family of four). That per-1,000-gallon surcharge would increase as the city moves into stricter water stages, he said.

Other proposals include allowing residents to continue to water their trees in all water stages, as long as they use a hose.

Exemptions granted

While there are nine exemptions granted in Stages 2 and 3, there are only four exemptions granted in Stage 4: watering around foundations by hose; washing motor vehicles used to transport food products or for trash collection; watering on the premises of commercial nurseries raising vegetation for sale; and commercial car washes and services stations and convenience stores that sell fuels.

Announcing: An Extension of the Comment Period for the Draft Environmental Assessment for Demonstrations of Various Electric Fires and Loitering Aerial Munition Systems, Fort Sill, OK in compliance with the National Environmental Policy Act

Formal Comment Period Extended to February 8, 2015

The formal comment period for this Draft Environmental Assessment (EA) began on December 21, 2014 with the release of the Draft EA and a newspaper announcement in the Lawton Sunday Constitution. The comment period formally began on that day and was originally scheduled to end on January 22, 2015. Due to a delay in the receipt of the Draft EA by a public agency, the formal comment period has been extended to February 8, 2015 to ensure the public and public agencies have adequate time to review the Draft EA. This Draft EA addresses the potential environmental consequences resulting from the demonstration of various electric fires and loitering aerial munition systems (LAMS) at Fort Sill. Electric Fires is a conceptual term used by the Army to identify systems that use electromagnetic energy to destroy, degrade, and deny enemy threats. Examples of electric fires systems include rail guns, high powered microwave and high powered laser systems. The LAMS are explosive guided munitions used to counter aerial and ground threats. The public is invited to review the Draft EA and provide comments.

An electronic copy of the Draft EA is available at http://sill-www.army.mil/USAG/dpw/Environmental.html, the Draft EA is located under the "Public Review Tab" on the webpage. Hardcopies of the Draft EA will also be available at the following local libraries:

Lawton Public Library 110 SW 4th Street Lawton, OK 73501 580-581-3450	Nye Library 1640 Randolph Road Fort Sill, OK 73503 580-442-3806

Substantive written comments and questions will be addressed in the Final EA. To be included in the Final EA, substantive comments and questions must be received prior to the close of the extended formal comment period on February 8, 2015. Comments and questions about the Draft EA or the comment process can be directed to:

Ms. Sarah Sminkey, NEPA Coordinator
Fort Sill DPW-EQD
2515 Ringgold Road
Fort Sill, Oklahoma 73503
Phone: 580-442-2849
e-mail: sarah.e.sminkey.civ@mail.mil

January 11, 2015

Ms. Sarah Sminkey-NEPA Coordinator

Ft. Sill DPW-EQD

2515 Ringgold Road

Ft. Sill, OK 73503

RE: DRAFT EA for the DEMONSTRATION OD VARIOUS ELECTRIC FIRES AND LOITERING AERIAL MUNITION SYSTEMS, FT. SILL, OKLAHOMA

Greetings Ms. Sminkey,

I have read the Draft EA mentioned above and have serious concerns for the safety of humans, plants, wildlife, water, air, soil and infrastructure in or around the Ft. Sill ranges-to include Cache, Medicine Park, Wichita Mountains Wildlife Refuge, Wichita Mountain Estates area, Elgin and Lawton. The Draft EA is written from a perspective of perfection of performance on the part of all personnel and all machinery and weaponry involved. It also fails, in my opinion, to consider long-term, cumulative effects of such weapons being used not occasionally but normally for years and years in the same relative area. We are expected to have full confidence that everything will always be done in a safe manner. In fact, on page 3-10 this sentence appears: "None of the systems evaluated in this EA would be intentionally directed at military or civilian personnel." This begs the obvious question. **What are the consequences of UNINTENTIONALLY directing and "firing" these weapons? What will Ft. Sill do if such a tragedy occurs?**

Do we have data on the long-term effects of using high-powered microwaves, lasers, sound, particle beams and strong magnetic fields, etc. over and over again in the same area? The Draft EA states that including some or all of these weapons into the soldiers' training at Ft. Sill is an ultimate goal. Surely, there are effects that may not appear instantly or perhaps even for months or years to plants, animals and people living in and around or near these weapons usage zones. **Just how far away is far enough away?** I question also whether repeated use of some or all of these weapons could adversely affect our air or water shed. **Could such repeated uses of any of these weapons possibly cause any radiation or other threats of contamination to the soil or underground water table? If so, what possible adverse effects could that cause not only to the immediate area but down wind or down- stream?**

Infrastructural issues such as power lines, antenna signals for computers, cell phones, radios and television and people with pace-makers are already mentioned as an issue. The report states that about a mile and a half of power lines will have to be buried to prevent frying it. And, people in the area with pace-makers will have to be removed to a safer location. Maybe I missed it, but I saw no measurement on just how far away is safe. **Is it reasonable to assume that repeated use of these systems over months, years or decades in the same general areas cause some type of unsafe build-up of anything like radiation or a contaminant to that area and the surrounding areas?** Do we really have enough data on these issues or are we just hoping that the populace in and around Ft. Sill cares more about its own pocketbooks than about being guinea-pigs.

I propose that the classroom and simulation training be done here at Ft. Sill, and consider the money well spent on travel to the already known to be safe proving grounds for actual use of these systems. That's why we have wide-open vast unpopulated areas like White Sands, NM and the like. If something goes wrong in a place like that, only the immediate personnel are at risk because there is no surrounding populace and virtually nothing else but sand for many, many miles around.

I encourage the Ft. Sill big brass not to take us for granted. I encourage them to **extend the time limits for decision on this issue and to HOLD SEVERAL PUBLIC MEETINGS so that anyone can ask questions, make comments to military experts on these systems as well as non-affiliated experts- not chosen by the military or their associates.** Perhaps a teleconference could be done and recorded and aired on the internet or at a local theatre. After all, if these proposed weapon systems are truly as non-threatening as the Draft EA claims, Ft. Sill should jump at the chance to give this courtesy to all of her neighbors and delight in all the benefits this will bring to us.

Sincerely,

[redacted]

Appendix B

Demonstration Support Worksheet (DSW)

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Fort Sill, Oklahoma (FSOK)
Demonstration Support Worksheet (DSW) Preparation Instructions

General

Submit a copy of the security classification guide for your demonstration program along with the DSW.

Submit a copy of any environmental and/or safety assessments or studies completed for your demonstration program along with the DSW.

Submit all Information Assurance documentation (such as Authority to Operate) with the DSW, as well as network and data exchange formats/methods (e.g. VMF, XML etc via FM). This should include information exchange documentation.

Enter the date you are preparing the DSW. If you are revising the basic document, enter the date of the revision and the version number. On each subsequent page, enter the version number, if applicable.

If additional space is required in any section or box, use additional sheets listing the appropriate headings.

Section I – Demonstration Program Identification

Box 1 – Enter the demonstration program title.

Box 2 – Enter the official or accepted unclassified short title.

Box 3 – Responsible Agencies and Key Personnel:
a. User Agency: Enter the name of the agency with prime responsibility for the program.
b. User Representative: Enter the name of the individual representing the requesting agency.
c. User Contractor Representative: Enter the name of the individual representing the prime contractor for the requesting agency (if applicable).
d. Fort Sill, Oklahoma (FSOK) Government Support Coordinator: Enter the name of the government coordinator assigned to support the customer demonstration program.
e. FSOK Lead Support Contractor Rep: Enter the name of the lead government contractor assigned to support the demonstration program.

Box 4 – Technology Category: mark all appropriate boxes with a check to identify the general categories of technologies that will be demonstrated.

Box 5 – Demonstration Program Information:
a. Type Of Program: Enter the type of specific demonstration program of the primary technology (e.g., high energy laser, high power microwave, etc.)
b. Start Date: Enter the anticipated date of initial demonstration activity, such as arrival of personnel.
c. First Demonstration Date: Provide the estimated date of the first significant demonstration event.
d. Completion Date: Enter the estimated date of termination of demonstration program activity at FSOK.
e. Program Status: Check the applicable boxes indicating the approval and funding status of the program.
f. Program Security Classification: Enter the overall security classification for the program.

g. Security Classification Guide: Enter the title, originator, and classification authority for the security classification guide applicable to the demonstration program. A copy of the guide must be submitted along with the DSW.

Box 6 – Requesting Agency Authentication: Enter agency name, signature, name and title, and telephone number of your organization.

Box 7 – Receiving Agency Authentication: Support Agency Receipt. As the receiving agency, a representative from FSOK Capabilities Development and Integration Directorate (CDID) will complete the information in this box.

Section II – Demonstration Program And Mission Information

Box 1 – Program Background Information: Provide a brief narrative discussion of the program context and significant milestones or events leading to the demonstration.

Box 2 – Demonstration Program Milestones and Phases: On this chart, list the appropriate milestones and phases for the demonstration program and indicate the fiscal years and quarters in which you expect to achieve them. Drop down boxes are provided for the fiscal year and quarter designations.

Box 3 – Success/Exit Criteria: Provide the objective criteria to be used to assess successful completion of the demonstration program.

Box 4 – Activity Plan: Enter the number of static lethal and dynamic demonstrations and other operations to be conducted during each FY quarter during the course of the program. Use double-headed arrows to indicate the time span to be covered by each listed phase of program activity. Drop down boxes are provided for the fiscal year and quarter designations.

Box 5 – Narrative of Demonstration Description and Objectives at FSOK: Provide a narrative description of each demonstration to be conducted. If a single scenario is to be repeated several times, only one description is needed. If there are variations to the demonstration scenarios, each variation should be described. If the scenario is known only in vague detail, provide what is known and state that the description is a rough outline of the demonstrations to be performed. Provide demonstration details as specific as possible in relation to timelines, requirements, and environmental and safety hazards.

Box 6 – Demonstration Equipment Characteristics: Complete this block with information required to provide a detailed description of the demonstration system. This will include: the type of technology (laser, high power microwave, etc.); length; width; height; diameter; weight; fuel(s) consumed; surface finish; chemical composition (as required); any explosive type used; explosive weight; amount of electrical power generated by the system; operating frequency of the system (as required); and any projectile material composition and weight (as required). Drop down boxes are provided for length, width, height, diameter and weight designations.

