



Missile Defense Agency Vertical Gun Test



Environmental Assessment

18 May 2004

Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington, DC 20301-7100

VERTICAL GUN TEST ENVIRONMENTAL ASSESSMENT

MISSILE DEFENSE AGENCY

AGENCY: Missile Defense Agency (MDA)

ACTION: Finding of No Significant Impact

BACKGROUND: The Missile Defense Agency (MDA) prepared an Environmental Assessment (EA) to evaluate the potential environmental consequences of using thickened tributyl phosphate (TBP) as a chemical agent simulant in a maximum of six vertical gun experiments to be conducted at the Energetic Materials Research and Testing Center (EMRTC) at the New Mexico Institute of Mining and Technology (NMT), located near Socorro, New Mexico. Canisters containing dye enhanced, thickened TBP would be launched vertically at speeds approaching Mach 3 or 4 from the 3K North site and dispersed to assist MDA in determining drop size distribution for a simulated chemical agent threat. Aerosol and droplet debris would be primarily monitored using passive sensors. The TBP experiments would improve MDA's ability to evaluate ground hazards from the intercept of a threat warhead bearing chemical payloads.

After reviewing and analyzing currently available data and information on existing conditions, project impacts, and measures to mitigate those impacts, the MDA has determined that the proposed action is not a Federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969, as amended. Therefore, the preparation of an Environmental Impact Statement (EIS) would not be required and MDA is issuing a Finding of No Significant Impact. The MDA made this determination in accordance with all applicable environmental laws.

The EA was prepared in accordance with NEPA; the Council on Environmental Quality regulations that implement NEPA (Code of Federal Regulations [CFR], Title 40, Parts 1500-1508); Department of Defense Instruction 4715.9, *Environmental Planning and Analysis*; and the applicable service regulations that implement these laws and regulations.

DESCRIPTION OF THE PROPOSED ACTION: Droplet size distribution has been identified by MDA as the most important factor in determining ground hazard estimations from chemical payloads. Therefore, the purpose of the proposed action is to provide MDA with test scenarios where the drop size and dispersion of simulated threat agents can be monitored, and thus enhance MDA's ground hazard estimation modeling capability. The data collected from these tests would be used to validate MDA's Post-Engagement Ground Effects Model (PEGEM).

MDA proposes to conduct up to six vertical gun tests within a two-week period at the NMT 3K North site. Canisters containing TBP would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and any rain deposited on the ground quickly evaporates which would meet the test designers objectives of preventing the TBP from dispersing over a wide area and allow TBP deposited on the ground to rapidly photodegrade. The canisters would contain approximately 50 kilograms (110 pounds) of TBP thickened using polybutyl methacrylate (PBMA) enhanced with blue dye for observation purposes. A small amount of explosives would be used to rupture the canister tanks during ascent at an altitude of approximately 500 meters (1,640 feet), resulting in the creation of a short-lived aerosol debris cloud and the subsequent dispersion of TBP droplets. TBP droplets would be monitored using several remote-sensing methods including:

- High-speed cameras placed at different locations at the test site would provide a visual documentary.
- Doppler radar would be used to monitor velocity of the canister during the tests.
- Lidar would be used to characterize the drop formation process, with Ka-Band radar and W-Band radar used to monitor drop size.

Approximately twelve witness cards designed to receive the dye enhanced TBP would also be placed on the ground approximately one to two hours prior to the test, with their location determined by modeling based on the current prevailing wind conditions.

The test planners have determined that weather related criteria would be established to determine Go/No-Go test conditions. The test planners determined a worst-case scenario based on PEGEM. The model predicted when winds from the west (blowing between 270 to 315 degrees) were less than or equal to 13 kilometers per hour (8 miles per hour), the test objectives could not be met and the tests would not be conducted. Test planners indicated that realistically given normal meteorological conditions the proposed tests would be conducted when winds are less than 3 miles per hour (4.83 kilometers per hour). At this wind speed, TBP dispersion is anticipated to remain within the immediate vicinity of the 3K North site.

ALTERNATIVES TO THE PROPOSED ACTION: While alternatives to the proposed action were initially considered during formulation of the test plan, these alternatives were considered infeasible because they would not adequately meet MDA's objective to determine drop size distribution for a simulated chemical agent threat. The use of simulants other than TBP was considered, specifically the use of Bis (2-ethylhexyl) phosphonate and triethyl phosphate. Using either of

these two substances would not achieve the test objectives of realistically simulating the threat. In addition, although parathion and malathion would realistically emulate the threat, they were eliminated from further consideration because of their high toxicity.

The High Performance Magazine site at EMRTC was considered as an alternate site for the proposed tests. The High Performance Magazine site is located at a relatively high altitude. This altitude, in conjunction with fewer mountains surrounding the site results in increased wind velocities. Thus, conducting the proposed vertical tests at the High Performance Magazine site would result in the potential for TBP to be dispersed over a greater land mass area, and to reach a greater height in the atmosphere than test planning intended. These factors would severely affect meeting test objectives; therefore, the High Performance Magazine site was dismissed from further evaluation.

ENVIRONMENTAL EFFECTS:

Methodology

Thirteen resource areas were considered to provide a context for understanding the potential effects of the proposed action and to provide a basis for assessing the severity of potential impacts, with attention focused on key issues. The resource areas considered included: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, health and safety, land use, noise, socioeconomics and environmental justice, transportation and infrastructure, visual resources, and water resources.

The Region of Influence was determined for each resource area discussed in this EA. The Region of Influence describes a unique region for each resource area that represents the area with the potential to be affected by the proposed action. The environmental consequences associated with the proposed action and no action alternatives were analyzed for each Region of Influence within the context of resource areas.

Proposed Action

A detailed impacts analysis was conducted for all resource areas. No significant impacts to airspace, cultural resources, health and safety, land use, socioeconomics and environmental justice, transportation and infrastructure, or visual resources would occur from up to six proposed tests at the 3K North site. No significant impacts would result from hazardous materials or hazardous waste used or produced as a result of the proposed action. Applicable regulations and operating procedures would be followed when handling hazardous materials and waste. The following describes the results for those resource areas that presented a potential for impact.

Construction activities and equipment, propellant from the gun, and generators would produce air emissions; however, no significant impacts would be expected. PBMA and the dye are inert; therefore, no significant air quality impacts would be expected from their use. Given the rapid dispersion of the droplets and the facility's remote location, no long-term air quality impacts would be expected. In a failed test, the canister would fall and rupture upon impact with the ground. The primary receiving environment would be soils, and there would be no significant air quality impacts.

It is unlikely that noise would elicit startle responses in wildlife. Biological resources near the 3K North site would not be exposed to concentrations of TBP over 100 milligrams per square meter. PEGEM indicates concentrations of TBP would not approach toxic levels for birds. The use of spill prevention measures would reduce or eliminate potential impacts to biological resources. There would be no effects to endangered, threatened, or proposed species, New Mexico Species of Concern, or designated or proposed critical habitat as a result of this proposed action.

TBP droplets landing on the ground would photodegrade within a few hours when exposed to sunlight. The dye would also break down rapidly; however, some dye may be visible for up to a few months. If TBP were deposited in one spot (due to a spill or failed test), clean up would be conducted using existing procedures. Therefore, no significant impact to geology and soils would be expected.

Noise from generators would not be heard in the community of Socorro. The primary noise would be from firing the gun, which would be similar to jet flyovers. Socorro would be buffered from noise by the mountains and would not be affected. A test failure would not alter noise levels. Therefore, no significant noise impacts would be expected.

PEGEM indicates that TBP concentrations at a local spring would be 1 to 10 milligrams per square meter, which would be unlikely to significantly impact water quality. Given the amount of TBP and its likelihood to photodegrade in sunlight, no significant impacts would be expected. In a test failure or spill, TBP would impact soils; however, because of spill prevention and cleanup protocols, soil impermeability, and the depth to ground water, no significant ground water impacts would be expected.

Cumulative Impacts

According to 40 CFR § 1508.7, cumulative impacts can be defined as "...the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

For this analysis, cumulative impacts include impacts from the proposed tests and reasonably foreseeable tests at EMRTC. No significant cumulative impacts to airspace, cultural resources, land use, socioeconomics and environmental justice, transportation and infrastructure, or visual resources would occur from the combined impact of existing testing operations and the up to six proposed tests at the 3K North site.

Because TBP would photodegrade and decompose, no significant cumulative impacts would be expected to air quality, biological resources, geology and soils, and water resources. In addition, all applicable standard operating procedures for health and safety and for handling hazardous materials and waste would be followed; therefore, no significant cumulative impacts would be expected.

No Action Alternative

Under the no action alternative, the proposed tests using TBP would not occur from the 3K North site. Other unrelated tests at EMRTC would continue to occur and would have the potential to impact the environment. There would be no significant impacts to air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, land use, noise, transportation and infrastructure, visual resources, and water resources.

Under the no action alternative, there would be no proposed tests using TBP; and therefore, none of the potential impacts to health and safety would occur. The purpose of the proposed action is to allow MDA to better predict the dispersion of simulated chemical weapon threats that could compromise public health and safety. Without data obtained from the proposed tests using TBP as a threat simulant, MDA would be unable to verify necessary data and would be forced to rely on data produced from computer-based simulation rather than field-tested observations.

Under the no action alternative, no proposed testing would occur at the 3K North site, and it is unlikely that the vertical gun would be developed or used for future tests. Revenue generated by research, testing, and training activities at EMRTC supply a large portion of the income for the community of Socorro. Local hotels and restaurants benefit substantially from the number of scientists, researchers, and individuals receiving training at the facility that visit the community annually. Although the no action alternative would not affect employment trends in the region, it would place limitations on the current and future test capabilities of EMRTC. This phenomenon could inadvertently result in adverse economic effects for the community.

PUBLIC COMMENT: The EA and Draft Finding of No Significant Impact were released for public review and comment. The MDA established a toll free fax line, e-mail address, and U.S. postal service mailbox to receive comments. Three comments were received. Two of the comments were determined to be outside the scope of this project and one comment requested additional information about the availability of the documents from the MDA public web site. None of the comments resulted in revisions to the EA or Finding of No Significant Impact.

CONCLUSION: An analysis of the proposed action has concluded that there are no significant short-term or long-term effects to the environment or surrounding populations. After careful and thorough consideration of the facts herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives set forth in Section 101(a) of NEPA and that it will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102 (2) (c) of NEPA. Therefore, an EIS for the proposed action is not required.

DEADLINE FOR RECEIPT OF WRITTEN COMMENTS: 18 May 2004

POINT OF CONTACT: Submit written comments or requests for a copy of the Vertical Gun Test EA to: Vertical Gun EA, c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031; via toll-free fax 1-877-851-5451; or via E-mail verticalgun.ea@icfconsulting.com.

**VERTICAL GUN TEST
ENVIRONMENTAL ASSESSMENT**

AGENCY: Missile Defense Agency (MDA)

ACTION: Finding of No Significant Impact

PROPONENT:



DATE: 19 May 04

DR. CHARLES A. LIND
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Modeling and Simulation Program

APPROVED:



DATE: 21 May 04

MARK D. SHACKELFORD
Brigadier General, USAF
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EXECUTIVE SUMMARY

Introduction

The Missile Defense Agency (MDA) prepared this Environmental Assessment (EA) to evaluate the potential environmental consequences of using tributyl phosphate (TBP) as a chemical agent simulant in a maximum of six vertical gun experiments to be conducted at the Energetic Materials Research and Testing Center (EMRTC) at the New Mexico Institute of Mining and Technology (NMT), located near Socorro, New Mexico. Canisters containing dye enhanced, thickened TBP would be launched vertically at speeds approaching Mach 3 or 4 from the 3K North site and dispersed to assist MDA in determining drop size distribution for a simulated chemical agent threat. Aerosol and droplet debris would be primarily monitored using passive sensors. The TBP experiments would improve MDA's ability to evaluate ground hazards from the intercept of a threat warhead bearing chemical payloads.

Purpose and Need for Proposed Action

Droplet size distribution has been identified by MDA as the most important factor in determining ground hazard estimations from chemical payloads. Therefore, the purpose of the proposed action is to provide MDA with test scenarios where the drop size and dispersion of simulated threat agents can be monitored, and thus enhance MDA's ground hazard estimation modeling capability. The data collected from these tests would be used to validate MDA's Post-Engagement Ground Effects Model (PEGEM).

Using TBP as a simulant would allow MDA to characterize the size, velocity, and spatial dispersion of threat agents. While tests have been conducted at various sites by MDA using water, triethyl phosphate and TBP as simulants, no tests have been conducted with vertically launched TBP. Similar experiments using TBP have been conducted using an elevated horizontally positioned gun. Conducting vertical launches would fulfill MDA's need to more realistically simulate the impact of the dispersion of the threat agent O-ethyl-S-(2-diisopropylaminoethyl) methylphosphonothiolate (VX) resulting from a boost phase engagement.

Proposed Action

MDA proposes to conduct up to six vertical gun tests within a two-week period at the NMT 3K North site. Canisters containing TBP would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and any rain deposited on the ground quickly evaporates which would meet the test designers objectives of preventing the TBP from dispersing over a wide area and allow TBP deposited on dry ground to rapidly photodegrade. The canisters would contain

approximately 50 kilograms (110 pounds) of TBP thickened using polybutyl methacrylate (PBMA) enhanced with blue dye for observation purposes. A small amount of explosives would be used to rupture the canister tanks during ascent at an altitude of approximately 500 meters (1,640 feet), resulting in the creation of a short-lived aerosol debris cloud and the subsequent dispersion of TBP droplets. TBP droplets would be monitored using several remote sensing methods including¹

- High-speed cameras placed at different locations at the test site would provide a visual documentary.
- Doppler radar would be used to monitor velocity of the canister during the tests.
- Lidar would be used to characterize the drop formation process, with Ka-Band radar and W-Band radar used to monitor drop size.

Approximately twelve witness cards designed to receive the dye enhanced TBP would also be placed on the ground approximately one to two hours prior to the test, with their location determined by modeling based on the current prevailing wind conditions.

The test planners have determined that weather related criteria would be established to determine Go/No-Go test conditions. The test planners determined a worst-case scenario based on PEGEM. The model predicted when winds from the west (blowing between 270 to 315 degrees) were less than or equal to 13 kilometers per hour (8 miles per hour), the test objectives could not be met and the tests would not be conducted. Test planners indicated that realistically given normal meteorological conditions the proposed tests would be conducted when winds are less than 4.83 kilometers per hour (3 miles per hour). At this wind speed, TBP dispersion is anticipated to remain within the immediate vicinity of the 3K North site.

Each of the six proposed tests would use approximately 50 kilograms (110 pounds) of thickened TBP, containing a blue dye. The thickener added to the TBP would be PBMA. The blue dye and PBMA are inert substances. TBP is listed as an eye, skin, and respiratory irritant, and may also cause headaches and nausea in high concentrations or unventilated areas. TBP has been shown to irritate skin and mucous membranes of humans due to its high capacity for skin penetration.