Box 7 – Environmental Policy Act Compliance: Check the applicable boxes to indicate: a) whether an Environmental Assessment has been made of the program, b) whether an Environmental Statement has been prepared, c) attach historical environmental documents to the DSW, d) if the system emits air pollutants, e) if the systems generates hazardous waste (if so, specify what type, quantities and disposal plan in separate narrative), and f) if the system will increase surrounding noise levels. The assigned FSOK

representatives, in conjunction with Garrison Environmental Quality Division (EQD), will assist you in determining environmental requirements for your demonstration program.

Box 8 – Dynamic/Static Target Description and Engagement Events: Describe the dynamic or static targets planned for use in the demonstration, and their usage in the demonstration program.

Box 9a. – Dynamic Target Characteristics: Provide sufficient detail by completing the designated characteristic data to determine its size, configuration, intended trajectory, and number of launches anticipated. This information will include: the target type, basic physical characteristics, and type of guidance and propulsion system. Drop down boxes are provided for length, width, height, diameter, and wingspan designations.

Box 9b. – Static Target Characteristics: Provide sufficient detail by completing the designated characteristic data to determine its size, configuration, composition, and number of anticipated engagements. Drop down boxes are provided for length, width, height, diameter and weight designations.

Box 10 – User-supplied Instrumentation and Equipment: List all instrumentation and equipment to be supplied by the requesting agency and indicate the anticipated date of delivery to FSOK. (NOTE: Do not delay submitting the DSW because information to complete this page is unavailable. FSOK will accept this information at a later date.)

Box 11 – User-supplied Laser Systems: Mark "Y" or "N" at the top of the block to answer the question for Laser Clearing House registration. Provide all the information required in items a through p. Customer lasers delivered to FSOK must be approved for use prior to the demonstration through numerous organizations. Lasers that are not programs of record, will have to apply for registration with the Laser Clearing House. Additional agencies will require further coordination that FSOK representatives will execute. Drop down boxes are provided for laser type and class.

Box 12 – FSOK-supplied Equipment: Provide a description of any equipment or resources you want FSOK to provide in support of the demonstration. For each item, enter the required availability date(s). This request alone does not guarantee that FSOK will provide this equipment or resources, and a Demonstration Agreement must be signed between FSOK representatives and the requesting agency.

<u>Section III – Demonstration Support Requirements</u>

Box 1 – Recovery Requirements: Describe components of dynamic target debris to be recovered and provide details on potential hazards associated with recovery. Explosive ordnance disposal personnel may be required to dispose of contaminated, classified, or hazardous material.

Box 2 – Meteorological Considerations: Describe meteorological support required, including update frequency of temperature, barometric pressure, and crosswinds. Discuss weather minima required to support the demonstration (e.g., ceiling, crosswinds, etc.).

Box 3 – Communications Request: Provide information on intercom, hand-held radio, and telephone requirements. Indicate whether secure voice communications and secure email access are required to support the demonstration program.

Box 4 – Medical Requirements: Describe hazardous demonstration operations that may require the availability of medical support in addition to FSOK Emergency Medical Technicians.

Box 5 – Security Requirements: Provide details on security measures necessary to meet requirements in the security classification guide for the demonstration program (e.g. counter-surveillance canopies, target access and storage, restricted test area access, etc.). Each agency approved to conduct a demonstration at FSOK will be responsible to provide their own continuous guard force with a minimum requirement of two personnel at all times.

FSOK Demonstration Support Worksheet		Date:		Version No:	

I. Demonstration Program Identification

1. Program Title		2. Short Title	

3. Responsible Agencies and Key Personnel

a. User Agency	
b. User Representative	
c. User Contractor Representative	
d. FSOK Government Support Coordinator	
e. FSOK Lead Support Contractor/Rep.	

4. Technology Category

a. Acoustic		e. Particle Beam	
b. High Power Microwave/Radio Frequency		f. Electromagnetic Launch	
c. Laser		g. Electrothermal Chemical	
d. Laser Induced Plasma Channel		h. Combustion Light Gas	

5. Demonstration Program Information

a. Type of Program		f. Program Security Classification	
b. Start Date (DD-MM-YY)		g. Security Classification Guide	
c. First Demo Date (DD-MM-YY)		*(1) Title*	
d. Completion Date (DD-MM-YY)		*(2) Originator*	
e. Program Status ☐ Funded ☐ Approved ☐ of Record		*(3) Classification Authority*	

6. Requesting Agency Authentication

The services requested herein are required for conduct of the demonstration and are not within any currently approved scope of work except as follows:

Requesting Agency _____ Date _____ (DD-MM-YY)

Signature _____ Agency _____

Name and Title _____

Phone _____

7. Receiving Agency Authentication

Capabilities Development and Integration Directorate Receipt

Signature _____ Date _____ (DD-MM-YY)

Name and Title _____ Agency _____

Phone _____

II. Demonstration Program and Mission Information

1. Program Background Information

2. Program Milestone Phases	FY		FY		FY		FY		FY		FY	

3. Success/Exit Criteria

4. Activity Plan	FY		FY		FY		FY		FY		FY	

5. Narrative of Demonstration Description and Objectives at FSOK

6. Demonstration Equipment Characteristics

a. Type		i. Chemical Composition	
b. Length		j. Explosive Type	
c. Width		k. Explosive Weight	
d. Height		l. Power generated by system	
e. Diameter		m. Frequency of the system	
f. Weight		n. Projectile material composition	
g. Fuel(s)		o. Projectile weight	
h. Surface			

7. Environmental Policy Act Compliance

As required by Public Law 91-190, National Environmental Policy Act, and DoD Directive 6060.1, an

a. Environmental Assessment	☐ has been made	☐ has not been made
b. Record of Environmental Consideration	☐ has been prepared	☐ has not been made

c. Provide copies of any historical environmental documentation.

d. Will use of the system or its auxiliary equipment emit hazardous air pollutants? ☐ no ☐ yes _____

e. Will use of the system or its auxiliary equipment generate hazardous waste? ☐ no ☐ yes _____

f. Will use of the system or its auxiliary equipment potentially increase surrounding noise levels? ☐ no ☐ yes _____

8. Dynamic/Static Target Description and Engagement Events

9a. Dynamic Target Characteristics

a. Target Type		i. Surface Material	
b. Length		j. Guidance System	
c. Width		k. Propulsion System	
d. Height		l. Flight Termination System Requirement	☐ Yes ☐ No
e. Diameter		m. System Explosive Weight	
f. Weight		n. Launch System	
g. Wing Span		o. Previous FSOK Flight	
h. Airframe		p. Other	

9b. Static Target Characteristics

a. Target Type		f. Weight	
b. Length		g. Surface Material	
c. Width		h. Explosive Characteristics	
d. Height		i. Other	
e. Diameter			

10. User-supplied Instrumentation and Equipment

Description	Delivery Date
Standard Operating Procedure	60 Days Prior to Demonstration Date
Interface Control Documentation	60 Days Prior to Demonstration Date

11. User-supplied Laser Systems

	TYPE	CLASS	Laser registered with Laser Clearing House?	
a. Type/Class			i. Tracking rate	
b. Output energy/power			j. Jitter	
c. Wavelength			k. Focus	
d. Beam Divergence			l. Focus spot size	
e. Beam aperture diameter			m. Laser beam termination system	☐ Yes ☐ No
f. Pulse repetition frequency			n. SOP Requirement	☐ Yes ☐ No
g. Pulse width			o. Laser Safety Analysis	
h. Lasing azimuth and elevation			p. Other	

12. FSOK-supplied Equipment

Description	Date Required (DD-MM-YY)

III. Demonstration Support Requirements

1. Recovery Requirements

2. Meteorological Considerations

3. Communications Request

4. Medical Requirements

5. Security Requirements

6. Requesting Agency Equipment and Personnel

What vehicles and equipment will the requesting agency BRING with them to support the demonstration?

Equipment/Vehicle Type	Quantity	PAX	Ownership	Additional Comments

7. Requesting Agency Equipment and Personnel

What vehicles and equipment will the requesting agency be REQUESTING from Fort Sill to support the demonstration?

Equipment/Vehicle Type	Quantity	PAX	Ownership	Additional Comments

Approval Process Requirements By System

System Type	Organization																		
	US Army Public Health Command	TRADOC Capability Manager-Range	NEC & Army Spectrum Manager	FCC	FAA	FAA Other Than Laser Concerns	Post Safety and Risk Assessment	Fort Sill Airfield: UAS	Fort Sill Airfield: NOTAM	Range Operations (in general)	Laser Clearing House (Above the Horizon)	Laser Clearing House (Below the Horizion)	Range Operations Laser Safety Office (Non -PoR BTH)	Operations Orders Production	Staff Judge Advocate	Fire Department	Public Affairs Office	DPTMS	Demo Agreement (if no CRADA)	Harmless Agreement (if no CRADA)
High Powered Microwave (HPM)/Radio Frequency	YES	YES	YES	YES	YES (note 4)		YES	IF USING UAS (note 1)	YES	YES	IF APPLICABLE (note 2)	NO	IF APPLICABLE (note 3)	YES	YES	YES	IF APPLICABLE	YES	YES	YES
Rail Gun	YES	YES	NO	NO	IDK	IDK	YES	IF USING UAS (note 1)	YES	YES	IF APPLICABLE (note 2)	NO	IF APPLICABLE (note 3)	YES	YES	YES	IF APPLICABLE	YES	YES	YES
High Energy Laser (HEL)	YES	YES	NO	NO	YES (note 4)		YES	IF USING UAS (note 1)	YES	YES	YES	NO	YES	YES	YES	YES	IF APPLICABLE	YES	YES	YES
Acoustic	YES	YES	NO	NO	NO	IDK	YES	IF USING UAS (note 1)	NO	YES	IF APPLICABLE (note 2)	NO	IF APPLICABLE (note 3)	YES	YES	IF APPLICABLE	IF APPLICABLE	YES	YES	YES
Laser Induced Plasma	YES	YES	NO	NO	IDK		YES	IF USING UAS (note 1)	YES	YES	YES	NO	YES	YES	YES	YES	IF APPLICABLE	YES	YES	YES
Particle Beam	YES	YES	NO	NO	NO		YES	IF USING UAS (note 1)	YES	YES	IF APPLICABLE (note 2)	NO	IF APPLICABLE (note 3)	YES	YES	YES	IF APPLICABLE	YES	YES	YES

KEY	YES (see note on chart)	YES	NO
Note	1) UAS is being engaged by system or will be used to support during range operations	4) ASMO will coordinate FAA approval based on the DD 1494 that you submit to ASMO	
	2) The system uses a laser but not as the weapon itself. i.e. targeting or for any other reason. ATH		
	3) The system uses a laser as a secondary system and is only employed for a below the horizon shot.		