A preliminary ground deposition calculation was performed using PEGEM version 5.1, employing the Defense Threat Reduction Agency's Hazard Prediction and Assessment Capability transport and dispersion model. Based upon the PEGEM model assumptions for the Proposed Action, a localized plume of TBP is predicted to form at the 3K North test site immediately following discharge of the canister. Given meteorological conditions at the site, the plume is anticipated to disperse droplets in an easterly –

¹ Remote sensing is defined as the acquisition and measurement of data by a device that is not in physical contact with the item under surveillance.

northeasterly direction up to a maximum of approximately 5 kilometers (3 miles). Monthly average weather patterns that could affect the dispersion direction of the plume were entered into the PEGEM model, and two different sets of predictions were calculated for the months of June and July. Within a worst-case scenario, the total land area exposed to TBP droplet dispersion at deposition levels greater than 1 milligram per square meter (2.92×10^{-5} ounces per square yard) would be 0.9 square kilometers (0.3 square miles) in either June or July. Coverage of 6.4 square kilometers (2.5 square miles) in July and 8.4 square kilometers (3.2 square miles) in June could occur for levels as low as 0.1 milligram per square meter (2.92×10^{-6} ounces per square yard). No depositions greater than 100 milligrams per square meter (2.92×10^{-3} ounces per square yard) would occur beyond 1 kilometer (0.6 miles) from the gun mount.

A suite of remote sensing instruments operated by the U.S. Air Force Research Laboratory would be employed at the 3K North test site to monitor firing of the vertical gun, the TBP aerosol debris cloud that would form upon rupture of the launched canister, and the resulting TBP droplet debris fallout, including droplet formation, size, and spatial distribution. MDA's proposed test plan includes the use of remote sensing applications that include lidar and radar.

Alternatives Considered

While other alternatives to the Proposed Action were initially considered during formulation of the test plan, these alternatives were considered infeasible because they would not adequately meet MDA's objective to determine drop size distribution for a simulated chemical agent threat. The use of simulants other than TBP was considered, specifically the use of Bis (2-ethylhexyl) phosphonate and triethyl phosphate. Using either of these two substances would not achieve the test objectives of realistically simulating the threat. In addition, although parathion and malathion would realistically emulate the threat, they were eliminated from further consideration because of their high toxicity.

The High Performance Magazine site at EMRTC was considered as an alternate site for the proposed tests. The High Performance Magazine site is located at a relatively high altitude. This altitude, in conjunction with fewer mountains surrounding the site results in increased wind velocities. Thus, conducting the proposed vertical tests at the High Performance Magazine site would result in the potential for TBP to be dispersed over a greater land mass area, and to reach a greater height in the atmosphere than test planning intended. Therefore, the High Performance Magazine site was dismissed from further evaluation.

Methodology

Thirteen resource areas were considered to provide a context for understanding the potential effects of the proposed action and to provide a basis for assessing the severity of potential impacts, with attention focused on key issues. The resource areas considered included: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, health and safety, land use, noise, socioeconomics and environmental justice, transportation and infrastructure, visual resources, and water resources.

For each resource area discussed in this EA the Region of Influence was determined. The Region of Influence describes a unique region for each resource area that represents the area with the potential to be affected by the proposed action. The environmental consequences associated with the proposed action and no action alternatives were analyzed for each Region of Influence within the context of resource areas.

Summary of Environmental Impacts from Proposed Action

This section summarizes the conclusions of the analyses based on the application of the described methodology. This section also discusses cumulative impacts. According to 40 CFR § 1508.7, cumulative impacts can be defined as "...the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

For this analysis, cumulative impacts include impacts from the proposed tests and reasonably foreseeable tests at EMRTC. A summary of potential environmental effects and cumulative impacts from the proposed tests is included in Exhibit ES-1.

Summary of Environmental Impacts from No Action Alternative

Under the no action alternative, the proposed tests using TBP would not occur from the 3K North site. Other unrelated tests at EMRTC would continue to occur and would have the potential to impact the environment. A summary of potential environmental effects from the no action alternative is included in Exhibit ES-2.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action

Resource Area	Proposed Action	Cumulative Impacts
Air Quality	Construction activities and equipment, gun propellant, and generators would produce emissions; however, no significant impacts would be expected. PBMA and dye are inert; therefore, no significant air quality impacts would be expected. Given the rapid dispersion of the droplets and the facility's remote location, no long-term significant air quality impacts would be expected. In a failed test, the canister would fall and rupture upon impact with the ground. The primary impact would be to soils, and there would be no significant air quality impacts.	No exceedances of air quality or health-based standards of non-criteria pollutants would be anticipated. TBP would photodegrade and decompose, and any test-related emissions would be dispersed. No cumulative air quality impacts would be expected.
Airspace	Airspace above 2,438 meters (8,000 feet) would not be affected. Notices to Airmen would be issued prior to the proposed tests, and no Restricted Areas or Military Operating Areas would be affected. If the canister fails to rupture, it would reach its maximum ascent altitude.	Notices to Airmen would be issued and air traffic would be temporarily rerouted. Because the proposed tests would be limited, short-term events, no cumulative impacts to airspace would be expected.
Biological Resources	Noise would not likely elicit startle responses in wildlife. PEGEM indicates TBP concentrations would not approach toxic levels for birds. Use of spill prevention measures would reduce or eliminate potential impacts to biological resources. There would be no effects to endangered, threatened, or proposed species, or designated or proposed critical habitat.	Given the facility's size and location, it is unlikely that operational activities would affect regional diversity of animal and plant species or their habitat. Cumulative biological impacts would not be anticipated when considering the proposed tests in conjunction with other current facility operations.
Cultural Resources	No known archaeological resources are located at the 3K North site. In a failed test scenario or a spill, TBP would have the potential to impact cultural resources in the area of impact. However, TBP release would be within the 3K North site where no cultural resources are known to exist. Therefore, no impacts would be expected.	Known archaeological sites would be avoided. No cumulative impacts would be expected from the proposed tests or reasonably foreseeable test related activities at EMRTC.
Geology and Soils	TBP droplets would photodegrade within a few hours when exposed to sunlight. The dye would also break down rapidly; however, some dye may be visible for up to a few months. If TBP were deposited in one spot (due to a spill or failed test), clean up would be conducted using existing procedures. Therefore, no significant impact would be expected.	Given that soils at the site are previously disturbed and no invasive ground disturbing activities are associated with the proposed action, no cumulative impacts would be anticipated.
Hazardous Materials and Waste	Hazardous materials and hazardous debris protocols would be followed during tests and during failed tests or spills. Because Material Safety Data Sheet safety guidelines, handling, storage, spill prevention, and transportation protocols would be followed, no significant hazardous materials impacts would be expected. The use of explosives and	No cumulative impacts would be expected as EMRTC handles, stores, transports, and disposes of all hazardous materials and hazardous wastes in accordance with applicable Federal, State, and local regulations.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action

Resource Area	Proposed Action	Cumulative Impacts
	generators would be consistent with standard operations. Therefore, no significant impacts would be expected from explosives or generators.	
Health and Safety	Personnel would be located in bunkers 1,500 meters (1,650 yards) from the gun. Gates would prevent unauthorized personnel from entering the site. In a test-failure, staff would follow health and safety protocols. Therefore, no significant impacts would be expected.	Existing procedures for health and safety, procedures developed specifically for loading and operating the gun would mitigate the potential for adverse effects. No cumulative health and safety impacts would be expected.
Land Use	No changes to land use patterns would occur. The remote location and designated land use of the facility accommodates test-failures and inadvertent spills. Therefore, no significant impacts would be expected.	No cumulative impacts would be expected at EMRTC, NMT, or Socorro.
Noise	Noise from generators would not be heard in Socorro. The primary noise would be from firing the gun, the noise would be similar to jet flyovers. Socorro would be buffered from noise by the mountains and would not be affected. A test failure would not alter noise levels. Therefore, no significant noise impacts would be expected.	While the proposed tests would result in temporary noise effects, no long-term or cumulative impacts would be expected.
Socioeconomics	Economic benefits to the community would not be significant; however, test related activities would provide short-term financial benefits. There are no disproportionately low-income or minority populations adjacent to the site. Therefore, no adverse impacts would be expected.	No cumulative socioeconomic or environmental justice impacts would be expected.
Transportation and Infrastructure	Demand placed on transportation network, electricity, water supplies, and wastewater and solid waste disposal services from additional personnel for a period of roughly two weeks would be minimal.	No cumulative transportation or infrastructure impacts would be expected.
Visual Resources	Because of the mountains it is unlikely that the TBP plume would be visible from Socorro. A test-failure could temporarily affect visual resources. However, impacts would be consistent with intended operations and therefore, no significant impacts would be expected.	A maximum of six test events would occur, each test event would produce a short-lived visual cloud; therefore, no cumulative impacts would be expected. The proposed tests in conjunction with other reasonably foreseeable tests would have no significant impacts.
Water Resources	PEGEM indicates TBP concentrations at a spring would be 1 to 10 milligrams per square meter, which would be unlikely to significantly impact water quality. Given the amount of TBP and its likelihood to photodegrade in sunlight, no significant impacts would be expected. In a test failure or spill, TBP would impact soils; however, because of spill prevention and cleanup protocols, soil impermeability, and the depth to ground water, no significant ground water impacts would be expected.	Because only six test events would occur, no cumulative impacts would be expected.

Exhibit ES-2. Summary of Environmental Impacts from No Action Alternative

Resource Area	No Action Alternative
Air Quality	There would be no impacts from the proposed tests using TBP. Socorro County is in attainment for criteria pollutants; however, testing activities at the facility would release of NO _x , particulate matter, and other emissions from mobile sources, explosives, and munitions testing at EMRTC.
Airspace	No Notices to Airmen associated with the proposed tests would be required. Other tests at EMRTC may impact airspace.
Biological Resources	No proposed vertical launch tests using TBP at the 3K North site would occur. Consequently, no biological resource impacts would be expected.
Cultural Resources	No proposed vertical launch tests using TBP at the 3K North site would occur, and no cultural resource impacts would be expected. Testing at EMRTC would continue.
Geology and Soils	Potential impacts to geology and soils related to the proposed tests would not occur.
Hazardous Materials and Waste	Hazardous materials and waste associated with the proposed tests would not be produced. However, hazardous materials and waste associated with explosives, munitions, and artillery testing would continue at the facility.
Health and Safety	There would be no tests using TBP and therefore, no impacts to health and safety would occur. Without data obtained from the tests using TBP as a threat simulant, MDA's ability to verify data would not be enhanced, and MDA would be forced to rely on data produced from computer-based simulation rather than field-tested observations.
Land Use	Current land use patterns at NMT, EMRTC, and Socorro, would continue and no impacts would be expected.
Noise	Noise associated with the proposed tests would not occur. However, noises associated with other testing would continue at the facility.
Socioeconomics	Revenue generated by activities at EMRTC supply income for Socorro. Hotels and restaurants benefit from people visiting the facility. The no action alternative would not affect employment but it may place limitations on the test capabilities of EMRTC. This could result in adverse economic effects for Socorro. Under the no action alternative there would be no Federal action and therefore, no compliance with Executive Order 12898 would be considered.
Transportation and Infrastructure	There would be no transportation and infrastructure impacts under the no action alternative.
Visual Resources	Under the no action alternative, no impacts from the proposed tests would occur. However, other testing would continue at EMRTC and may produce smoke or other events that may be visible to the community of Socorro.
Water Resources	No water resource impacts from using TBP would occur. Other testing activities at EMRTC would continue and could have impacts on water resources.

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ACRONYMS AND ABBREVIATIONS

AFCPR	Air Force Cloud Profiling Radar
AFRL	Air Force Research Laboratory
ARTCC	Air Route Traffic Control Center
BLM	Bureau of Land Management
C	Celsius
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CLM	Core Lethality Model
CWA	Clean Water Act
dB	Decibel
dBA	A-Weighted Decibel
DoD	Department of Defense
DOE	Department of Energy
EA	Environmental Assessment
EMRTC	Energetic Materials Research Testing Center
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
HAP	Hazardous Air Pollutants
HPAC	Hazard Prediction and Assessment Capability
IDMP	Intercept Debris Measurement Program
IFR	Instrument Flight Rules
LD	Lethal Dose
MAPM	Mobile Atmospheric Pollutant Mapper
MLT	Mobile Lidar Trailer
MDA	Missile Defense Agency
MOA	Military Operations Area
MSL	Mean Sea Level
MSDS	Material Safety Data Sheet
MTR	Military Training Route
µg/m ³	Micrograms per cubic meter
N ₂	Elemental Nitrogen
NAAQS	National Ambient Air Quality Standards
Nd:YAG	Neodymium: Yttrium Aluminum Garnet
NEPA	National Environmental Policy Act
NMT	New Mexico Institute of Mining and Technology
NMED	New Mexico Environment Department

NO _x	Nitrogen Oxides
NO ₂	Nitrogen Dioxide
NOTAM	Notice to Airmen
NPS	National Park Service
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
Pb	Lead
PBMA	Polybutyl methacrylate
PEGEM	Post-Engagement Ground Effects Model
%	Percent
PM _{2.5}	Particulate Matter 2.5 microns or Less in Diameter
PM ₁₀	Particulate Matter With a Diameter Less Than 10 microns
ppm	Parts per Million
RCRA	Resource Conservation and Recovery Act
ROI	Region of Influence
SHPO	State Historical Preservation Officer
SO _x	Sulfur Oxides
SO ₂	Sulfur Dioxides
SOP	Standard Operating Procedure
TBP	Tributyl Phosphate
TEP	Triethyl Phosphate
UMass	University of Massachusetts
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
VFR	Visual Flight Rule
VOC	Volatile Organic Compounds
VX	O-ethyl-S-(2-diisopropylaminoethyl) methylphosphonothiolate
WSMR	White Sands Missile Range

1. PURPOSE AND NEED

1.1 Background

The National Environmental Policy Act (NEPA) of 1969, as amended; the Council on Environmental Quality regulations which implement NEPA (Code of Federal Regulations [CFR], Title 40, Parts 1500-1508); Department of Defense (DoD) Instruction 4715.9 Environmental Planning and Analysis; and applicable service environmental regulations that implement these laws and regulations direct DoD lead agency officials to consider potential environmental impacts and consequences when authorizing or approving Federal actions.

The Missile Defense Agency (MDA) prepared this Environmental Assessment (EA) to evaluate the potential environmental consequences of using thickened tributyl phosphate (TBP) as a chemical agent simulant of the threat nerve agent O-ethyl-S-(2-diisopropylaminoethyl) methylphosphonothiolate (VX) in a maximum of six vertical gun experiments to be conducted at the Energetic Materials Research and Testing Center (EMRTC) at the New Mexico Institute of Mining and Technology (NMT), located near Socorro, New Mexico. Canisters containing dye enhanced, thickened TBP would be launched vertically at speeds approaching Mach 3 or 4 from the 3K North site and dispersed so MDA can determine drop size distribution for a simulated chemical agent threat. Aerosol and droplet debris would be primarily monitored by using sensors. Approximately 12 witness cards designed to receive the dye enhanced TBP would also be placed on the ground one to two hours prior to the test, with their location determined by modeling based on the current prevailing wind conditions. The witness cards would each be approximately 30 by 36 centimeters (12 by 14 inches). Each card would be examined after a test and disposed of according to applicable requirements. The TBP launch experiments would improve MDA's ability to evaluate ground hazards from the intercept of a threat warhead bearing chemical payloads.

The EA and Draft Finding of No Significant Impact were released for public review and comment. The MDA established a toll free fax line, e-mail address, and U.S. postal service mailbox to receive comments. During the public review period, the MDA received three comments. Two of the comments were determined to be outside of the scope of this project and one comment requested additional information about the availability of the documents from the MDA web site. None of the comments resulted in revisions to the EA or Finding of No Significant Impact.

1.2 Purpose

Droplet size distribution has been identified by MDA as the most important factor in determining ground hazard estimations from chemical payloads. Therefore, the purpose of the proposed action is to provide MDA with test scenarios where the drop size and dispersion of simulated threat agents can be monitored, and thus enhance MDA's ground hazard estimation modeling capability. The data collected from these tests would be used to validate MDA's Post-Engagement Ground Effects Model (PEGEM).

1.3 Need

Using TBP as a simulant would allow MDA to characterize the size, velocity, and spatial dispersion of threat agents. While tests have been conducted at various sites by MDA using water, triethyl phosphate (TEP) and TBP as simulants, no tests have been conducted with vertically launched TBP at the EMRTC facility. Similar experiments using TBP were conducted using an elevated horizontally positioned gun. Conducting vertical launch tests would fulfill MDA's need to more realistically simulate the impact of the dispersion of a threat agent resulting from a boost phase intercept and validate PEGEM.

1.4 Scope of Analysis

This EA describes the use of TBP as a threat agent simulant in a maximum of six vertical gun launch tests that have been proposed to be conducted at the EMRTC 3K North test site. This EA characterizes the surrounding environment and evaluates the potential environmental impacts that could result from the proposed action. This EA also considers the use of sensors to collect data regarding drop size and dispersion of the simulated threat agent. The EA addresses the potential impacts of the use of

- Vertical guns at the 3K North site,
- TBP in aerial dispersion tests, and
- Sensors to collect data.

1.5 Relevant Environmental Documentation

The NEPA analyses identified below have been incorporated by reference and impact determinations have been summarized, as appropriate in this document.

- *Theater High Altitude Area Defense Pacific Test Flights Environmental Assessment*, December 2002, analyzed the testing of Terminal High Altitude Area Defense missiles at the Pacific Missile Range Facility, Hawaii. Some of the tests were proposed to be conducted to evaluate the effectiveness of the

missiles against target missiles with simulant payloads. The simulant proposed to be used was TBP.

- *Theater Missile Defense Lethality Programmatic Environmental Assessment*, April 1993, analyzed the reaction of simulants in indoor and outdoor exercises to simulate theater missile defense engagements. One of the testing facilities covered in this assessment was NMT.
- The use of TBP in the *Intercept Debris Measurement Program (IDMP) at White Sands Missile Range (WSMR) Draft Environmental Assessment*, November 2003, analyzed the effects of TBP in the payloads of intercepted missiles over WSMR.

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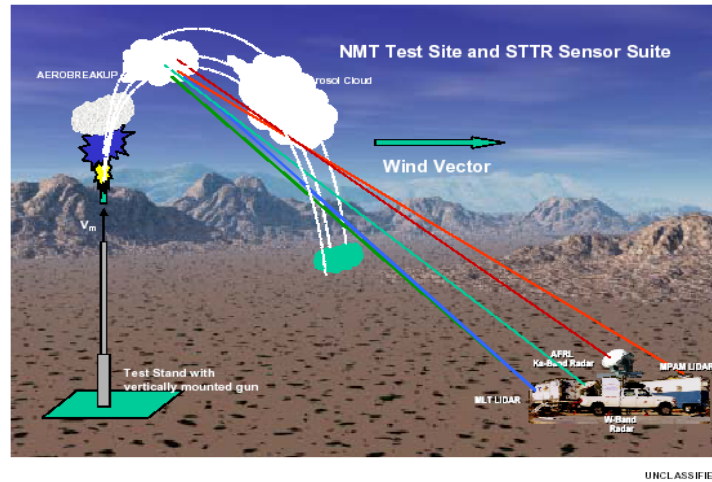
2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

MDA proposes to conduct up to six vertical gun tests within a two-week period during June or July at the NMT 3K North site. Canisters containing TBP, a simulant capable of mimicking a chemical weapon payload, would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and any rain deposited on the ground would quickly evaporate which would meet the test designers objectives of preventing the TBP from dispersing over a wide area and allow TBP deposited on dry ground to rapidly photodegrade. The canisters would contain approximately 50 kilograms (110 pounds) of thickened TBP enhanced with blue dye for observation purposes. The canisters would be vertically launched at speeds approaching Mach 3 or Mach 4 (1 to 1.3 kilometers per second). A small amount of explosives would be used to rupture the canister tanks during ascent at an altitude of approximately 500 meters (1,640 feet), resulting in the creation of a brief aerosol debris cloud and the subsequent dispersion of TBP droplets. TBP droplets would be monitored using several methods. High-speed cameras placed at different locations at the test site would provide a visual documentary. Doppler radar would be used to monitor velocity of the canister during the tests. Lidar would be used to characterize the drop formation process, with Ka-Band radar and W-Band radar used to monitor drop size. Remote sensing would be used to monitor the TBP cloud.² Witness cards designed to receive the dye enhanced TBP would also be placed on the ground approximately one to two hours prior to the test, with their location determined by monitoring based on the current prevailing wind conditions. Exhibit 2-1 shows the proposed test scenario.

² Remote sensing is defined as the acquisition and measurement of data by a device that is not in physical contact with the item under surveillance.

Exhibit 2-1. Proposed Test Scenario



Source: Richardson, 2004.

2.1.1 New Mexico Tech Test Range

NMT is located near Socorro, New Mexico, approximately 120 kilometers (75 miles) south of Albuquerque. NMT's EMRTC is located in the mountains adjacent to NMT, and has more than 30 test facilities located on a 104 square kilometer (40 square mile) field research complex (see Exhibit 2-2). EMRTC performs 200 to 300 field tests per year for clients such as DoD, U.S. Environmental Protection Agency (EPA), and Lockheed-Martin Corporation. EMRTC's location in the mountains allows for natural containment and shielding of tests performed at the facility given topographic and climatic conditions. See Exhibit 2-3. Due to the semi-arid climate there are few inclement weather days at the facility.

Exhibit 2-2. Location of EMRTC Facilities

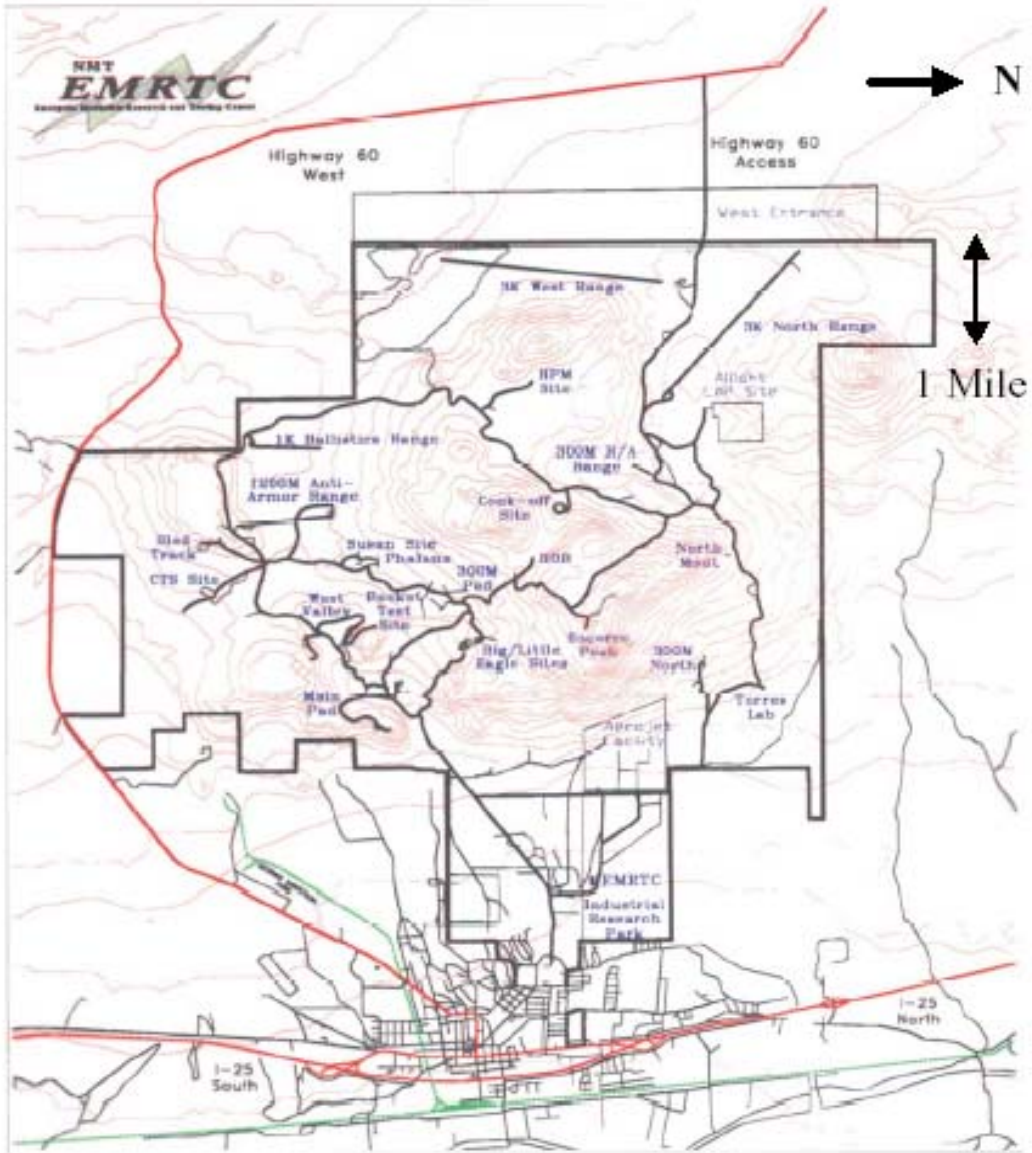
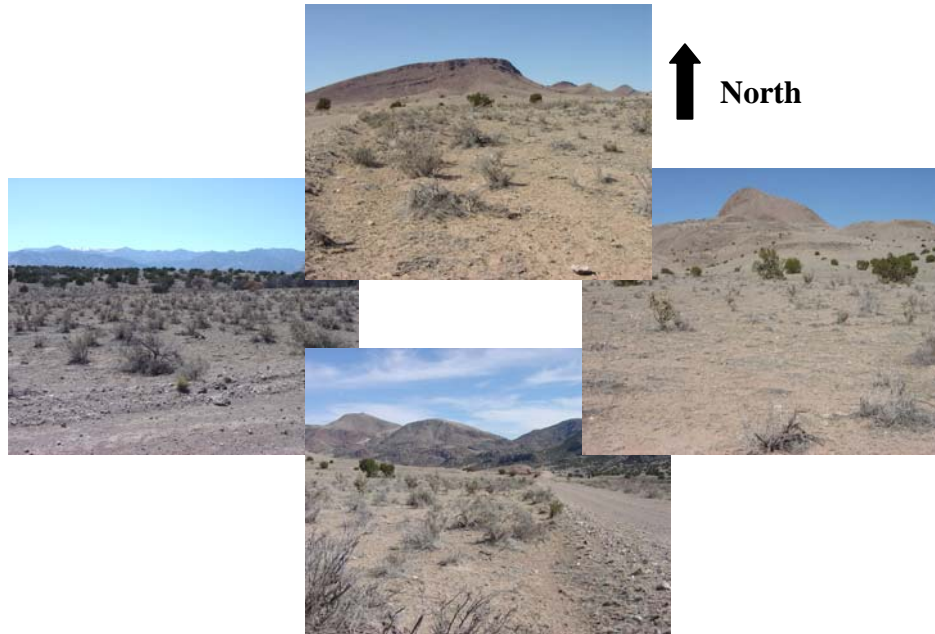


Exhibit 2-3. View from the 3K North Test Site

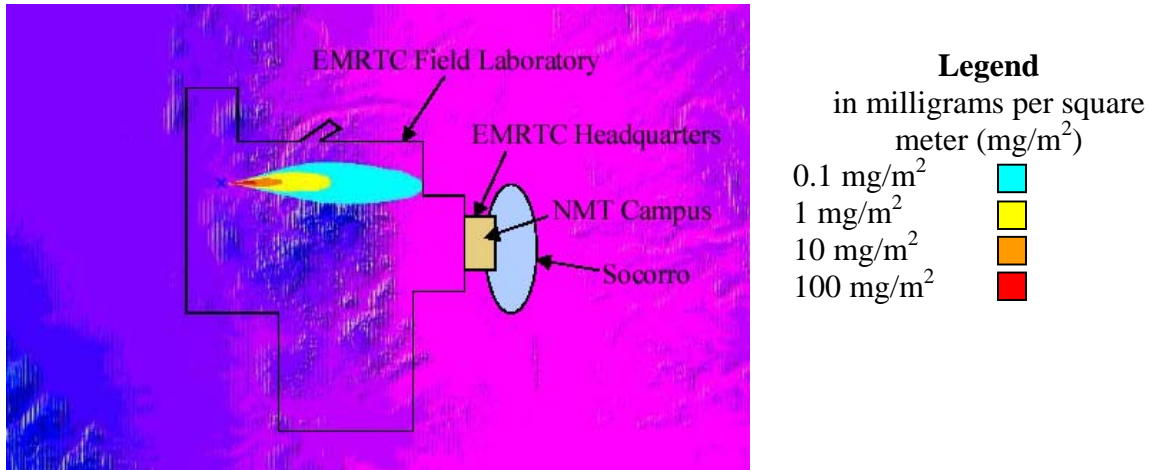


The facility has permits to conduct tests using high explosives, flash munitions, and conventional and hypervelocity gun systems. The gun facilities allow EMRTC to perform warhead characterization tests, and fragment or debris distribution studies. The facility is able to modify its gun systems to meet ballistic experiment requirements. EMRTC has data collection and processing systems that can be used to analyze test results. The facility also has heavy equipment that allows for rapid preparation and restoration of test sites. EMRTC has established programs for handling, storing, and using hazardous materials. Regular inspections are performed to comply with Occupational Safety and Health Administration (OSHA), New Mexico Environmental Department, Bureau of Alcohol, Tobacco, and Firearms, U.S. Navy, U.S. Army, and Defense Contract Management Office regulations. Controls have been established to protect personnel and the environment while conducting tests using hazardous materials.