CONTACTS

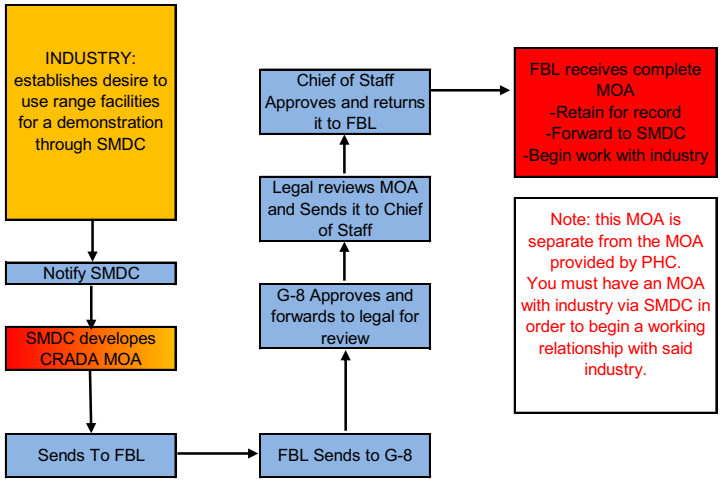
Name (Last, First)	Phone #	Organization
Mr. Colville, Francis	410-436-6607/5066	U.S. Army Public Health Command
Mr. Pfoutz, Jeffrey	410-436-6607/5067	U.S. Army Public Health Command
Mr. Webers, Joseph	757-878-0516	TRADOC Capability Manager-Range
Mr. Durrani, Agha (AJ)	301-225-3758	Army Spectrum Management
Mrs. Witts, Heather	805-606-1282	Laser Clearing House (Primary POC)
MAJ Pindrock, Douglas	805-606-1282	Laser Clearing House (Alternate POC)
MSGT Roberts, Michael	805-606-1282	Laser Clearing House (Alternate POC)
CPT Mason, Alice	805-606-1282	Laser Clearing House (Alternate POC)
Mr. Pease, Christopher	580-442-3003	Directorate of Plans Training Mobilization and Security (DPTMS)
Mr. Deaville, William	580-442-1970	Network Enterprise Center (NEC)
Mr. Cordes, John	580-442-4701	Post Safety
MAJ Brewer, Carol	580-442-1589	Staff Judge Advocate (SJA)
Mr. Langford, Clint	850-442-6010	Fire Department
Mr. Aller, Larry	580-442-5191/5613	Range Operations/Post Laser Safety Office
Mr. Thornton, Sheldon	580-442-2387	Airfield/UAS Approval Authority/Notice To Airmen (NOTAM)
Mr. Ames, Darrel	580-442-4500	Public Affairs Office (PAO)
Mrs. Sminkey, Sarah	580-442-2849/2715	Environmental Office
Mr. Wheat, Thomas	580-442-2849/2716	Environmental Office
Mr. Benitezpena, William	580-442-8865	G-3
Mr. White, James	580-442-3132	Memorandum of Agreement (MOA) FCoE G-8
Ms. McRae, Susan	256-955-1501	Cooperative Research and Development Agreement (CRADA) SMDC
Mr. Cox, David	256-955-9923	Cooperative Research and Development Agreement (CRADA) SMDC

M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-52							T-51							T-50							T-49						
Contact Mr. White for Memorandum of Agreement assistance. Initiate MoA with Public Health Command (PHC).							Draft MoA approval through Battle Lab and CDID.							Coordinate MOA draft with PHC													
Initial Range Concept and Intent Brief (FBL, CDID, DPTMS, EQD, FA/ADA, CG)																											
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-48							T-47							T-46							T-45						
MOA review by Sill Contracting Office							MoA review by Sill SJA.							MoA final approval through Battle Lab and CDID.													
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-44							T-43							T-42							T-41						
MoA signature by Sill Chief of Staff							MoA to PHC and request start of approval process. PHC will need technical specifications and parameters of the system to be employed.							PHC Approval													
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-40							T-39							T-38							T-37						
PHC Approval																											
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-36							T-35							T-34							T-33						
PHC Approval																											
														Contact Network Enterprise Center (NEC) for an "Authority to Radiate" on the range based on system specifications and parameters.							Follow-up with NEC for memorandum. If local authority cannot approve the specific frequencies, the request will go to ASMO whom works with the FCC.						
														Review MIL-HDBK-828B. Approval from Range Operations if Laser is Program of Record. If non-POR, then approval from LCH (Above the Horizion Only).							Contact Laser Clearinghouse if a laser system will be employing a non-POR Laser (Above the Horizion Only).						

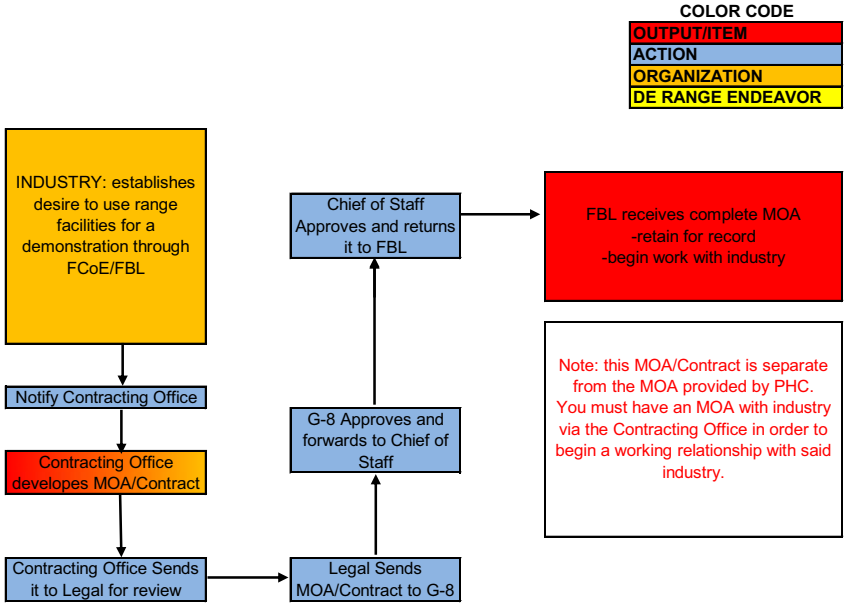
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-32							T-31							T-30							T-29						
							PHC Approval Received																				
Submit DD Form 1494 to Army Spectrum Management Office (ASMO)							Monitor status of DD Form 1494 submission.							PHC Approval forwarded to TCM-Range along with specific Ft. Sill range and system technical specs.							TCM-Range create Surface Danger Zone (SDZ).						
														ASMO Coordinates with FCC and FAA													
Submit request to Laser Clearinghouse for approval.							Monitor Laser Clearinghouse request.							Monitor Laser Clearinghouse request.													
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-28							T-27							T-26							T-25						
														In Progress Review (FBL, CDID, FA/ADA, and CG)													
ASMO Coordinates with FCC and FAA																											
Monitor Laser Clearinghouse request.																											
														Coordinate with Fires Center G-3 for Operations Order (OPORD) and Warning Order (WARNO) format and requirements.							Submit WARNO to Fires Center G-3 for publication and tasking.						
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-24							T-23							T-22							T-21						
Contact Sill Post Safety Office and complete DD 2977, Composite Risk Management for the range							Receive SJA approval for range operations.							Contact Sill Staff Judge Advocate (SJA) office for range operations approval.							Receive approved DD Form 2977 from Post Safety Office.						
							Follow up with Post Safety for DA 2977																				
ASMO Coordinates with FCC and FAA																											
Monitor Laser Clearinghouse request.																											
Submit WARNO for approval through Battle Lab and CDID.							Draft WARNO for range operations.																				
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-20							T-19							T-18							T-17						
Enter into Signature Process with DD Form 2977 and FS Form 51							DD Form 2977 and FS Form 51 Signature Process (follow up until complete)																				
ASMO Coordinates with FCC and FAA																											
Monitor Laser Clearinghouse request.																											
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-16							T-15							T-14							T-13						
ASMO Coordinates with FCC and FAA																											
Monitor Laser Clearinghouse request.																											
							Draft OPORD for range operations							Submit OPORD for approval through Battle Lab and CDID.							Submit OPORD to Fires Center G-3 for publication and tasking.						