2.1.2 Vertical Launch Test Conditions

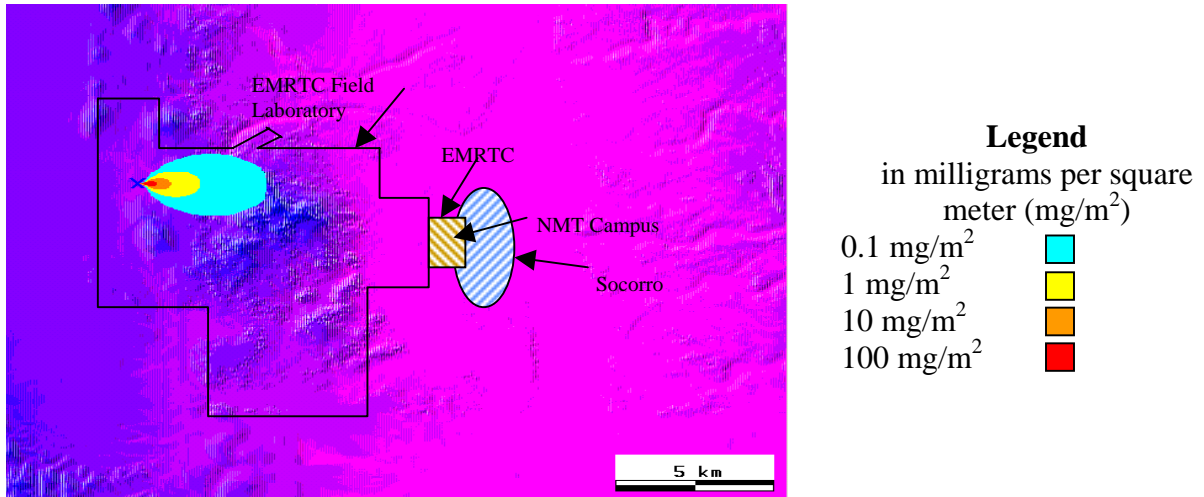
The test planners have determined that weather related criteria would be established to determine Go/No-Go test conditions. The test planners determined a worst-case scenario based on PEGEM. The model predicted when winds from the west (blowing between 270 to 315 degrees) were less than or equal to 13 kilometers per hour (8 miles per hour), the test objectives could not be met and the tests would not be conducted. The graphical depiction of this scenario is presented in Exhibit 2-4.

Exhibit 2-4. PEGEM Results for Worst-Case Scenario



Test planners indicated that given normal meteorological conditions the proposed tests would be conducted only when winds are less than 4.83 kilometers per hour (3 miles per hour) as seen in Exhibit 2-5. At this wind speed, TBP dispersion is anticipated to remain within the immediate vicinity of the 3K North site.

Exhibit 2-5. PEGEM Results for Realistic Scenario



2.1.3 Vertical Gun Description

The gun proposed for use in the vertical launches is a new design, which is based on the recoilless concept of the Davis Gun. The gun's recoilless design is achieved by locating the firing mechanism at the mid-point of the gun's barrel. (Richardson, pers. comm.) Recoil from the canister leaving the gun is counterbalanced by allowing high velocity gas to escape from the opposite end of the gun at the same time the projectile is discharged. This design eliminates large shocks that would occur if the firing mechanism were placed at the end of the gun.

The vertical launch gun would be portable and fired from an outdoor test site. Firing of the vertical gun and handling of the canister containing thickened TBP would be overseen by EMRTC. All guns at EMRTC are remotely fired from permanent personnel shelters. (U.S. Army Space and Strategic Defense Command, 1993) These shelters hold a maximum of eight personnel and are reinforced with concrete or earthen fill. They are usually out of the line of sight of the test, and viewing is done using non-direct observation methods. (U.S. Army Space and Strategic Defense Command, 1993) The canisters would be launched from the gun at a speed of one kilometer per second (0.6 miles per second). This equates to approximately Mach 3 or 4. (Richardson, 2004)

2.1.4 TBP Simulant Description

Each of the six proposed tests would use approximately 50 kilograms (110 pounds) of thickened TBP, containing a blue dye. The thickener added to the TBP would be polybutyl methacrylate (PBMA). The PBMA would constitute three percent by weight of simulant. The blue dye and PBMA are inert substances. The properties of TBP are provided in Exhibit 2-6.

Exhibit 2-6. Properties of TBP

<i>Physical Description</i>	Odorless, colorless liquid, non-explosive, non-flammable, stable under normal temperatures and pressures
<i>Relative Molecular Mass</i>	266.3
<i>Solubility in water at 50°Celsius (C) (122°Fahrenheit [F])</i>	2.85×10^{-4} milligrams per liter (9.41×10^{-9} ounces per quart)
<i>Melting Point</i>	-80°C (-112°F)
<i>Boiling Point</i>	289°C (552°F)
<i>Decomposition (Time)</i>	Approximately 50 minutes during previous horizontal launch tests at EMRTC (Alexander, Pers. comm.)
<i>Decomposition (Thermal)</i>	Reported to decompose at temperatures below its boiling point at the weak carbon-oxygen bond. This break is due to thermal instability at the bond, and the break results in butane and phosphoric acid products. (Bruneau et al., 1981)
<i>Hydrolysis</i>	Thought to decompose readily in water because it is similar to trimethyl phosphate, which has been shown to break down in water, regardless of pH.
<i>Biodegradation</i>	Ranges from moderate to slow depending on the ratio of TBP to active biomass, and produces orthophosphate and n-butanol (which will degrade further). (Pickard et al., 1975)

TBP has varied industrial uses that include functioning as a solvent for cellulose esters, lacquers, natural gums, and ore extraction; as a primary plasticizer in the manufacturing of plastics and vinyl resins; as an antifoaming agent in paper and textile production; and as a flame retardant in aircraft hydraulic fluid. (Sandmeyer and Kirwin, 1981; Windholz, 1983; U.S. EPA, 1985) TBP has also been used increasingly as an extractant in the dissolution process in conventional nuclear fuel reprocessing. (Parker, 1980; Laham et al., 1984; Shultz et al., 1984) TBP is sometimes used in desiccant defoliants. (Nakamura, 1991) TBP is found in the air, water, sediment, and aquatic organisms, but previous environmental samples have shown low levels of the chemical. Studies suggest that most TBP in the environment is found in sediments, though there are no data on its transport to ground water. (Nakamura, 1991)

The International Programme on Chemical Safety (Nakamura, 1991) provides a summary of the toxicology data for TBP. TBP is listed as an eye, skin, and respiratory irritant, and may also cause headaches and nausea. Metabolism studies suggest that the chemical is broken down by oxidation reactions, and is then excreted as N-acetyl cysteine derivatives, primarily through urination. (Suzuki et al., 1984a,b) When considering toxicity, the average daily intake of TBP for the U.S. population was determined by the U.S. Food and Drug Administration to be 38.9, 27.7, and 2.7 to 6.2 nanograms per kilogram (6.19×10^{-10} , 4.41×10^{-10} , and 4.30×10^{-11} to 9.86×10^{-11} ounces per pound) in bodyweight for infants, toddlers, and adults, respectively. *In vitro* human studies have shown slight inhibition of plasma cholinesterase, which could impair normal nerve signal conduction. (Sabine and Hayes, 1952) TBP has been shown to irritate skin and mucous membranes of humans due to its high capacity for skin penetration.

The general industry airborne permissible exposure limit-time weighted average set by OSHA for TBP is 5.0 milligrams per cubic meter (1.35×10^{-4} ounces per cubic yard) over an 8-hour time period during a 40-hour workweek. Toxicology data include

- Oral LD₅₀ (the oral dose at which 50 percent of the test population die) in mice of 900 to 1,240 milligrams per kilogram (0.014 to 0.020 ounces per pound) and
- Dermal LD₅₀ (the skin exposure dose at which 50 percent of the test population die) in rabbits of 3,100 to 10,000 milligrams per kilogram (0.049 to 0.16 ounces per pound).

Subchronic studies have reported TBP dose-dependant decreases of bodyweight gain as well as increases in liver, kidney, and testis weights. These subchronic studies suggest that kidneys are target organs of TBP.

At high concentrations, TBP has been reported to be teratogenic (i.e., causing abnormalities in embryos or fetuses that lead to birth defects). Mutagenicity studies, which are conducted to determine a compound's potential to mutate genes, have been conducted for TBP. These studies for TBP have produced negative results in bacterial tests and in a lethal recessive mutation test with *Drosophila melanogaster* (fruit fly).³ A dosing regimen of 0.42 milliliter per kilogram per day (5.73×10^{-3} fluid ounces per pound per day) for 14 days indicated that TBP has a neurotoxic effect on the peripheral nervous system, which led to a reduction in caudal nerve conduction velocity.⁴ (Laham et al., 1983) There are currently inadequate data to determine the carcinogenic potential of TBP, and no studies have been conducted on reproductive effects.

2.1.5 Dispersion Monitoring Description

Studies regarding proposed TBP dispersion monitoring and preliminary ground deposit calculations are presented by MDA in the *White Paper – Ground Deposition Predictions from a Release of Thickened Tributyl Phosphate at ½ km Above Ground Level Over the NMT 3K North Site* (see Appendix A). A preliminary ground deposition calculation was performed using PEGEM version 5.1, employing the Defense Threat Reduction Agency's Hazard Prediction and Assessment Capability (HPAC) transport and dispersion model. PEGEM was developed by the MDA as a Core Lethality Model (CLM). CLMs are predictive computer models that assess missile intercepts from the intercept to collateral and ground effects. PEGEM can be used to predict the ground effects of chemical weapons in bulk, canister, or bomblet submunition payloads in intercepted or functioning missiles.

PEGEM not only has internally developed modules, but also interfaces with external codes like HPAC. HPAC is a predictive system that assesses downwind hazard areas of events such as a chemical weapon strike. The system predicts the effects of releases of hazardous material into the atmosphere through integrated source terms, high-resolution weather forecasts and particulate transport analyses.

Based upon the PEGEM model assumptions for the proposed tests, a localized plume of TBP is predicted to form at the 3K North test site immediately following discharge of the canister. Given meteorological conditions at the site, the plume is anticipated to disperse droplets in an easterly – northeasterly direction up to a maximum distance of approximately 5 kilometers (3 miles). Monthly average weather patterns that could affect the dispersion direction of the plume were

³ A lethal recessive mutation test determines when an individual exposed to the test substance would produce a recessive mutation that results in death.

⁴ Caudal nerve conduction velocity refers to the speed at which an electrical impulse travels through the caudal nerve.

entered into the PEGEM model, and two different sets of predictions were calculated for the months of June and July. The total land area exposed to TBP droplet dispersion at deposition levels greater than 1 milligram per square meter (2.92×10^{-5} ounces per square yard) would be 0.9 square kilometers (0.3 square miles) in either June or July. Coverage of 6.4 square kilometers (2.5 square miles) in July and 8.4 square kilometers (3.2 square miles) in June could occur for deposition levels as low as 0.1 milligram per square meter (2.92×10^{-6} ounces per square yard). No depositions greater than 100 milligrams per square meter (2.92×10^{-3} ounces per square yard) would occur beyond 1 kilometer (0.6 miles) from the gun mount.

2.1.6 Sensor Monitoring Description

A suite of remote sensing instruments would be provided by the U.S. Air Force Research Laboratory (AFRL), Space Vehicles Directorate, Battlespace Environment Division, Hanscom Air Force Base, Massachusetts. These sensors are existing assets. The sensors would be employed at the 3K North test site to monitor firing of the vertical gun, the TBP aerosol debris cloud that would form upon rupture of the launched canister, and the resulting TBP droplet debris fallout, including droplet formation, size, and spatial distribution. MDA's proposed test plan includes the use of a remote sensing suite that includes lidar and radar. All appropriate requirements related to radiofrequency, electromagnetic radiation, and electromagnetic interference would be followed.

Mobile Lidar Trailer (MLT). The AFRL's MLT containing a Neodymium: Yttrium Aluminum Garnet (Nd:YAG) lidar would be used to support tests (see Exhibit 2-7). By operating at three different wavelengths, the Nd:YAG lidar can infer particle or droplet density and size observed during the test launch. Because of its sensitivity, the lidar signal can detect aerosol layers and direct other ground-based and airborne sensors even when the TBP plume is no longer visible. The MLT instrumentation requires 100-amp, 208 volt three phase power. Its only operational consumable is 38.5 liters (10 gallons) of distilled water. The MLT is not an eye-safe lidar, and therefore only operates at altitudes specified by range safety specifications.

Exhibit 2-7. MLT Exterior



Mobile Atmospheric Pollutant Mapper (MAPM). The AFRL's MAPM carbon dioxide (CO₂) lidar is a mobile system that uses a precision full hemispherical scanner (see Exhibit 2-8). MAPM CO₂ lidar can measure wind speed and direction to assist in aerosol cloud movement predictions. Power requirements for this lidar are 100-amp, 208 volt three phase, and consumables include nitrogen, helium and CO₂ gases, 60 liters (15.6 gallons) of ultrahigh purity liquid nitrogen and 77 liters (20 gallons) of distilled water. The lidar's operating wavelength and transmitted beam size make it eye-safe at the exit aperture.

Exhibit 2-8. MAPM



U.S. Air Force Cloud Profiling Radar (AFCPR). The AFCPR is a Ka-Band short wavelength Doppler radar designed to measure the microphysical properties of clouds. This radar is compact and mobile, and can be operated from either a fixed vertical pointing mode, or mounted on a positioner for spatial scanning (see Exhibit 2-9). The radar transmitter uses a Klystron amplifier capable of producing 2-kilowatt peak transmitter power. The AFCPR Ka-Band radar can infer the characteristics of clouds and large atmospheric aerosols by measuring features such as internal structure, geometric thickness, particle asymmetry, orientation, and relative motion. The AFCPR radar operates in two range modes, either

transmitting a chirp waveform or a conventional pulse. For either mode, the range resolution for the radar is 75 meters (246 feet). Given its wavelength, the AFCPR is most sensitive to the largest particles in a cloud. It has the capacity to detect densities above 10^{-6} per cubic meter (7.69×10^{-7} per cubic yard) for 10-millimeter (0.4 inch) particles. The AFCPR is less sensitive to 100 micrometer (4.0×10^{-3} inch) particles, but can still detect densities above 10,000 per cubic meter (7,692 per cubic yard).

Exhibit 2-9. U.S. Air Force Cloud Profiling Radar



W-Band Radar. The University of Massachusetts (UMass) W-Band Radar is not owned by AFRL, but has been used in previous military tests. It would be employed at the test site to track the TBP aerosol cloud. Designed by UMass to provide ground-based severe storm and tornado measurements, the radar is a truck mounted Doppler radar that is widely recognized for its tornado-chasing capabilities (see Exhibit 2-10). The receiver of the UMass radar has a noise figure of 13 decibels (dB), a bandwidth of 2 or 5 megahertz, and is capable of vertical or horizontal polarization. The radar receives its power from a 3,500-watt generator, and the average operational power is 15 watts.

Exhibit 2-10. UMass W-Band Radar



Additional monitoring methods would also be employed at the test site. PEGEM models would be run just prior to the proposed launch, and would factor in the current meteorological conditions. Based upon the model results, witness cards would be placed on the ground to capture dye enhanced drop distribution. Several high-speed cameras would be positioned at the test site to capture the launch sequence and provide imaging for post-test analyses.

2.2 Alternatives to the Proposed Action

While other alternatives to the proposed action were initially considered during formulation of the test plan, these alternatives were considered infeasible because they would not adequately meet MDA's objective, to determine drop size distribution for a simulated chemical agent threat. A discussion of the dismissed alternatives is presented in Section 2.4. Because there are no other practicable alternatives that would adequately allow MDA to estimate ground hazards, only the proposed action and the no action alternative have been carried forward for evaluation in this EA.

2.3 No Action Alternative

Under the no action alternative, the proposed tests with TBP would not be conducted. The chemical dispersion data would not be available and MDA's ability to realistically simulate the impacts of a threat agent would not be enhanced.

2.4 Alternatives Considered But Dismissed From Further Evaluation

Alternatives to the proposed action were considered and ultimately dismissed from detailed analysis because they did not meet the purpose and need of the proposed tests.