M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-12							T-11							T-10							T-9						
Receive final FCC and FAA approval from AMSO.																											
Receive LCH Approval																											
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-8							T-7							T-6							T-5						
Notify Sill Airfield of range operations so they can produce a "Notice to Airmen" (NOTAM							Notify Sill Public Affairs Office of event. Coordinate request for information release through SJA.							**Complete any final coordination with Sill agencies or off-post agencies**												
Submit FS 833-E for Bus Transportation																											
Notify FS Fire Department of Range Execution Dates and Times (for support)																											
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
T-4							T-3							T-2							T-1						
														Range Ops Rehersal													
							Range Operations brief to Battle Lab Director.							Final Range Brief (FBL, CDID, FA/ADA)							CG Range Breif						
M	T	W	T	F	S	S	M	T	W	T	F	S	S														
T							T+1																				
Range Execution																											

CRADA Process (SMDC)

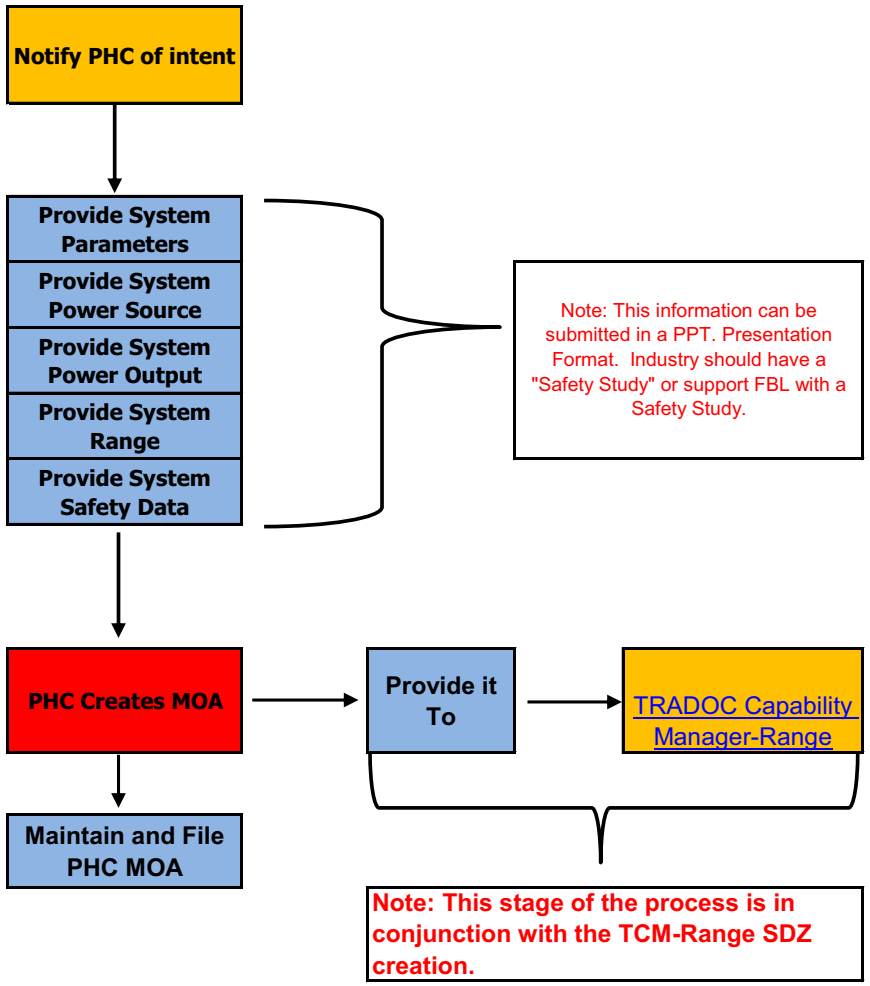


Demonstration Agreement



US Army Public Health Command

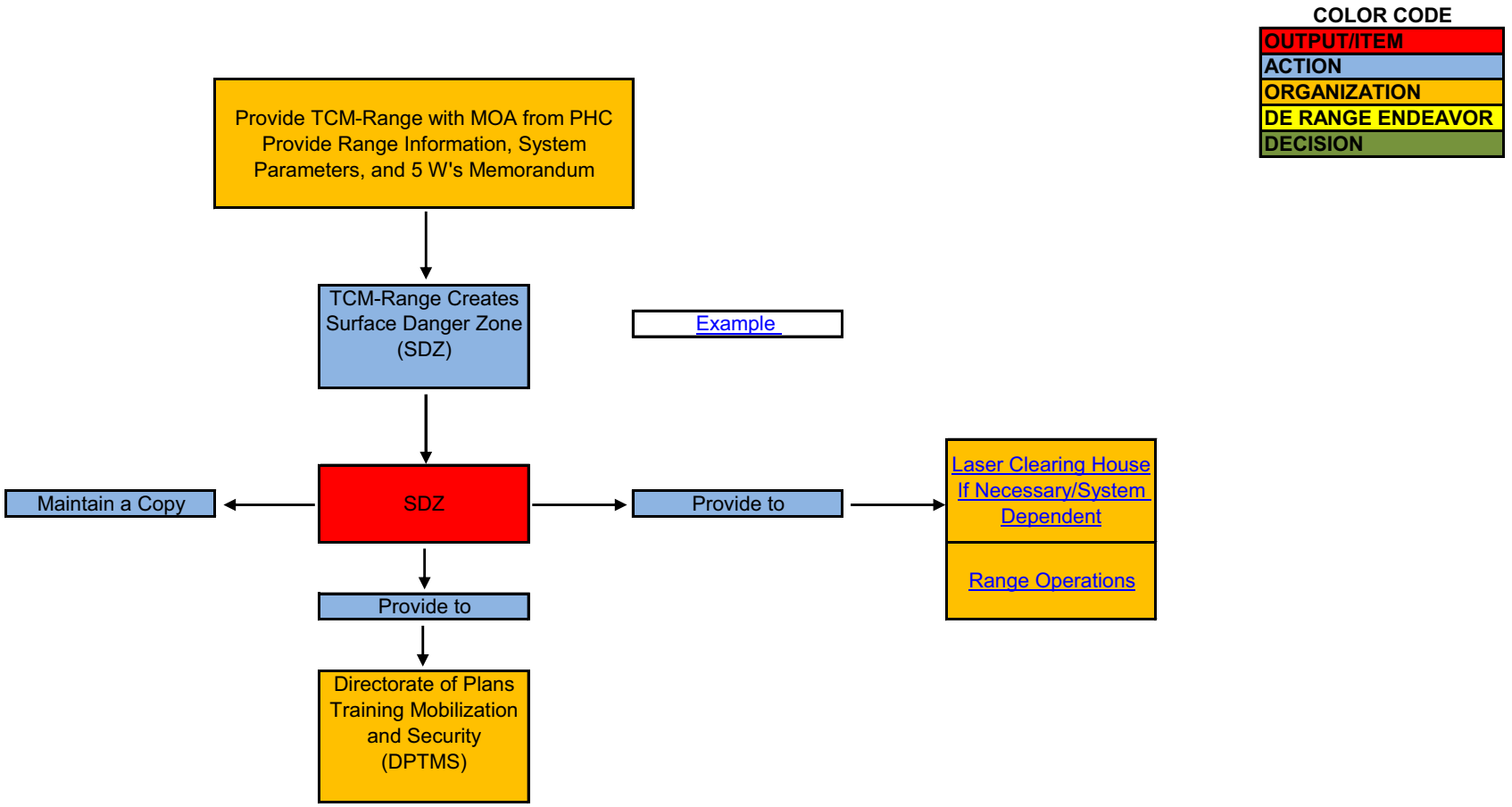
COLOR CODE
OUTPUT/ITEM
ACTION
ORGANIZATION
DE RANGE ENDEAVOR
DECISION



References (System Dependent)

DODI 6055.11	Protection Personnel From Electromagnetic Fields
IEEE C95.1	Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic
ANSI N43.3	Radiation Safety for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV

TRADOC Capability Manger-Range



UAS Approval and Notice to Airmen (Fort Sill Airfield)

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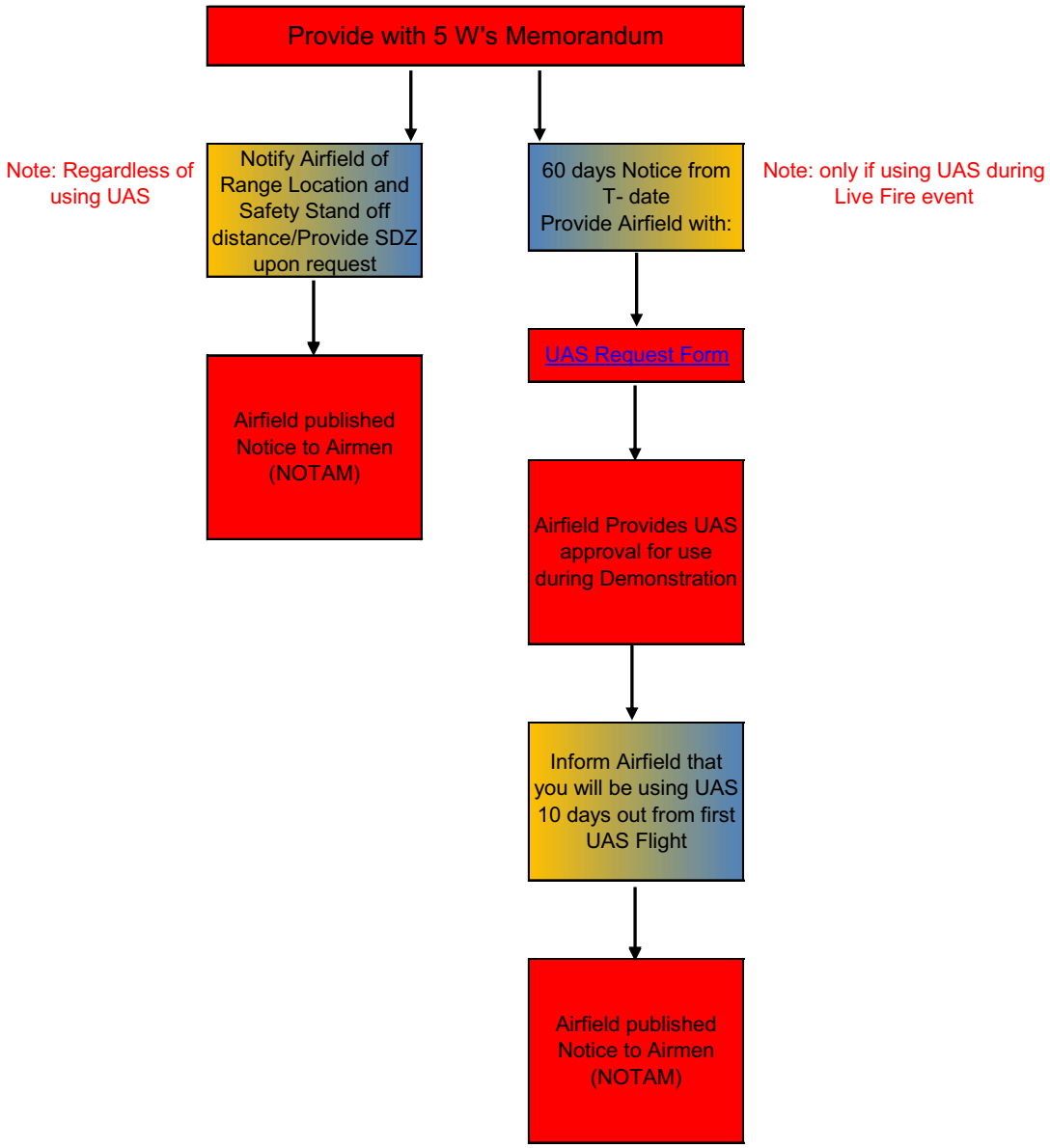
DE RANGE ENDEAVOR
DECISION