2.4.1 Use of Alternate Simulants

The use of simulants other than TBP that replicate the desired threat agent was considered, specifically the use of Bis (2-ethylhexyl) phosphonate and TEP. Bis (2-ethylhexyl) phosphonate cannot be thickened very effectively and thus would not demonstrate the proper viscosity and weight to emulate the threat agent VX. TEP has been used in earlier test events but it does not have the proper physical and viscoelastic properties to emulate the threat agent, and therefore would not be a good simulant to meet the objectives of these tests. Using either of these two substances would not achieve the test objectives of realistically simulating the threat. In addition, although parathion and malathion would realistically emulate the threat, they were eliminated from further consideration because of their high toxicity.

2.4.2 Use of an Alternate Site

The High Performance Magazine site at EMRTC was considered as an alternate site for the proposed tests. The site was originally constructed to support hazardous debris tests of explosive storage magazines. The site has been used for testing scale model aircraft shelters and other scaled structure experiments, and has more recently been used for horizontal gun launched TBP experiments. While the High Performance Magazine site is characteristic of the semi-arid, sparsely vegetated, and remote topography present at EMRTC, the site maintains a relatively high altitude. This altitude, in conjunction with fewer mountains surrounding the site result in increased wind velocities. Thus, conducting the proposed vertical tests at the High Performance Magazine site would result in the potential for TBP to be dispersed over a greater land mass area, and to reach a greater height in the atmosphere than test planning intended. Therefore, the High Performance Magazine site was dismissed from further evaluation.

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3. AFFECTED ENVIRONMENT

This section gives an overview of the affected environment and the resource areas that may be impacted. The affected environment is described succinctly to provide a context for understanding potential impacts. The level of detail provided for each resource area is commensurate with the potential for impact to that resource area.

Thirteen resource areas were considered to provide a context for understanding the potential effects of the proposed action and to provide a basis for assessing the severity of potential impacts, with attention focused on key issues. The resource areas considered include: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, health and safety, land use, noise, socioeconomics and environmental justice, transportation and infrastructure, visual resources, and water resources.

For each resource area discussed in this EA, the definition of the resource, Region of Influence (ROI), and existing environmental conditions are provided. The definition of the resource describes relevant laws and regulations that pertain to the resource area. The ROI describes a unique region for each resource area that represents the area with the potential to be affected by the proposed action. The existing conditions describe the environment within the ROI for each resource area discussed.

3.1 Air Quality

Definition of Resource. Air quality in a given location is usually measured in terms of the concentration of various air pollutants in the atmosphere. 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 primary air pollutants of concern fall into three categories.

- **Criteria Air Pollutants** are a group of seven pollutants identified in the Clean Air Act for which the EPA is required to establish allowable concentrations in ambient air: sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (including the compounds that contribute to its formation - volatile organic compounds [VOCs] and nitrogen oxides [NO_x]), particulate matter with a diameter less than 10 microns (PM₁₀), particulate matter 2.5 microns or less in diameter (PM_{2.5}), and lead (Pb). The EPA has established National Ambient Air Quality Standards (NAAQS) for these criteria air pollutants (see Exhibit 3-1). To further define local and regional air quality, EPA divided the country into areas that achieve the NAAQS, attainment areas, and those that do not achieve the NAAQS, nonattainment areas. Some areas

are unclassified because insufficient data are available to characterize them, while other areas are classified as maintenance areas, i.e., areas that are currently in compliance with the NAAQS but have held nonattainment status in the past.

- **Hazardous Air Pollutants (HAPs)** are a group of 188 chemicals identified in the Clean Air Act. (40 U.S.C. 7412(b)) Exposure to these pollutants has been shown to cause or contribute to cancer, birth defects, genetic damage, and other adverse health effects. Examples of HAPs include benzene, asbestos, and carbon tetrachloride.
- **Mobile source air toxics** are a group of 20 HAPs plus “diesel particulate matter and diesel exhaust organic gases,” which are complex mixtures that contain numerous HAPs.

New Mexico developed State ambient air quality standards for particulates (PM_{2.5} and PM₁₀), sulfur compounds (SO₂, hydrogen sulfide, and total reduced sulfur), CO, and NO₂ (see Exhibit 3-1). In addition, the State of New Mexico’s Regional Haze State Implementation Plan complies with the requirements of Title 40 CFR 51.309, known as the Regional Haze Rule. The Regional Haze Rule addresses impairment across large geographic areas that impacts visibility in mandatory Federal Class I areas, with a goal of returning visibility in Class I areas to natural conditions by the year 2064. Class I areas are designated as having special national or regional value from a natural, scenic, recreational, and/or historic perspective.

New Mexico established standards for Toxic Air Pollutants. Toxic Air Pollutants are chemicals that are generally found in trace amounts in the atmosphere, but that can result in chronic health effects or increase the risk of cancer when present in amounts that exceed established exposure limits. The Toxic Air Pollutants regulated by the New Mexico Environment Department (NMED) may be found in the New Mexico Administrative Code 20.2.72.402, available at the following Internet address, <http://www.nmcpr.state.nm.us/nmac/parts/title20/20.002.0072.htm>. The NMED applies guidelines for determining if a new or modified source emitting a Toxic Air Pollutant requires air quality permitting. (20.2.72.402 New Mexico Administrative Code)

Exhibit 3-1. Federal and New Mexico Air Quality Standards

Pollutant	Time Average	National Standard	New Mexico Standard
Ozone	8-hour average	0.08 parts per million (ppm)	None
	1-hour average	0.12 ppm	None
Carbon Monoxide	8-hour average	9.0 ppm	8.7 ppm
	1-hour average	35.0 ppm	13.1 ppm
Nitrogen Dioxide	Annual average	0.053 ppm	0.05 ppm
	24-hour average	None	0.10 ppm
Sulfur Dioxide	Annual average	0.03 ppm	0.02 ppm ⁽¹⁾
	24-hour average	0.14 ppm	0.10 ppm ⁽¹⁾
	3-hour average	0.5 ppm	None
Lead	Calendar quarter	1.5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)	None
PM ₁₀	Annual average	50 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ ⁽²⁾
	24-hour average	150 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$ ⁽²⁾
PM _{2.5}	Annual average	15 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ ⁽²⁾

Source: U.S. Army Space and Missile Defense Command, 2003

⁽¹⁾ New Mexico standard with the exception of the area within 5.6 kilometers (3.5 miles) of the Chino Mines Company

⁽²⁾ The maximum allowable concentrations of total suspended particulate in the ambient air

The primary sources of air pollutants include

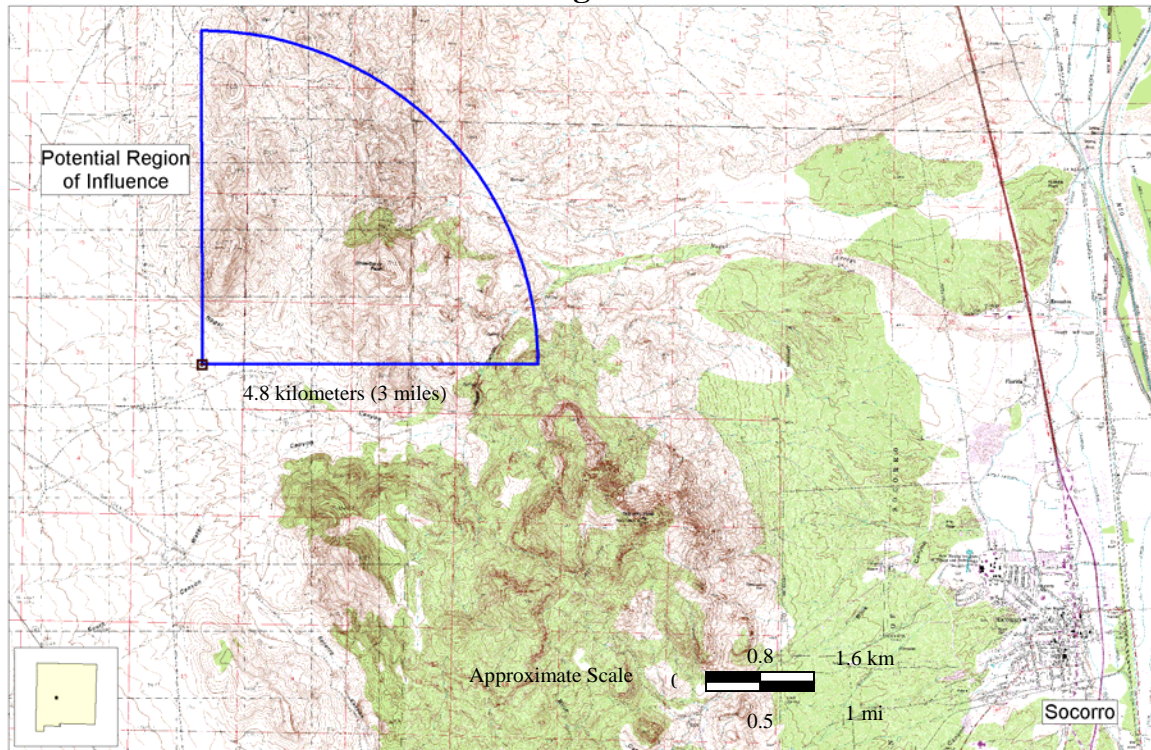
- Stationary sources - industrial facilities, refineries, power plants, launch pads;
- Area sources - a collective representation of sources not specifically identified;
- Mobile sources - motor vehicles, ships, aircraft, off-road engines, mobile platforms; and
- Biogenic (natural) sources - forest fires, volcanoes.

In some areas, background levels of air pollutants are relatively high due to air currents carrying pollution that was generated elsewhere into the area. An example of such secondary pollution would be ozone (i.e., smog) created when NO_x and VOCs react in the presence of sunlight. The NO_x and VOCs could be released into the atmosphere a long distance from where the ozone degrades the air quality.

Region of Influence. The ROI for Air Quality consists of the area where PEGEM modeling has predicted TBP droplets would be deposited during a test. PEGEM modeling shows the potential for the ROI to extend into off-site locations under

some test scenarios. The ROI would not include the Community of Socorro because tests would not be conducted when conditions indicate the potential for TBP droplets to be deposited in the Community of Socorro. The ROI for any one test would be significantly smaller than the area indicated on Exhibit 3-2.

Exhibit 3-2. Region of Influence



Existing Conditions. The climate for EMRTC and the surrounding area is typical of semi-arid, desert/dry grassland regions. The average annual temperature is 10.6°C (51.1°F) with approximately 62 days of rain per year. Average monthly precipitation totals 21.6 millimeters (0.85 inches), and wind speed averages 14.3 kilometers per hour (8.9 miles per hour). NMT monitors wind data daily from the National Weather Service’s station in Albuquerque. The proposed tests would occur in June or July; therefore, the average temperature and wind speed are provided for these months. The average temperature for June is 22.8°C (73.2°F) with four days of precipitation totaling 15.2 millimeters (0.6 inches). The average temperature for July is 25°C (76.9°F) with nine days of precipitation totaling 38.1 millimeters (1.5 inches). The average wind speed in June is 15.8 kilometers per hour (9.8 miles per hour) and 14.3 kilometers per hour (8.9 miles per hour) in July. (City Data, 2004)

Air quality in Socorro County is considered good for all air pollutants, including criteria pollutants and HAPs. (Creative Methods, 2004) Consequently, Socorro County is in attainment for all NAAQS and State Ambient Air Quality Standards.

Air quality is regularly monitored at NMT, particularly for particulates, ozone, and nitrogen oxides. (Zamora, 2002) The closest National Air Monitoring Station or State and Local Air Monitoring Station is located approximately 113 kilometers (70 miles) to the north near Albuquerque.

There are nine Class I areas in New Mexico, including the Bosque del Apache National Wildlife Refuge located approximately 32 kilometers (20 miles) southeast of Socorro. However, none of the Class I areas are expected to be impacted by the proposed action, as TBP droplets quickly disperse and degrade.

Air pollution sources at EMRTC include mobile sources, such as exhaust from ground vehicles, rockets, missiles, and explosives, and non-mobile sources, such as boilers, generators, workshops, and fuel storage and pumping facilities. Previous air quality modeling studies at EMRTC indicate that the facility does not create stationary source emissions that compromise the area's current attainment standards. (Banks, Pers. comm.) Permits for open burns or other activities that could affect air quality at the facility are obtained by EMRTC prior to such activities. Emission sources in Socorro County are predominantly from road traffic and open burning, both prescribed burns and forest and wild fires. (Creative Methods, 2004)

3.2 Airspace

Definition of Resource. Airspace management and use are governed by the regulations set forth by the Federal Aviation Administration (FAA). The types of airspace are dictated by (1) the complexity or density of aircraft movements, (2) the nature of operations conducted within the airspace, (3) the level of safety required, and (4) the national and public interest in the airspace.

The categories of airspace are *controlled, uncontrolled, special use, and other airspace*. Simple definitions of the categories of airspace are provided in Exhibit 3-3.

Exhibit 3-3. Definitions of Airspace Categories

Category	Definition	Examples
Controlled Airspace	Airspace used by aircraft operating under Instrument Flight Rules (IFR) that require different levels of air traffic service	Altitudes above Flight Level (FL) 180 (5,500 meters [18,000 feet] above mean sea level [MSL]), Airport Traffic Areas, Airport Terminal Control Areas, Jet Routes, and Victor Routes
Uncontrolled Airspace	Airspace primarily used by general aviation aircraft operating under Visual Flight Rules (VFR)	As high as 4,420 meters (14,500 feet) above MSL
Special Use Airspace	Airspace within which specific activities must be confined or access limitations are placed on non-participating aircraft	Restricted Areas Military Operations Areas (MOA)
Other Airspace	Airspace not included under controlled, uncontrolled, or special use categories	Military Training Routes (MTR)

Source: FAA, 2002

Operators of aircraft within controlled airspace are subject to specific pilot qualifications, operating rules, and equipment requirements. Controlled airspace can be classified as Class A, B, C, D, or E. (DoD, 2002) Exhibit 3-4 provides descriptions for the airspace classifications. Uncontrolled airspace is for aircraft operating under VFR and is not classified by the FAA. Uncontrolled airspace can extend up to 4,420 meters (14,500 feet) above MSL and is referred to as Class G airspace. (DoD, 2002)

Exhibit 3-4. Airspace Classification Descriptions

Classification	Controlled or Uncontrolled	Description
Class A	Controlled	U.S. airspace overlying waters within 22 kilometers (12 nautical miles) of the coast of the continental U.S. from 5,486 meters (18,000 feet) above MSL up to and including FL600 (18,288 meters, or 60,000 feet, above MSL).
Class B	Controlled	Ranges from the surface to 3,049 meters (10,000 feet) above MSL surrounding the nation’s busiest airports in terms of IFR operations or passenger enplanements.
Class C	Controlled	Ranges from the surface to 1,220 meters (4,000 feet) above the airport elevation and surrounding those airports that have an operational control tower, that are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements.
Class D	Controlled	Ranges from the surface to 762 meters (2,500 feet) above the airport elevation and surrounding those airports that have an operational control tower.
Class E	Controlled	Controlled airspace that is not Class A, B, C, or D and includes uncontrolled airspace above FL 600.
Class G	Uncontrolled	Airspace that is not classified by the FAA

Source: DoD, 2002

Region of Influence. The ROI for Airspace consists of airspace from the surface to 2,438 meters (8,000 feet) above the test area.

Existing Conditions. The airway and jet route segments in the flight corridor over EMRTC lie within airspace managed by the Albuquerque Air Route Traffic Control Center (ARTCC). This office exercises control of its Class A and B Controlled airspace traffic within sectors, dividing the airspace both vertically and horizontally.