Staff Judge Advocate (SJA)

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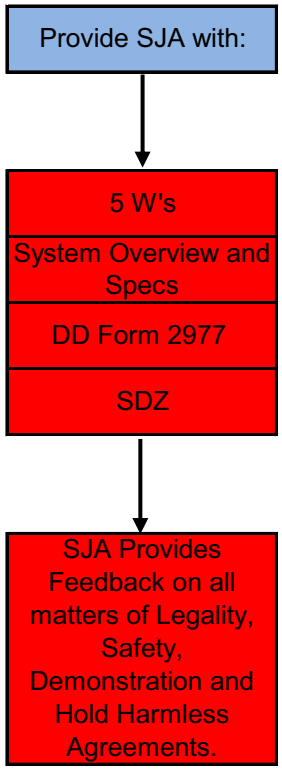
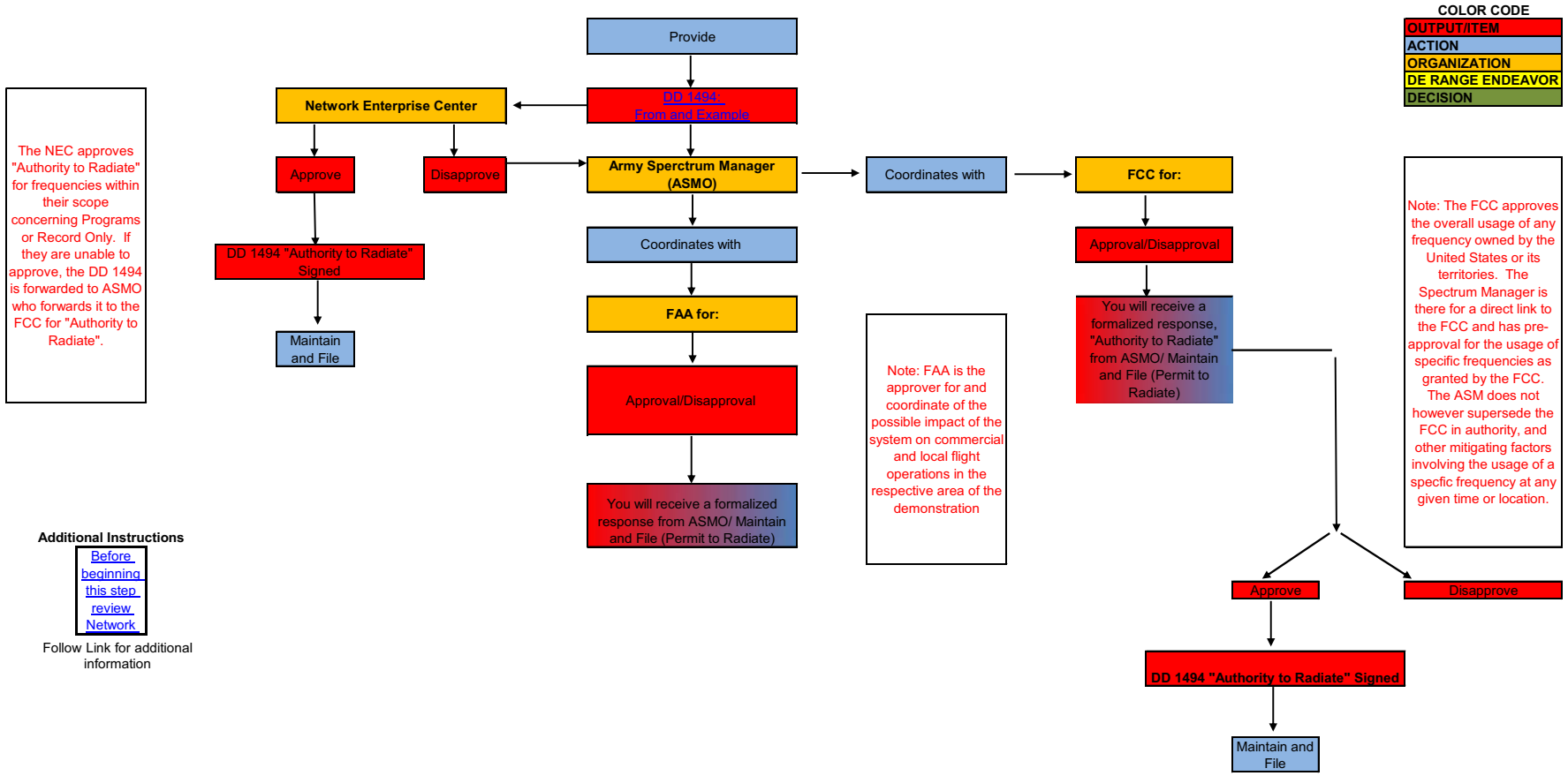
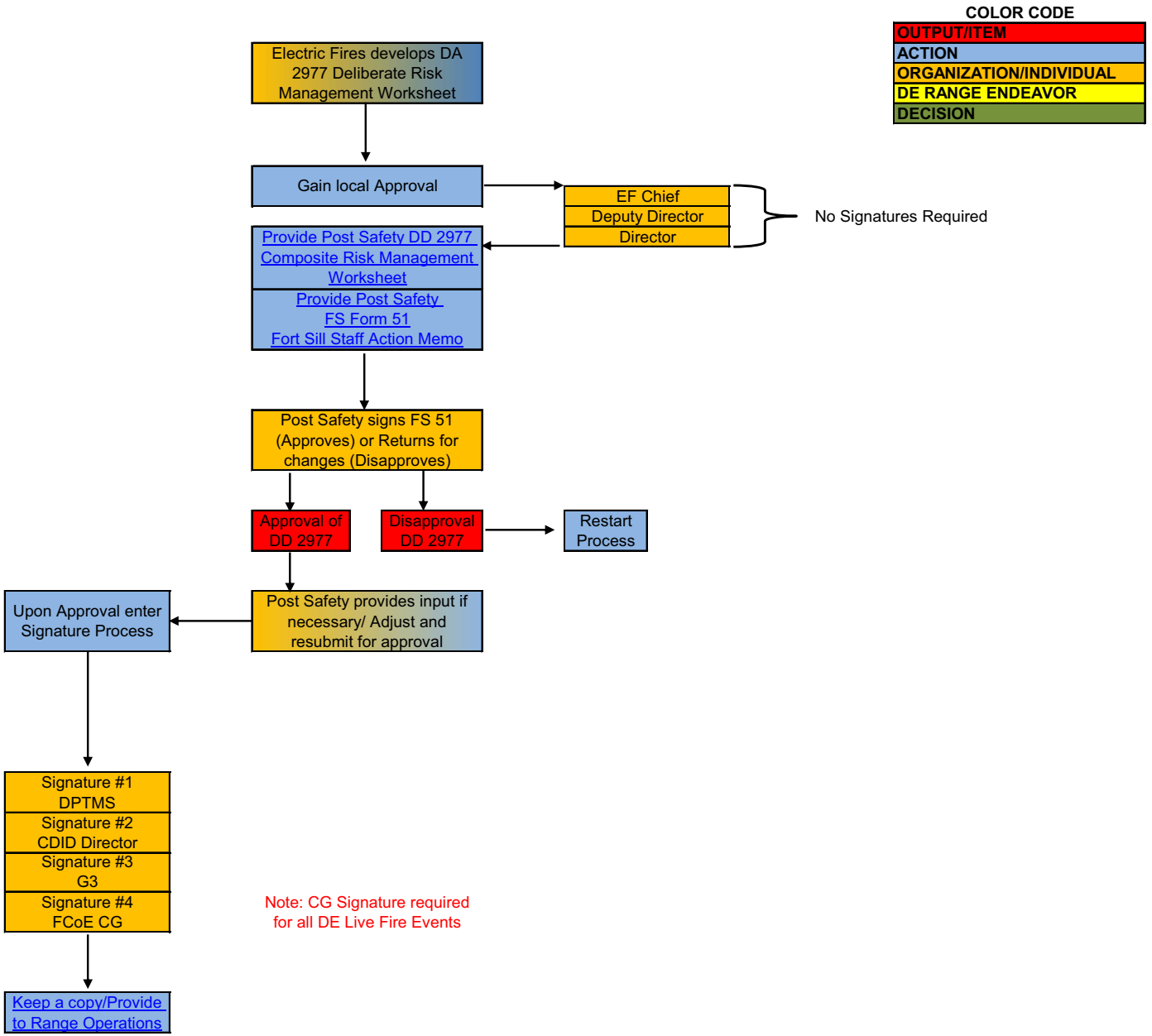
DECISION



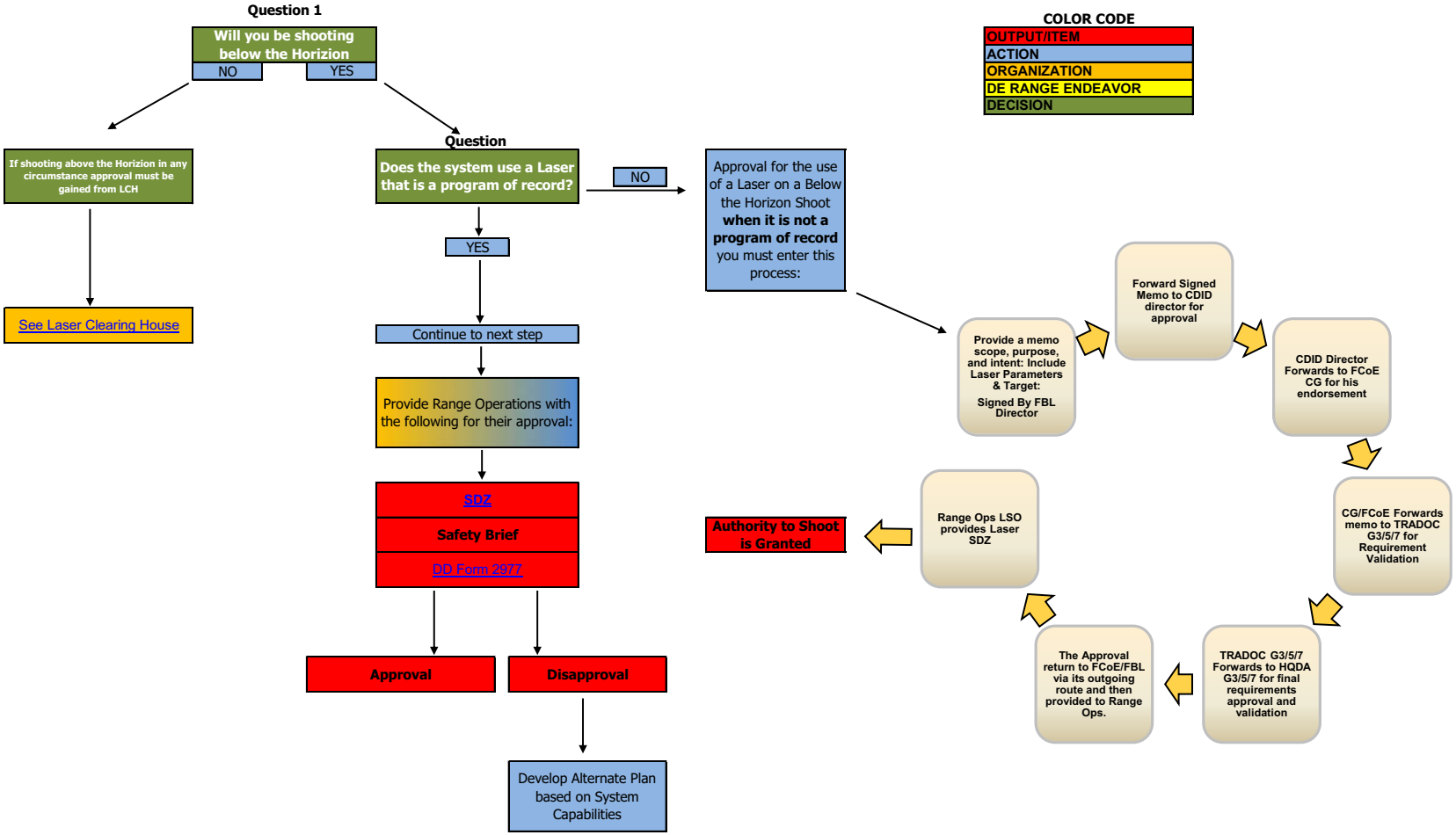
Army Spectrum Management



Post Safety/Risk Assessment



Range Operations (Laser-focused)



G-3 Operations Orders Production and Distribution

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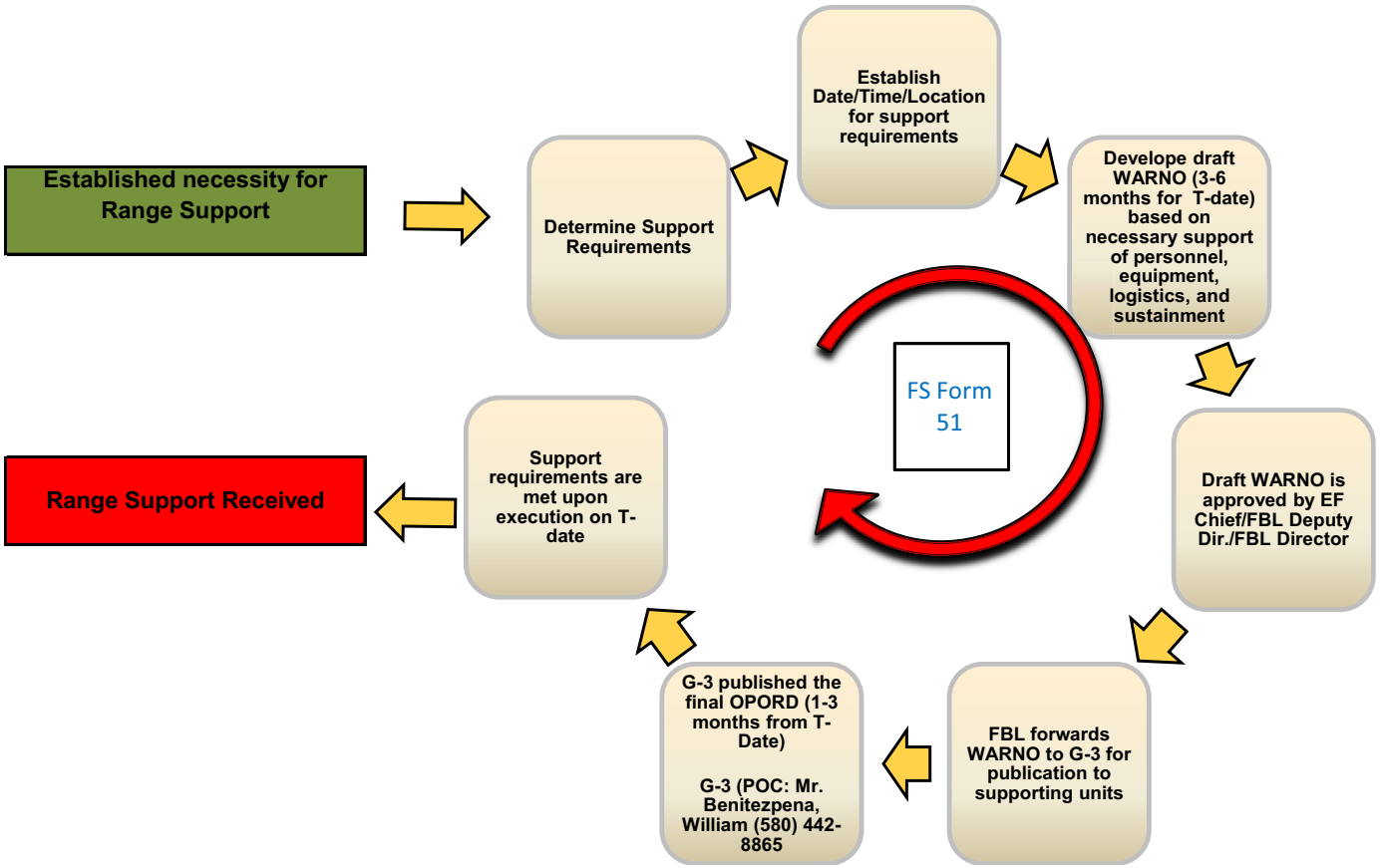
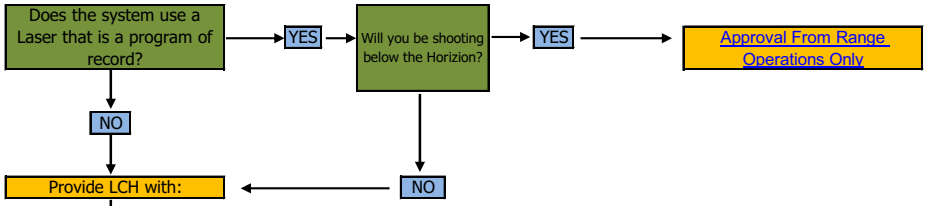
DECISION



Laser Clearing House



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DECISION

SDZ
Laser Registration Form (V5) (2009-05-01)
Standard CPA Plan (C1) (Signed) (2008-11-12)

Laser Deconfliction Six Step Planning Process (Ref: Standard CPA plan Chap 3)
Step 1: Registration of the Laser.
Step 2: Evaluation of the Lasers' potential to harm Satellites (waiver assessment).
Step 3: Analysis of alternative P/A approches.
Step 4: Planning of implementation of P/A approches.
Step 5: P/A capability validation.
Step 6: Authorization of the Laser activity.

Continuous coordination with LCH for Changes or further provisions

LCH provides approval for Above the Horizon Laser Shot

EF/FBL provides LCH with all information required by "Standard CPA Plan (C1)" Tables 1-4; and specifically Table 5; and Appendix A, B, C, and D before, during, and after Laser usage or in the event of a incident involving the Laser or the "operating window" for the Laser Shoot.

Note: "Standard CPA Plan (C1) (Signed) (2008-11-12)" is the guide used along with "Laser Registration Form (V5)" and holds all the necessary information and processes you must enter and complete to meet the LCH requirements to fire a Laser Above the Horizion. This spreadsheet is meant to give you an outline only. You must review the guide book and coordinate with LCH to recieve any additional guidance or unique requirements your "Laser" may have to meet in addition to any request for information from LCH.

Note: LCH only requires the information in "Form V5" all requirements outlined in "Standard Centralized Predictive Avoidence and Capability Validation Plan".