The Albuquerque Air Flight Service Station is responsible for providing en route flight advisory service, among other services, to the entire state of New Mexico, as well as the Texas counties of El Paso, Hudspeth, and Culbertson. The Albuquerque Flight Watch area coincides with ARTCC boundaries and includes all of New Mexico and parts of Arizona and West Texas.

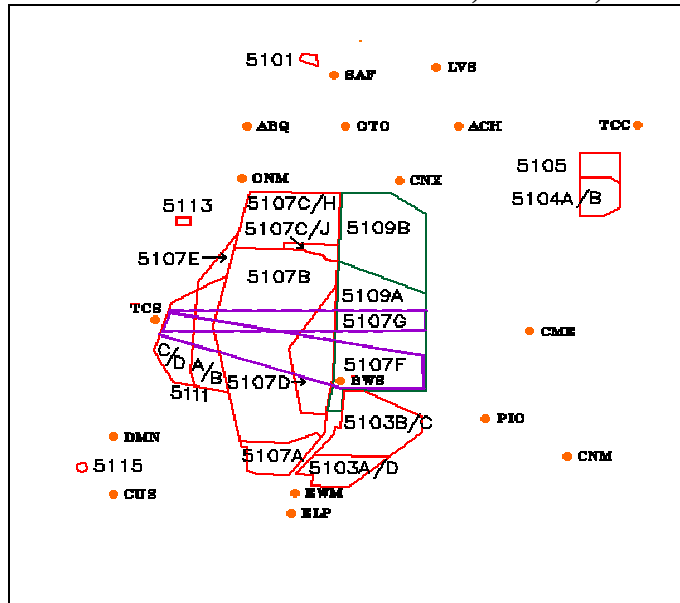
The Community of Socorro lies in Class G airspace. (Albuquerque Air Flight Service Station, 2004c)

Several Restricted Areas are operational in the Socorro/Central New Mexico vicinity: R-5107, R-5109, R-5113, R-5119, and R-5123. R-5113 covers rocket landing areas for Langmuir Laboratory, part of the NMT research facilities where thunderstorm research is conducted during the summer. The area may be closed to aircraft on one-hour notice from June 1 through September 30 and extends from the surface to 13,716 meters (45,000 feet) MSL.

R-5119 is designated as a missile reentry and planned termination area for use by the U.S. Army and designated joint-use agencies to conduct tests to validate operational effectiveness. R-5119 may be closed to non-participating aircraft by issuance of a Notice to Airmen (NOTAM) 24 hours in advance of a planned test. R-5119 extends from FL 350 to unlimited altitude and is adjacent to the existing WSMR Restricted Area R-5107 to the east and southeast of Socorro. R-5109 is also a WSMR Restricted Area located southeast of Socorro.

R-5123 is located over Cibola National Forest west of Socorro in Magdalena, New Mexico, and extends from the surface to unlimited altitude. The Restricted Area provides a booster drop zone to contain debris from missile boosters after launch from R-117 in Fort Wingate, near Gallup in northwestern New Mexico. Missile testing at R-5117, R-5119, and R-5123 is generally completed prior to 9:00 a.m. Mountain Standard Time. The locations of R-5113, R-5109, and R-5107 are shown in Exhibit 3-5.

Exhibit 3-5. Restricted Areas R-5113, R-5109, and R-5107

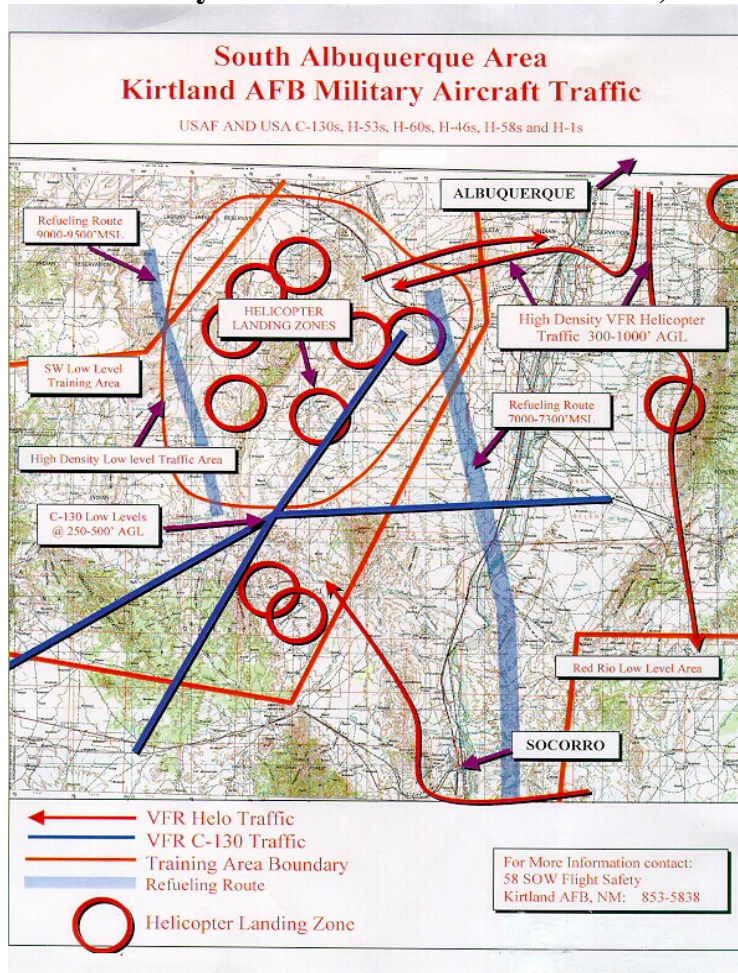


Source: Albuquerque Air Flight Service Station, 2004

The CATO MOA lies west and southwest of Socorro. However, the CATO MOA has a 4,115-meter (13,500-foot) floor (Dougan, 2003) and therefore, would not be impacted by the proposed vertical gun tests.

There are no MTRs directly overlying EMRTC or Socorro, although there are MTRs in use surrounding the area as shown in Exhibit 3-6.

Exhibit 3-6. Military Aircraft Traffic near Socorro, New Mexico



Source: Albuquerque Air Flight Service Station, 2004

The closest airport to EMRTC is the Socorro Municipal Airport, which is located 5 kilometers (3 miles) south of Socorro. The airport is for public use and lies under the jurisdiction of the Albuquerque ARTCC.

Albuquerque International Sunport is located 122 kilometers (76 miles) north of Socorro and provides the closest air traffic control tower. Albuquerque International Sunport is located in Class C Airspace and lies under the jurisdiction of the Albuquerque ARTCC.

The closest military airfield is Stallion Army Airfield located 13 kilometers (8 miles) southeast of Socorro. The airfield also has a missile firing range located east and south of the field. The Albuquerque ARTCC maintains authority over air traffic for Stallion Army Airfield.

3.3 Biological Resources

Definition of Resource. Native or naturalized flora (vegetation), fauna (wildlife), and the habitats in which they occur are collectively referred to as biological resources. This section identifies flora, fauna, and wetland resources in Socorro County and the 3K North site that could potentially be affected by the proposed action. Applicable Federal, State, and local statutes that are designed to protect indigenous and special status species present within the affected area are also cited in this section.

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act, which states that all Federal departments and agencies shall seek to conserve endangered species and threatened species. Endangered species means any plant or animal species in danger of extinction throughout all or a significant portion of its range. The Act defines a threatened species as any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Special status species are defined as plant or animal species that are candidates for, proposed as, or listed as sensitive, threatened, or endangered by USFWS. In addition to federally listed species, the State of New Mexico has two laws designed to protect animals and plants, the Wildlife Conservation Act (New Mexico Statutes Annotated 1978 § 17-2-37 *et seq.*) and the Endangered Plant Species Act (New Mexico Statutes Annotated 1978 § 75-6-1). The New Mexico Department of Game and Fish, Conservation Services Divisions, administers the Wildlife Conservation Act. Through the Act, the New Mexico Department of Game and Fish administers the listing of special status animal species in coordination with other Federal, State, and local organizations. The Forestry Division of the Energy, Minerals, and Natural Resources Department administers the Endangered Plant Species Act. This Act only acknowledges an “Endangered” status for plants in New Mexico, and no list is currently available through the Department. In its place, the New Mexico Rare Plant Technical Council maintains a list of special status plants developed through collective agency efforts, academic research, and field surveys. (New Mexico Rare Plant Technical Council, 2004)

Region of Influence. The ROI for Biological Resources is the same as that described for Air Quality and is as shown in Exhibit 3-2.

Existing Conditions. The diverse biological resources of the area are representative of the varied elevation, climate, topography, soils, and available water resources, as well as land use practices. There is a variation in precipitation, temperature, and soil types, given the Chihuahuan Desert's mountains, mesas, valleys, plains, and grassland environs.

The dominant plant life is juniper (*juniperus spp.*) Other dominant plant life includes Creosotebush, Four-winged Saltbush (*Atriplex canescens*), Mariola (*Parthenium incanum*), and Honey Mesquite (*Prosopis glandulosa*). Tarbush (*Flourensia cernua*) is less dominant, but may be found in the proper soil and moisture conditions. A variety of small to medium-sized cacti, yuccas (*Yucca elata*, *Yucca torreyi*), and agaves (including *Agave lechuguilla*), are considered to be indicator species of the Chihuahuan Desert. Various grasses occur commonly, including Black Gramma (*Bouteloua eriopoda*) and Tobosa Grass (*Hilaria mutica*). Other less common plants include Ocotillo (*Fouquieria spendens*), Sotol (*Dasylirion spp.*), and the Barrel Cactus (*Ferrocactus wislizenii*). (National Park Service [NPS], 2004a)

Socorro County encompasses the Rio Grande floodplain and wetlands, as well as the diverse Chihuahuan Desert. Grasslands, valleys, and woodlands serve as important foraging habitat, as well as wildlife corridors. The forests, mountains, and canyon areas remain undeveloped and provide nesting and den sites, food, water, and wildlife corridors to a wide variety of mammals and birds. Common species include the Desert Cottontail (*Sylvilagus audubonii*), Black-tailed Jack Rabbit (*Lepus californicus*), Cactus Mouse (*Peromyscus eremicus*), Kit Fox (*Vulpes velox*), Cactus Wren (*Campylorhynchus brunneicapillus*), Greater Roadrunner (*Geococcyx californianus*), Mojave Rattlesnake (*Crotalus scutulatus*), Coachwhip snake (*Masticophis flagellum*), New Mexican Whiptail lizard (*Cnemidophorus neomexicanus*), Red-spotted Toad (*Bufo punctatus*), and Tiger Salamander (*Ambystoma tigrinum*). (NPS, 2004a)

The Cibola National Forest is 6,578 square kilometers (2,548 square miles) in size and extends into Oklahoma and Texas, as well as portions of New Mexico and central Socorro County. (U.S. Forest Service, 2004b) Vegetation found in the New Mexico portion of the Cibola National Forest consists primarily of ponderosa pine (*Pinus ponderosa*), spruce-fir forests, and some mixed coniferous forests, but also includes woodland vegetation, such as pinyon and juniper, in limited outcrops. Grasslands and desert vegetation as previously described is common at lower elevations. (U.S. Forest Service, 2004b)

The Bosque del Apache National Wildlife Refuge is a 231 square kilometer (89 square mile) wildlife range that straddles the Rio Grande River roughly 32 kilometers (20 miles) south of the community of Socorro. In an otherwise arid

environment, the Bosque del Apache provides a winter haven for migratory birds, such as snow geese, sandhill cranes, and whooping cranes, and provides a permanent home to other species that include blue heron, fox, coyote, mule deer, and elk. (USFWS, 2004d) The refuge consists of approximately 52 square kilometers (20 square miles) of moist bottomlands, with roughly 15 square kilometers (6 square miles) of active floodplain and 37 square kilometers (14 square miles) of sustained wetlands, farmlands, and riparian forests. According to USFWS, the remaining portions of the Bosque del Apache refuge consists of arid foothills and mesas that are preserved as wilderness areas.

Another significant biological resource within the area is the Sevilleta National Wildlife Refuge (see Exhibit 3-7). Encompassing approximately 3,600 square kilometers (1,390 square miles), the Sevilleta Refuge is located approximately 32 kilometers (20 miles) north of Socorro, New Mexico. (University of New Mexico, 2004) The Sevilleta Refuge is managed primarily as a research area and is not open to most public recreation activities. It serves as a significant natural resource given the diverse range of ecosystems that include Chihuahuan Desert, Great Plains Grassland, Great Basin Shrub-Steppe, Piñon-Juniper Woodland, Bosque Riparian Forests, Wetlands, and Montane Coniferous Forests. (USFWS, 2004c) Given its diversity of resources, research at the Sevilleta Refuge is dedicated to examining biomes and their transition zones. (University of New Mexico, 2004)

Exhibit 3-7. Sevilleta National Wildlife Refuge



Source: USFWS, 2004

Exhibit 3-8 provides a list of special status plants that may be present in Socorro County, as well as their State status through the State of New Mexico and the New Mexico Heritage Program and Federal status through USFWS, U.S. Forest Service, or Bureau of Land Management (BLM). (New Mexico Rare Plants Technical Council, 2004)

Exhibit 3-8. Special Status Plants of Socorro County, New Mexico

Common Name	Scientific Name	USFWS ¹	State of NM ²	U.S. Forest Service ²	BLM ²	NM Heritage Program ²
Fugate's blue-star	<i>Amsonia fugatei</i>	SOC	SOC	-	SS	G2, S2
La Jolla prairie clover	<i>Dalea scariosa</i>	-	-	-	SS	G4, S4
Standley's whitlowgrass	<i>Draba standleyi</i>	-	SOC	-	SS	G3, S1
Rock fleabane	<i>Erigeron scopulinus</i>	-	SOC	-	SS	G3?, S3?
Tall bitterweed	<i>Hymenoxys brachyactis</i>	-	SOC	S	-	G3, S3
Dune pricklypear, sand pricklypear, sanbue cactus	<i>Opuntia arenaria</i>	SOC	E	-	SS	G2, S2
San Mateo penstemon	<i>Penstemon pseudoparvus</i>	-	SOC	S	-	G3?, Q, S3?
San Andres rock daisy	<i>Perityle staurophylla</i> var. <i>homoflora</i>	-	SOC	-	-	G4, T2, S2
Plank's campion	<i>Silene plankii</i>	-	SOC	-	SS	G3, S3
Wright's campion	<i>Silene wrightii</i>	-	SOC	-	SS	G3, S3
Laguna flame flower	<i>Talinum brachypodium</i>	-	-	S	-	-

Source: ¹Letter from USFWS dated March 18, 2004

²New Mexico Rare Plants Technical Council, 2004

Key: E-Endangered, SOC-Species of Concern, SS-Special Status, S-Sensitive, G2-Global imperiled, G3-Global vulnerable, G4-Global apparently secure ?-unranked, Q-Questionable taxonomy that may reduce conservation priority, T-Inspecific taxon, S1-State critically imperiled, S2-State imperiled, S3-State vulnerable, S4-State apparently secure

Exhibit 3-9 identifies special status animal species within Socorro County. A complete list of New Mexico animal species of concern identified by the New Mexico Department of Game and Fish is available in Appendix B.