Form Number	Form Name or Contact	Blank Form/Link	Example Form	Form Guide	Note:
DD 1494	**Application for Equipment Frequency Allocation**	DD 1494 Extended Version.doc; DD Form 1494	**Example Located in Folder (NEC and Spectrum Management)**	DD 1494 Preparation Guide	It is recommended that you use the extended version of this form unless otherwise requested by NEC or Spectrum Manager.
SDZ	**Surface Danger Zone**	**Example Only**	SDZ (Example); SDZ (Example) 2		
DD 2977	**Deliberate Risk Management Work Sheet**	DD 2977	**Example Located in Folder (Range Control)**	AR 385-10 Army Safety Program ATP 5-19 Composite Risk Management	
Appendix B	**Laser Clearing House - Appendix B from MIL-HDBK-828B with Change 1**	MIL-HDBK-828B Appendix B with Ch	**No Example Provided**	MIL-HDBK-828B	
Laser Registration Form (V5, 2009-05-01)	**Laser Clearing House Registration Form (V5) (2009-05-01)**	Laser Registration Form (V5) (2009-05	Laser Registration Form (VIIII, 11 Feb	Standard CPA Plan (C1) (Signed) (2008	**Both the blank form and the example form inculde a filled out word document version of the "Laser Registration Spreadsheet". The Example document is a different yet similar version of the document required for LCH. Laser Registration for VIIII should be used as a refrence only. LCH will require the V5 form along with all the information required by the guide book attached.**
Laser Registration Table (LCH)	**Laser Registration Table** **note: you may append the Laser Registration Table to the Laser Registration Form or provide this information as a separate document.**	Laser Registration Table-Blank Form.xl	Laser Registration Table EXAMPLE.xls		**This Laser Registration Table may not be required and is here as an example only if the given space necessary for you to register your "Laser" is not availbale on the 'Laser Registration Form (V5) (2009-05-01)' form. LCH only requires the information in "Form V5" all requirements outlined in "Standard Centralized Predictive Avoidence and Capability Validation Plan".**
UAS Approval	**Unmanned Ariel System Aproval Form**	**Format Example Only**	UAS Approval Form		
OPORD Example	**Operations Order (WARNO) Example**	**Format Example Only**	OPORD Format Example		**This example should be used as a start point. Refinement will be necessary. Please view the final OPORD example in the "Directed Energy Live Fire Procedure" book (tab 13) to determine what additional information you may want to add to your draft Order before it is sent through the Operations Orders Production Process.**
Logistcal Support					
Bus Request FS Form 833-E	**Request for Motor Transportation**	FS Form 833-E			
Bleachers	Mr. Larry Aller				
Additional Forms or Supporting Documents					
Fort Sill Staff Action Memorandum FS Form 51	**Staff Action Memorandum (Update to CG, Risk Assessment Signature)**	FS Form 51			

Information below is derived from the Laser Safety Classification guide "ANSI Z-136.1-1993"

Comparrison of Classifications

Class	IEC 60825 (Amend. 2)	U.S. FDA/CDRH	ANSI-Z136.1 (2000)
Class 1	Any laser or laser system containing a laser that cannot emit laser radiation at levels that are known to cause eye or skin injury during normal operation. This does not apply to service periods requiring access to Class 1 enclosures containing higher class lasers.		
Class 1M	Not known to cause eye or skin damage unless collecting optics are used.	N/A	N/A
Class 2a	N/A	Visible lasers that are not intended for viewing and cannot produce any known eye or skin injury during operation based on a maximum exposure time of 1000 seconds.	N/A
Class 2	Visible lasers considered incapable of emitting laser radiation at levels that are known to cause skin or eye injury within the time period of the human eye aversion response (0.25 seconds).		
Class 2M	Not known to cause eye or skin damage within the aversion response time unless collecting optics are used.	N/A	N/A
Class 3a	N/A	Lasers similar to Class 2 with the exception that collecting optics cannot be used to directly view the beam Visible Only	Lasers similar to Class 2 with the exception that collecting optics cannot be used to directly view the beam
Class 3R	Replaces Class 3a and has different limits. Up to 5 times the Class 2 limit for visible and 5 times the Class 1 limits for some invisible.	N/A	N/A
Class 3b	Medium powered lasers (visible or invisible regions) that present a potential eye hazard for intrabeam (direct) or specular (mirror-like) conditions. Class 3b lasers do not present a diffuse (scatter) hazard or significant skin hazard except for higher powered 3b lasers operating at certain wavelength regions.		
Class 4	High powered lasers (visible or invisible) considered to present potential acute hazard to the eye and skin for both direct (intrabeam) and scatter (diffused) conditions. Also have potential hazard considerations for fire (ignition) and byproduct emissions from target or process materials.		

Additional Laser Classification Details

Overview of Laser Safety Classes

Class	Type of lasers	Meaning	Relationship to MPE	Hazard Area	Typical AEL for CW Lasers
Class 1	Very low power lasers or encapsulated lasers	Safe	MPEs are not exceeded, even for long exposure duration (either 100 seconds or 30000 seconds), even with the use of optical instruments	No hazard area (NOHA)	40 µW for blue
Class 1M	Very low power lasers; either collimated with large beam dia-meter or highly divergent	Safe for the naked eye, potentially hazardous when optical instruments** are used	MPEs are not exceeded for the naked eye, even for long exposure durations, but maybe exceeded with the use of optical instruments**	No hazard area for the naked eye, but hazard area for the use of optical instruments** (extended NOHA)	Same as Class 1, distinction with measurement requirements
Class 2	Visible low power lasers	Safe for unintended exposure, prolonged staring should be avoided	Blink reflex limits exposure dura-tion to nominally 0.25 seconds. MPE for 0.25 seconds not exceeded, even with the use of optical instruments.	No hazard area when based on unintended exposure (0.25 seconds exposure duration)	1 mW
Class 2M	Visible low power lasers; either collimated with large beam diameter or highly divergent	Same as Class 2, but potentially hazardous when optical instruments** are used	MPE for 0.25 seconds not exceeded for the naked eye, but maybe exceeded with the use of optical instruments**	No hazard area for the naked eye when based on accidental exposure (0.25 seconds exposure duration), but hazard area for the use of optical instruments** (extended NOHA)	Same as Class 2, distinction with measurement requirements
Class 3R	Low power lasers	Safe when handled carefully. Only small hazard potential for accidental exposure	MPE with naked eye and optical instruments may be exceeded up to 5 times	5 times the limit of Class 1 in UV and IR, and 5 times the limit for Class 2 in visible, i.e. 5 mW	5 times the limit of Class 1 in UV and IR, and 5 times the limit for Class 2 in visible, i.e. 5 mW
Class 3B	Medium power lasers	Hazardous when eye is exposed. Wear Eye Protection within NOHA. Usually no hazard to the skin. Diffuse reflections usually safe	Ocular MPE with naked eye and optical instruments may be exceeded more than 5 times. Skin MPE usually not exceeded.	Hazard area for the eye (NOHA), no hazard area for the skin	500 mW
Class 4	High power lasers	Hazardous to eye and skin, also diffuse reflection may be hazardous. Protect Eye and skin. Fire hazard.	Ocular and skin MPE exceeded, diffuse reflections exceed ocular MPE	Hazard area for the eye and skin, hazard area for diffuse reflections	No limit

Appendix C

Air Conformity Applicability Model Report

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DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location

Installation: Fort Sill
County(s): Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Demonstrations of Various Electric Fires and Loitering Aerial Munitions Systems at Fort Sill, Oklahoma

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2015

- Action Purpose and Need:

Completion of these demonstrations would help establish the foundation for future training of Electric Fires and loitering aerial munition systems at Fort Sill. Electric Fires systems are revolutionary technologies that show promise to reduce costs and hazards, and achieve enormous gains in flexibility and mobility versus present day gun powder-based systems.

- Action Description:

Alternative 1: Utilize the West Range. Under this Alternative, the various Electric Fires and LAM systems would be demonstrated on the West Range. Implementation of Alternative 1 also includes improvements to Firing Point 240E in the West Range area. Firing Point 240E is an existing improved artillery firing point with a gravel access road, gravel and concrete firing pads, and earth berms. Improvements at this location would include construction of a concrete pad (100 x 100 feet), conversion of 1,500 feet of utility line from aboveground to below ground, construction of one building (a 20 x 30 foot building with an observation deck), earth work to remove and flatten existing man-made berms (less than 0.2 acres), and construction of a gravel parking area (100 x 100 feet).

Alternative 2: Utilize the East Range. Implementation of this alternative would be the same as that described for Alternative 1, with the exception of the improvements described for Firing Point 240E. No improvements would be required at any location in the East Ranges area.

- Point of Contact

Name: Brad Boykin
Title: CTR
Organization: Leidos
Email: boykinb@leidos.com
Phone Number: 850-609-3450

- Activity List:

	Activity Type	Activity Title
2.	Construction / Demolition	Grading
3.	Construction / Demolition	Building
4.	Construction / Demolition	Concrete Pad
5.	Construction / Demolition	Utility lines
6.	Construction / Demolition	Parking Area
7.	Construction / Demolition	Earth Work

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Grading

- Activity Description:
Grading of up to 29,312 sq ft.

- Activity Start Date
Start Month: 1
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 6
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.232634
SO_x	0.002513
NO_x	1.777607
CO	1.113662
PM_{10}	1.812048

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.081514
Pb	0.000000
NH_3	0.001442

2.2 Site Grading Phase

2.2.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2015

- Phase Duration
Number of Month: 6
Number of Days: 0

2.2.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 29312
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors / Loaders / Backhoes Composite	1	7

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.2.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
Pollutant	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CH_4	CO_2
Emission Factors	0.1277	0.0014	0.9794	0.5930	0.0488	0.0488	0.0115	132.74
Other Construction Equipment Composite								
Pollutant	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CH_4	CO_2
Emission Factors	0.0768	0.0012	0.6391	0.3645	0.0263	0.0263	0.0069	122.59
Rubber Tired Dozers Composite								
Pollutant	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CH_4	CO_2
Emission Factors	0.2721	0.0024	2.2344	1.0419	0.0924	0.0924	0.0245	239.09
Tractors / Loaders / Backhoes Composite								
Pollutant	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CH_4	CO_2
Emission Factors	0.0666	0.0007	0.4500	0.3715	0.0297	0.0297	0.0060	66.799

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

2.2.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building

- Activity Description:
Construction of a 20' x 30' building.

- Activity Start Date
Start Month: 7
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 12
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.335682
SO_x	0.003829
NO_x	2.235864
CO	1.807323
PM_{10}	0.115629

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.115028
Pb	0.000000
NH_3	0.004351

3.2 Building Construction Phase

3.2.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 7
Start Quarter: 3
Start Year: 2015

- Phase Duration
Number of Month: 6
Number of Days: 0

3.2.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 600
Height of Building (ft): 30
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors / Loaders / Backhoes Composite	1	8

- Vehicle Exhaust

Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

3.2.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.1203	0.0013	1.0199	0.4395	0.0425	0.0425	0.0108	128.63
Forklifts Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0458	0.0006	0.3163	0.2200	0.0155	0.0155	0.0041	54.395
Tractors / Loaders / Backhoes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0666	0.0007	0.4500	0.3715	0.0297	0.0297	0.0060	66.799

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

3.2.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3.3 Architectural Coatings Phase

3.3.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 11
Start Quarter: 4
Start Year: 2015

- Phase Duration
Number of Month: 2
Number of Days: 0

3.3.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category:
Total Square Footage (ft^2): 600
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

3.3.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

3.3.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

4. Construction / Demolition

4.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Concrete Pad

- Activity Description:
Construction of a 100' x 100' concrete pad.

- Activity Start Date
Start Month: 7
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 12
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.328754
SO_x	0.003830
NO_x	2.236124
CO	1.807400
PM_{10}	0.115639

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.115035
Pb	0.000000
NH_3	0.004353

4.2 Building Construction Phase

4.2.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 7
Start Quarter: 3
Start Year: 2015

- Phase Duration
Number of Month: 6
Number of Days: 0

4.2.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 10000
Height of Building (ft): 2
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors / Loaders / Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

4.2.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.1203	0.0013	1.0199	0.4395	0.0425	0.0425	0.0108	128.63
Forklifts Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0458	0.0006	0.3163	0.2200	0.0155	0.0155	0.0041	54.395
Tractors / Loaders / Backhoes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0666	0.0007	0.4500	0.3715	0.0297	0.0297	0.0060	66.799

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

4.2.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Construction / Demolition

5.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Utility lines

- Activity Description:
Conversion of 1,500 feet of utility lines

- Activity Start Date
Start Month: 4
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 6
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.111116
SO_x	0.001318
NO_x	0.788826
CO	0.554096
PM_{10}	0.233144

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.039423
Pb	0.000000
NH_3	0.000721

5.2 Trenching / Excavating Phase

5.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 4
Start Quarter: 2
Start Year: 2015

- Phase Duration
Number of Month: 3
Number of Days: 0

5.2.2 Trenching / Excavating Phase Assumptions

- General Trenching / Excavating Information
Area of Site to be Trenched / Excavated (ft^2): 6560
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipmen Composite	1	8
Tractors / Loaders / Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

5.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2
LDGV	00.6070	00.0068	00.4460	08.8500	00.0248	00.0113	NA	00.1017	00368.1
LDGT	00.8380	00.0095	00.6830	10.5400	00.0249	00.0114	NA	00.1017	00516.1
HDGV	00.9060	00.0165	01.4500	08.7600	00.0485	00.0321	NA	00.0451	00905.3
LDDV	00.1320	00.0029	00.2000	00.8080	00.0532	00.0374	NA	00.0068	00314.0
LDDT	00.3870	00.0056	00.4600	00.6570	00.0601	00.0438	NA	00.0068	00599.2
HDDV	00.3430	00.0116	03.2960	00.9410	00.1285	00.0996	NA	00.0270	01245.6
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

5.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

6. Construction / Demolition

6.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Parking Area

- Activity Description:
Construct a 100' x 100' gravel parking area. Estimate 200 cubic yards of gravel at 3,000 lbs/yd^3

- Activity Start Date
Start Month: 7
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 9
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.116385
SO_x	0.001259
NO_x	0.889344
CO	0.556991
PM_{10}	0.336034

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.040772
Pb	0.000000
NH_3	0.000727

6.2 Site Grading Phase

6.2.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 7
Start Quarter: 3
Start Year: 2015

- Phase Duration
Number of Month: 3
Number of Days: 0

6.2.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 10000
Amount of Material to be Hauled On-Site (yd^3): 200
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors / Loaders / Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

6.2.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.1277	0.0014	0.9794	0.5930	0.0488	0.0488	0.0115	132.74
Other Construction Equipment Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0768	0.0012	0.6391	0.3645	0.0263	0.0263	0.0069	122.59
Rubber Tired Dozers Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.2721	0.0024	2.2344	1.0419	0.0924	0.0924	0.0245	239.09
Tractors / Loaders / Backhoes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0666	0.0007	0.4500	0.3715	0.0297	0.0297	0.0060	66.799

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**Pb**	**NH_3**	**CO_2**
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

6.2.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Construction / Demolition

7.1 General Information & Timeline Assumptions

- Activity Location
County: Comanche
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Earth Work

- Activity Description:
Estimate an area approximately 9,000 square feet to remove and flatten existing berms.

- Activity Start Date
Start Month: 7
Start Year: 2015

- Activity End Date
Indefinite: False
End Month: 9
End Year: 2015

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.116351
SO_x	0.001258
NO_x	0.889074
CO	0.556911
PM_{10}	0.306507

Pollutant	Total Emissions (TONs)
$PM_{2.5}$	0.040765
Pb	0.000000
NH_3	0.000724

7.2 Site Grading Phase

7.2.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 7
Start Quarter: 3
Start Year: 2015

- Phase Duration
Number of Month: 3
Number of Days: 0

7.2.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 9000
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 100

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors / Loaders / Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

7.2.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.1277	0.0014	0.9794	0.5930	0.0488	0.0488	0.0115	132.74
Other Construction Equipment Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0768	0.0012	0.6391	0.3645	0.0263	0.0263	0.0069	122.59
Rubber Tired Dozers Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.2721	0.0024	2.2344	1.0419	0.0924	0.0924	0.0245	239.09
Tractors / Loaders / Backhoes Composite								
Pollutant	**VOC**	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CH_4**	**CO_2**
Emission Factors	0.0666	0.0007	0.4500	0.3715	0.0297	0.0297	0.0060	66.799

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**Pb**	**NH_3**	**CO_2**
LDGV	00.5190	00.0068	00.3740	08.3200	00.0248	00.0113	NA	00.1017	00368.0
LDGT	00.7450	00.0095	00.5880	09.8000	00.0249	00.0113	NA	00.1017	00516.2
HDGV	00.7620	00.0165	01.0640	08.4000	00.0432	00.0275	NA	00.0451	00904.8
LDDV	00.1110	00.0029	00.1370	00.7480	00.0447	00.0295	NA	00.0068	00314.1
LDDT	00.3450	00.0056	00.3830	00.6140	00.0533	00.0375	NA	00.0068	00598.6
HDDV	00.3090	00.0116	02.4520	00.7240	00.0970	00.0707	NA	00.0270	01243.4
MC	02.6100	00.0033	01.1700	14.7900	00.0372	00.0207	NA	00.0113	00177.4

7.2.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

Vehicle Emissions

Vehicle emissions were calculated for 6 HMMVs (Heavy Duty Gas Vehicle [HDGV]), 12 LMTVs / Strykers (Heavy Duty Diesel Vehicle [HDDV]), 6 General trucks (Light Duty Gas Truck [LDGT]), and 10 UTVs (Motorcycles [MC]). The table below provides the emission factors used to calculate annual emissions. Each was presumed to operate 16 hours per day for 232 days annually at an average speed of 15 miles per hour.

- Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CO_2
LDGT	0.731	0.0095	0.574	8.96	0.0249	0.0113	516.2
HDGV	0.764	0.0165	1.056	8.17	0.0432	0.0275	904.8
HDDV	0.309	0.0116	2.452	0.724	0.097	0.0707	1,243.4
MC	2.39	0.0033	1.15	14.25	0.0372	0.0207	177.4

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; VOC = volatile organic compound; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter less than or equal to 2.5 microns; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; SO_2 = sulfur dioxide; HDGV=Heavy Duty Gas Vehicle, HDDV=Heavy Duty Diesel Vehicle, LDGV=Light Duty Gas Vehicle, LDGT=Light Duty Gas Truck

The table below provides the calculated annual emissions for each vehicle type and the annual total emissions.

Vehicle type	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CO_2
Gen Truck	8,421.12	109.44	6,612.48	103,219.20	286.85	130.18	5,946,624.00
HMMMWV	8,801.28	190.08	12,165.12	94,118.40	497.66	316.80	10,423,296.00
LMTVs / Strykers	3,559.68	133.63	28,247.04	8,340.48	1,117.44	814.46	14,323,968.00
UTVs	26,887.50	37.13	12,937.50	160,312.50	418.50	232.88	1,995,750.00
Total (g)	47,669.58	470.28	59,962.14	365,990.58	2,320.45	1,494.32	32,689,638.00
Total (lbs)	105.09	1.04	132.19	806.87	5.12	3.29	72,068.23
Total (tons)	*0.05*	*0.00*	*0.07*	*0.40*	*0.00*	*0.00*	*36.03*

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; VOC = volatile organic compound; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter less than or equal to 2.5 microns; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; SO_2 = sulfur dioxide; HDGV=Heavy Duty Gas Vehicle, HDDV=Heavy Duty Diesel Vehicle, LDGV=Light Duty Gas Vehicle, LDGT=Light Duty Gas Truck

Generator Emissions

Generator emissions were calculated for nine 2MW diesel generators, one each for powering EM Launch, Combustion Light Gas Gun, Electrothermal-Chemical, Acoustic, High Power Microwave, Radio Frequency, Laser, Particle Beam, and Laser Induced Plasma Channel systems. Emission factors were obtained from the USEPA's AP-42, Fifth Edition, Volume I, Chapter 3: Stationary Internal Combustion Sources Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines. The table below provides the emission factors used to calculate annual emissions. Each was presumed to operate during six events annually of 12 days per event and 8 hours per day.

- Emission Factors (lbs/hp-hr)

VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	CO_2
0.000705	0.00809	0.024	0.0055	0.0007	0.0007	1.16

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; VOC = volatile organic compound; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter less than or equal to 2.5 microns; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; SO_2 = sulfur dioxide

The table below provides the calculated annual total emissions for operation of generators.

- Emissions (tons/year)

	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOCs	CO_2e
ROI Emissions	**45,118**	**6,718**	**29,163**	**5,989**	**385**	**23,151**	**1,182,212**
Generator emissions	4.25	18.54	0.54	0.00	0.31	0.54	910

CO = carbon monoxide; CO_2e = carbon dioxide equivalents; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_x = sulfur oxides; VOC = volatile organic compound