Exhibit 3-9. Special Status Species within Socorro County, New Mexico

Common Name	Scientific Name	Federal Status	State Status
Alamosa springsnail	<i>Psuedotryonia alamosae</i>	E	E
Allen's big-eared bat	<i>Idionycteris phyllotis</i>	SOC	-
American peregrine falcon	<i>Falco peregrinus anatum</i>	SOC	T
Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	SOC	T
Baird's sparrow	<i>Ammodramus bairdii</i>	SOC	T
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	T
Bell's vireo	<i>Vireo bellii</i>	SOC	T
Black-footed ferret	<i>Mustela nigripes</i>	E	-
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	C	-
Black tern	<i>Chlidonias niger</i>	SOC	-
Chiricahua leopard frog	<i>Rana chiricahuensis</i>	T	-
Chupadera pyrg (springsnail)	<i>Pyrgulopsis chupaderae</i>	C	E
Desert pocket gopher	<i>Geomys bursarius arenarius</i>	SOC	-
Desert viceroy butterfly	<i>Limenitis archippus obsoleta</i>	SOC	-
Interior least tern	<i>Sterna antillarum</i>	E	E
Mexican spotted owl	<i>Strix occidentalis lucida</i>	T, CH	-
Mountain plover	<i>Charadrius montanus</i>	SOC	-
New Mexican meadow jumping mouse	<i>Zapus hudsonius luteus</i>	SOC	T
Northern apolomado falcon	<i>Falco femoralis septentrionalis</i>	E	E
Northern goshawk	<i>Accipiter gentilis</i>	SOC	-
Organ Mountains Colorado chipmunk	<i>Eutamias quadrivittatus australis</i>	SOC	T
Piping plover	<i>Charadrius melodus</i>	T	E
Pecos River muskrat	<i>Ondatra zibethicus ripensis</i>	SOC	-
Rio Grande silvery minnow	<i>Hybognathus amarus</i>	E, CH	E
Rio Grande sucker	<i>Castostomus plebeius</i>	SOC	-
Socorro isopod	<i>Thermosphaeroma thermophilus</i>	E	E
Socorro pyrg (springsnail)	<i>Pyrgulopsis neomexicana</i>	E	E
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	E
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	SOC	-
Western burrowing owl	<i>Athene cunicularia hypugea</i>	SOC	-
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	C	-

Sources: USFWS, 2004b, Letter from USFWS dated March 18, 2004, and New Mexico Department of Game and Fish, 2000

Key: T-Threatened, E-Endangered, C-Candidate Taxon, Ready for Proposal, SOC-Species of Concern

3.4 Cultural Resources

Definition of Resource. Historic properties are defined as archaeological sites, standing structures, or other historic resources listed, or potentially eligible for listing, on the National Register of Historic Places (NRHP).

Section 101(b)(4) of NEPA established a Federal policy for the conservation of historic and cultural, as well as the natural, aspects of the nation's heritage. Regulations implementing NEPA stipulate that federal agencies must consider the consequences of their undertakings on historic and cultural resources. (40 CFR Part 1502.16[g]) These guidelines are typically met under Section 106 of the National Historic Preservation Act. Requirements under Section 106 include the identification of significant historic properties that may be impacted by the proposed action, as well as consultation with the State Historic Preservation Officer (SHPO), and/or Tribal Historic Preservation Officer.

Region of Influence. The ROI for Cultural Resources is the same as that described for Air Quality and is as shown in Exhibit 3-2.

Existing Conditions. Characteristic of much of the southwest, the Socorro area is rich in Native American, Spanish, and Mexican culture. Prehistoric and historic sites are not uncommon throughout the region, with earliest evidence of human presence dating back approximately 25,000 years. (New Mexico Office of the Secretary of State, 2004) Cultural resources in the region are closely tied to Native American occupancy and the Spanish colonization of the Southwest, as well as the mining booms of the late 1800s, the Mexican-American War, and military research and testing that occurred in the area during World War II.

According to the NPS, there are currently 49 historic properties throughout the County that are listed on the NRHP. Of these 40 sites, 10 sites are Pueblo archaeological sites of the Chupadera Arroyo, located approximately 40 kilometers (25 miles) east of Socorro, near the town of Bingham, New Mexico. NRHP sites in or near the community of Socorro include the Hammel Illinois Brewery, the Val Verde Hotel, Fort Craig, Fitch Hall, and the Garcia Opera House. (NPS, 2004b)

Two national monument sites are present within Socorro County. The Salinas Pueblo Missions, also known as the Gran Quivira National Monument, occupies 10,769 acres (4,358 hectares), and is located east of the Rio Grande River in the eastern portion of the County (see Exhibit 3-10). With civilization at the site dating between 1,000 and 1,700 AD, it is a former village of the Pueblo Indians that contains the remains of early dwellings and religious structures. (NPS, 2004b)

Exhibit 3-10. Salinas Pueblo Missions



Source: NPS, 2004

The second national monument site within Socorro County is known as the Trinity Site, located in the southeastern portion of the County at WSMR, approximately 193 kilometers (120 miles) south of Albuquerque. The site was added to the NRHP in 1966 and has been a National Historic Landmark since 1975 due to its military significance to the nation. The Trinity Site occupies 147,627 hectares (364,800 acres), and served as the site of the world's first nuclear bomb detonation on July 16, 1945. (NPS, 2004b)

Several archaeological sites are located throughout the EMRTC facility, and archaeological investigations are ongoing. The 3K North site was investigated for archaeological remains upon its development in 1986. It was determined that no archaeological resources were present at the location. (Stanley, Pers. comm.) Furthermore, no historic properties are located within the ROI for the proposed action.

A search of the New Mexico State Register of Cultural Properties revealed 86 listed cultural properties in the Community of Socorro. None of these properties are located within the 3K North Test Site and none of the sites appear to be located within the ROI.

3.5 Geology and Soils

Definition of Resource. Geology and soils are those earth resources that may be adversely affected by a proposed action. These resources are described in terms of landforms, geology, and soil conditions as they could contribute to seismicity, erosion, and flooding. A geologic hazard is a naturally occurring or human-induced geologic condition that presents a risk or a potential danger to life and property. These hazards could include phenomena such as landslides, flooding, ground subsidence, faulting, and earthquakes.

Region of Influence. The ROI for Geology and Soils is the same as that described for Air Quality and is as shown in Exhibit 3-2.

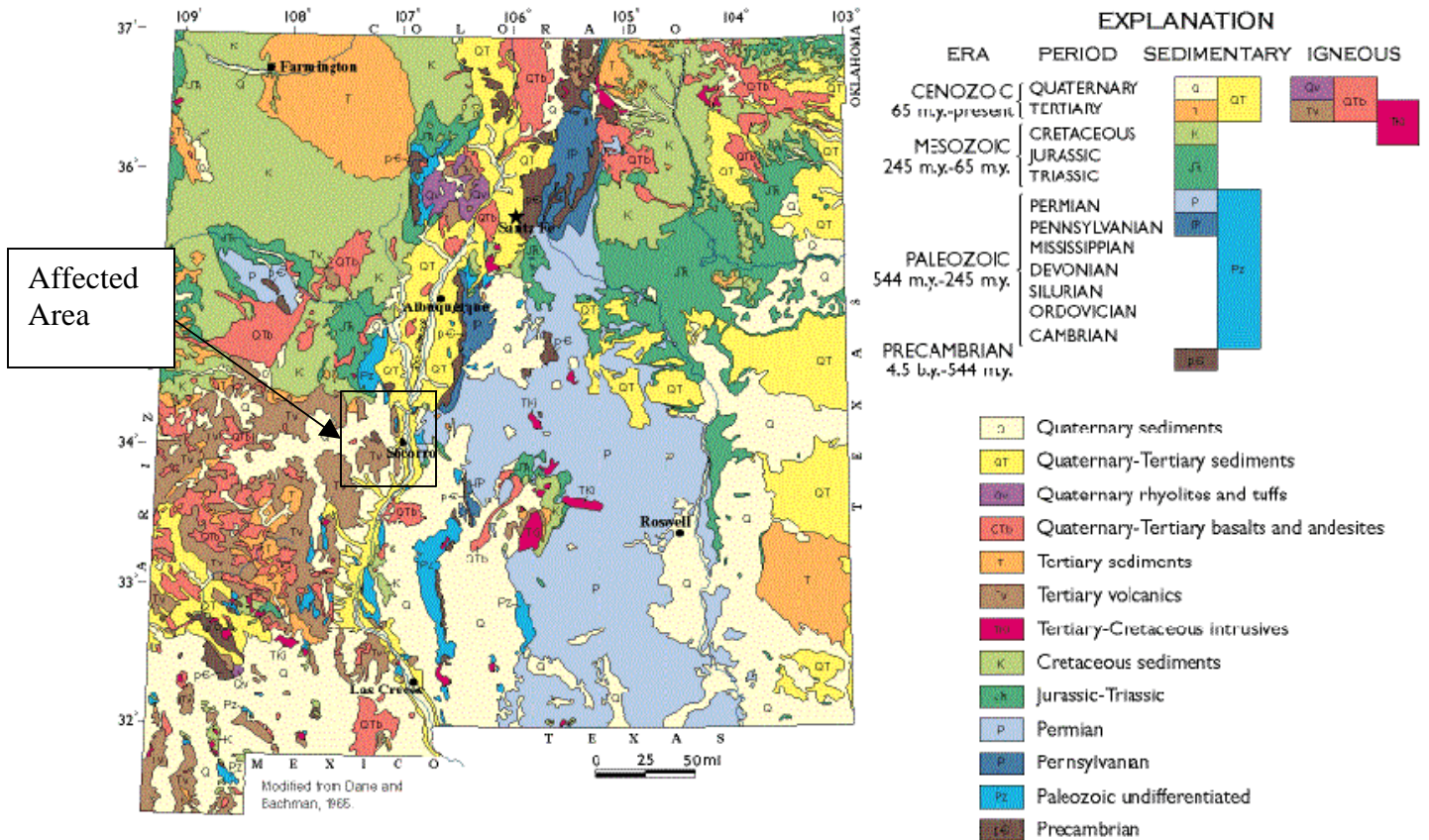
Existing Conditions. The majority of the geologic formations around EMRTC were formed by Quaternary sediments (sediments from erosion, transportation, or deposition within the last 2 million years) and Tertiary volcanics (formations from volcanic eruptions between 2 and 63 million years ago). (New Mexico Bureau of Geology and Mineral Resources, 2004) A general geological map of the area around Socorro is presented in Exhibit 3-11. The major soil types in the proposed test area are ustolls, a suborder of mollisols. Ustolls are found in semiarid climates of the Great Plains and Rocky Mountain States. This soil type is associated with areas of frequent drought and erratic rain, which usually falls during a growing season in heavy showers. The low levels of moisture limit crop yields unless the soil is irrigated. This soil type is associated with cropland or rangeland. Other possible soil types that might be found in the area would include entisols, inceptisols, aridisols, and alfisols. These soil types usually support rangeland, wildlife habitat, or grazing land.⁵ (Natural Resources Conservation Service, 2004; US Department of Agriculture, 1988) Soils containing sand and fines as well as natural rock debris characteristic of the surrounding mountains are present at the 3K North site. These soils support only scattered juniper and grasses adjacent to the site. All soils on the 3K North site have been previously disturbed.

Soil sampling was conducted in the National Cooperative Soil Survey (2004) about 50 kilometers (30 miles) east, and 17 kilometers (10 miles) south of Socorro. The survey found that the soils were moderately deep, well drained, and moderately permeable. Soils were found to be driest during May and June, and were primarily associated with rangeland.

The area between Socorro and Albuquerque was subject to frequent seismic activity between 1868 and 1973. Of the earthquakes that occurred in this region, about half of them were of an intensity of VI or greater on the modified Mercalli intensity scale. However, even the most intense earthquakes only caused minor damage in the area. (U.S. Geological Survey [USGS], 2004a) The last reported earthquake in the area was in May of 2003 when several small earthquakes occurred over a period of two days. The epicenter of these earthquakes was located approximately 50 kilometers (30 miles) southeast of Albuquerque and approximately 50 kilometers (30 miles) northeast of Socorro. (NMT, 2004a)

⁵ For further information regarding soil formation and classification see the following USDA link: <http://soils.usda.gov/education/facts/formation.html>

Exhibit 3-11. Geologic Map of the Socorro Area
GENERALIZED GEOLOGIC MAP OF NEW MEXICO



Source: New Mexico Bureau of Geology and Mineral Resources, 2004

3.6 Hazardous Materials and Hazardous Waste Management

Definition of Resource. Hazardous wastes, are defined by the Resource Conservation and Recovery Act (RCRA) as “a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed.” While the definition refers to “solids,” it has been interpreted to include semisolids, liquids, and contained gases. (Wentz, 1989)

Federal and state regulations require that hazardous waste be handled, stored, transported, disposed of, or recycled in compliance with applicable regulations. The sources of hazardous waste include waste fuel, waste oils, spent solvents, paint waste, and used batteries.

Region of Influence. The ROI for Hazardous Materials and Hazardous Waste includes the entire EMRTC test facility as well as the off-site areas that PEGEM modeling have shown would be potentially affected by the chemical plume produced during certain test scenarios.

Existing Conditions. Hazardous materials and wastes are regulated in New Mexico through a combination of federally mandated laws and state laws developed by NMED. The hazardous waste statutes are contained as part of the New Mexico Administrative Code, Titles 7, 11, and 20. Federal regulations governing the assessment and disposal of hazardous wastes include RCRA; RCRA Hazardous and Solid Waste Amendments, the Comprehensive Environmental Response, Compensation and Liabilities Act; the Solid Waste Act; and the Toxic Substances Control Act.

EMRTC has established programs for handling, storing, and using hazardous materials. Regular safety and environmental inspections are conducted to ensure compliance with OSHA and NMED (Radiation and Hazardous Waste Divisions) requirements. Standard operating procedures have been established for hazardous waste operations, which include controls to protect personnel and the environment during operations involving hazardous materials. These controls include limiting the quantity of materials used, using barricades or containment vessels, substituting non-hazardous materials, and developing plans to clean up after tests. (EMRTC, 2004b)

One local area of concern is about 11.7 kilometers (7 miles) north of Socorro at the Cal West Metals Site. The facility, which covered 17.5 hectares (43.8 acres), processed automobile batteries to recover lead between 1979 and 1981. The New Mexico Environmental Improvement Division detected lead in on-site monitoring wells at Cal West in 1984. Roughly 1,000 people obtain drinking water from public and private wells within 5 kilometers (3 miles) of the site. Lead also was found in water and sediments in drainage pathways leading from the site. Approximately 240 hectares (600 acres) of food and forage crops are irrigated by surface water within 5 kilometers (3 miles) downstream of the site. The EPA issued an order to the owner/operators under Section 3008(a) of RCRA for failure to operate and maintain the facility in compliance with RCRA hazardous waste management requirements. On July 15, 1987, a Consent Agreement and Final Order was signed, which set out a specific compliance schedule. (EPA, 2004c) This site was formally added to the Superfund National Priorities List on March 31, 1989. The EPA signed a Record of Decision on September 29, 1992 and a Preliminary Close-Out Report was completed on September 29, 1995, which marked the completion of remediation at the site. The site was deleted from the National Priorities List on December 20, 1996. NMED installed an additional

monitoring well at the site based on recommendations from the five-year monitoring review. (EPA, 2004b)

3.7 Health and Safety

Definition of Resource. Health and Safety includes consideration of any activities, occurrences, or operations that have the potential to affect the well-being, safety, or health of workers or members of the general public.

Region of Influence. The ROI for Health and Safety includes the entire EMRTC test facility, as well as the off-site areas that PEGEM modeling have shown would be potentially affected by the chemical plume produced during certain test scenarios.

Existing Conditions. EMRTC has developed programs for handling, storing, and using energetic and hazardous materials. Regular safety inspections are conducted to ensure the facility meets safety standards. The facility also has established standard operating procedures for general safety programs, testing procedures, and hazardous waste operations. Standard operation procedures would be developed specifically for the vertical gun prior to any test events. When hazardous materials are tested at EMRTC, established controls are enacted to ensure the safety of personnel, such as wearing protective clothing, masks, and ear protection. Additionally, gates located throughout the EMRTC facility on access roads to test sites are closed to isolate areas during active test periods.

In the event of an emergency during a test event, safety equipment, medical surveillance programs, Emergency Medical Technicians, and First Responders would be available to address any mishap. Personnel responsible for handling and storage of ordnance and munitions have received explosive ordnance disposal training. The facility has explosive storage magazines that allow it to receive, store, and use most conventional explosives and munitions.

3.8 Land Use

Definition of Resource. The EPA defines land use as “the way land is developed and used in terms of the kinds of anthropogenic activities that occur (e.g., agriculture, residential areas, and industrial areas).” (EPA, 2003)

Region of Influence. The ROI for Land Use includes the entire EMRTC test facility, as well as other off-site portions of Socorro County, including roads and other resources that service EMRTC.

Existing Conditions. Socorro County is located in central New Mexico and encompasses approximately 17,220 square kilometers (6,649 square miles). (U.S.

Census Bureau, 2004) Aside from the Rio Grande River, the setting is semi-arid Chihuahuan Desert that includes mountains, valleys, high plains, and grasslands. Surface water comprises only 0.03 percent of the total land area in the County. (U.S. Census Bureau, 2004)

Other than small communities such as Socorro and Magdalena, the County is rural in nature. The Socorro community primarily supports residential, commercial, and light industrial land uses. The outlying portions of the County are comprised of a mixture of conservation lands, research, development, and testing facilities, interspersed with agricultural and ranching activities. The Magdalena District of the Cibola National Forest is also in Socorro County, which contains the Magdalena, Bear, and San Mateo mountains. Given its diverse natural resources, the Socorro area supports local recreational and tourism activities, such as wildlife viewing, mountain biking, golfing, hiking, camping, and rock climbing.

The 36-hectare (90-acre) protected wilderness area of the Bosque del Apache National Wildlife Refuge is located approximately 32 kilometers (20 miles) south of the community of Socorro in the foothills of the Chupadera Mountains. The National Radio Astronomy Observatory is located approximately 80 kilometers (50 miles) west of Socorro in the San Agustin plains. To support its Very Large Array telescope, which is used by scientists worldwide, the Observatory maintains 27 large dish antennas (see Exhibit 3-12). (National Radio Astronomy Observatory, 2004)

Exhibit 3-12. National Radio Astronomy Observatory



Source: National Radio Astronomy Observatory, 2004

NMT and its affiliated research and development facilities are closely tied to land use within the County. Its institutions include: the Langmuir Laboratory for Atmospheric Research, EMRTC, the Geophysical Research Center, the Bureau of Mines and Mineral Resources, and the Petroleum Research and Recovery Center. (Center for Land Use Interpretation, 2004)

The EMRTC facility consists of multiple buildings that house its research and development activities, which typically pertain to the design, development, and testing of weapons, munitions, and other defense related projects. (EMRTC, 2004a) The EMRTC field laboratory is located near Socorro Peak and occupies 83 square kilometers (32 square miles) (see Exhibit 3-13). The 3K North test site is located within the northwestern portion of the EMRTC field laboratory.

Exhibit 3-13. EMRTC Field Laboratory



Source: EMRTC, 2004

Nestled between mountains, land surrounding the proposed 3K North site belongs to EMRTC and remains undeveloped except for facilities such as bunkers or platforms associated with testing activities. The closest private property is located to the north of the 3K North site, and is used for ranching. Only one residence is located within this area, and it is located several miles from the EMRTC facility. Although cattle fencing separates much of the EMRTC boundary, cattle grazing has been known to overlap onto EMRTC property. (Richardson, 2004) Cattle farmers would be granted access to the EMRTC property to remove cattle on the property prior to tests.

3.9 Noise

Definition of Resource. Noise can be defined as unwanted or annoying sound that is typically associated with human activity. Noise can cause hearing loss and interfere with communication.

Most sound is not a single frequency, but rather a mixture of frequencies, with each frequency differing in sound level. The intensity of each frequency combines to generate sound, which is usually measured and expressed in decibels. Decibels are measured on a logarithmic scale, which means that an increase of one decibel represents a tenfold increase in sound energy and an increase of two decibels represents a one hundredfold increase in sound energy. Noise associated with industrial activities is most commonly measured on a scale designated as A-weighted (dBA), which de-emphasizes low and extremely high frequency sounds

to which the human ear is less sensitive and which has been shown to correlate well with the perceived relative intensity (i.e., loudness) of sound. Examples of A-weighted noise levels for various common noise sources are shown in Exhibit 3-14.

Exhibit 3-14. Comparative A-Weighted Sound Levels

dBA	Comparative Sound	Effect
140	Threshold of pain, 12 Gauge Shotgun (0.9 meters [3 feet])	Continuous Exposure Causes Hearing Damage
130	Artillery Fire, Jackhammer (0.9 meters [3 feet])	
120	Jet Takeoff (61 meters [200 ft]), Thunder, Sonic Boom	
110	Rock Band, Chain Saw (15 meters [50 feet]), Jet Flyover (305 meters [1,000 feet])	
100	Lawn Mower, Power Tools (0.9 meters [3 feet]), Noisy Motorcycle (15 meters [50 feet])	
90	Heavy Truck (15 meters [50 feet])	Speech Interference
80	Normal Boat or Quiet Motorcycle (15 meters [50 feet])	
70	Normal Automobile (15 meters [50 feet]), Commercial Business Area	
60	Conversation (0.9 meters [3 feet]), Large Business Office	Sleep Disturbance
50	Quiet Residential Area, Library	
40	Quiet Home, Bedroom at Night	
30	Soft Whisper, Quiet Rural Night	
20	Recording Studio	
0	Threshold of Hearing	

Source: Modified from California Department of Boating and Waterways, 2004

Region of Influence. The ROI for noise includes the entire EMRTC test facility and surrounding portions of Socorro County that may be affected by noise produced during tests.

Existing Conditions. The proposed tests would take place on a site roughly 8 kilometers (5 miles) from the community of Socorro, which is the nearest inhabited area. The test site is about 3.5 kilometers (2 miles) from Highway 60. The test facility conducts approximately 200 to 300 tests per year, many of which include testing explosives and firing artillery. These tests produce short-term

noise events that are characteristic of testing ranges and are consistent with EMRTC's mission. Although some noise can occasionally be heard within the community of Socorro, such events are considered by local residents to be routine and are not considered to be an annoyance.

The Socorro Municipal Airport is located approximately 4 kilometers (2.5 miles) south of Socorro that has an average of 22 flights per day. Each take-off and landing produces a short-term noise event.

Background desert noise levels from wind were measured by the Department of Energy (DOE) to be 22 dBA on a still day and 38 dBA on a windy day. (DOE, 1996)

3.10 Socioeconomics and Environmental Justice

Definition of Resource. Socioeconomics deals with the basic attributes and resources associated with the human environment, specifically population and economic activity. Socioeconomic resources include demographics, housing, employment, and local economic trends.

Executive Order (E.O.) 12898 is entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This E.O. tasks federal agencies to make achieving environmental justice part of their mission by identifying and addressing disproportionately high and adverse public health or environmental effects of its programs, policies, and activities on minority and low-income populations. All federal projects and projects funded with federal monies must be evaluated for their potential to adversely affect minority or low-income populations. Additionally, federal agencies are required to ensure that notifications regarding environmental issues are concise, understandable, and readily accessible to the public.

Region of Influence. The ROI for Socioeconomics and Environmental Justice includes the Community of Socorro and the County.

Existing Conditions. According to the 2000 U.S. Census, Socorro County contains a total population of 18,078 persons and approximately 7,808 housing units. As seen in Exhibit 3-15, the ethnic distribution within Socorro County is similar to distributions observed in the State of New Mexico.

Exhibit 3-15. Socorro County Population Observations

Population Observations (percent)	Socorro County	New Mexico
Persons of Hispanic or Latino origin	49 %	42 %
White persons, not of Hispanic origin	38 %	45 %
Black or African American persons	1 %	2 %
American Indian or Aleutian persons	11 %	10 %
Native Hawaiian or other Pacific Islander	< 1 %	< 1 %
Asian persons	1 %	1 %

Source: U.S. Census Bureau, 2004

When compared to numbers for the State of New Mexico, the 2000 U.S. Census indicates that Socorro County incomes tend to be lower than those in the State, and there are a higher number of people living below the poverty level. The median income in Socorro County is \$23,439 the State median income is \$34,133. Approximately 32 percent of the County’s population is living below the poverty level. This compares to approximately 18 percent of the population living below the poverty level in the State of New Mexico. (U.S. Census Bureau, 2004)

Although there are still strong Native American ties within the Socorro community, there is only one tribal reservation within the County. The Alamo Navajo Band is a satellite community of the Navajo Nation with approximately 860 residents. (Alamo Chapter, 2004) The Alamo Navajo reservation is isolated from the other Navajo Nation communities, and is located approximately 48 kilometers (30 miles) west of Magdalena in the northwestern portion of the County. The Navajo nation has developed revenue from some of the natural resources (i.e., shale and oil) that are present within their lands; however, the major source of revenue on the reservation is tourism.

According to the New Mexico Department of Labor, the County’s unemployment rate was 5.2 percent in November of 2003. Federal, State, and local agencies are the largest employers in the County, providing nearly 2,000 jobs that include public and State educational institutions such as NMT. EMRTC employs approximately 110 persons. Because of EMRTC’s affiliation with NMT, these employees are State employees. Through salaries, benefits, and training held at the facility for out of state visitors, EMRTC brings roughly 3.5 to 4 million dollars annually to the community of Socorro. (Stanley, Pers. comm.) Accommodations and food services provide the next greatest number of jobs in the area, followed by professional and technical services, health care and social services, and retail trade categories. (New Mexico Economic Development, 2004) Farming and agriculture are another source of income for the County. With approximately 223 farms, the highest farm revenues stem from dairy products, cattle farming, hay production, and vegetable crops. (New Mexico Economic Development, 2004)

Socorro County has a wide variety of public services that include education, public health, library, emergency, and law enforcement services. There are currently six elementary schools, two middle and high schools, and one charter school serving the region. (School Tree, 2004) NMT, which is located within the community, is part of the State university system and has a current enrollment of approximately 1,800 students. (NMT, 2004c) Police services are provided by the Socorro Police Department and Socorro County Sheriff's Office. The Socorro Fire Department provides firefighting services. Socorro General Hospital is a 38-bed acute care facility equipped with emergency and trauma care for the Socorro community and County. There is also a 62-bed non-profit nursing home serving the County. (NMT, 2004c)

3.11 Transportation and Infrastructure

Definition of Resource. Transportation generally refers to the movement of people and goods. Infrastructure encompasses public and private utilities, and their capacity to accommodate the movement of people and goods. Infrastructure includes roadways, railways, ports, and airports. Within the context of infrastructure, goods include water, power, fuel, communications, waste disposal, and other vital services.

Region of Influence. The ROI for Transportation and Infrastructure includes the EMRTC test facility, as well as the off-site areas that PEGEM modeling has shown would be potentially affected by the TBP plume produced during certain test scenarios. In addition, roads and railways that service EMRTC and the Community of Socorro are included in the ROI for Transportation and Infrastructure.

Existing Conditions. EMRTC is accessible from the north and south via U.S. Interstate 25 (I-25) with speed limits of 121 kilometers per hour (75 miles per hour) through rural areas and 105 kilometers per hour (65 miles per hour) through Albuquerque, New Mexico. Exits 150 and 152 off I-25 provide access to EMRTC. From the west, U.S. Highway 60 (U.S. 60) intersects I-25 at exit 150 at the south end of Socorro. From the east, U.S. Highway 380 (U.S. 380) intersects I-25 at exit 139 roughly 16 kilometers (10 miles) south of Socorro. Both U.S. 60 and U.S. 380 are predominantly two-lane highways with posted speeds from 89 to 105 kilometers per hour (55 to 65 miles per hour).

The NMT campus is locally accessed from Bullock Avenue via exit 150. Exit 152 leads directly to EMRTC via security gates that are open between 6:00 a.m. and 10:00 p.m. There are unpaved access roads throughout the facility. No additional road construction would be required to support the proposed testing at EMRTC.

The Burlington Northern and Santa Fe Railway operates a north-south commercial rail line serving Socorro, and Amtrak provides a connecting thruway motor coach service for passengers.

The Socorro Electric Cooperative owns and operates an electric distribution system that originates at Socorro Substation (115/69-kilovolt transformer) and serves EMRTC. (WSMR Liquid Propellant Targets EA, 2002) The Western Electricity Coordinating Council provides the electrical transmission system to deliver power to EMRTC. However, generators would be used to provide the majority of power needed to support the sensors that would be used during the proposed testing.

The Community of Socorro supplies NMT's potable water. The water is withdrawn from the School of Mines and the Olsen wells. These wells represent two of the six water sources (four wells and two springs) used to supply water to the Community of Socorro. A fifth well is anticipated to be operational in the summer of 2004, and will provide a new potable water source for NMT and EMRTC. (Sanchez, Pers. comm.) Currently, drinking water is provided via water coolers and bottled water. For the Rio Grande Basin, water demand typically exceeds supply, and available water supplies within the basin are completely allocated to existing uses. However, no projected drinking water shortages are anticipated for the community of Socorro. (Sanchez, Pers. comm.)

The water provided to EMRTC by the Community of Socorro is run through a booster station at NMT, at which point the water and its distribution is under NMT's authority. This water is used for sanitary sewer and facility operation needs at EMRTC. NMT operates a Honeywell storage tank to store water for its facilities, including EMRTC. (Sanchez, Pers. comm.)

The Community of Socorro provides sewer and garbage collection services. (Sanchez, Pers. comm.) Socorro operates under a major National Pollution Discharge Elimination System permit (#NM0028835) issued by the NMED, Surface Water Quality Bureau. (NMED, Surface Water Quality Bureau, 2004)

3.12 Visual Resources

Definition of Resource. Visual resources are defined as the natural and man-made features that constitute the aesthetic qualities of an area. Landforms, surface water, vegetation and human-made features are the fundamental characteristics of an area that define the visual environment and form the overall impression that an observer receives of an area.

The importance of visual resources and any changes in the visual character of an area is influenced by social considerations, including the public value placed on the area, public awareness of the area, and community concern for the visual resources in the area. The visual resources of an area and any proposed changes to these resources can be evaluated in terms of “visual dominance” and “visual sensitivity.” Visual dominance describes the level of noticeability that occurs as the result of a visual change in an area. The levels of visual dominance vary from “not noticeable” to a significant change that demands attention and cannot be disregarded. Visual sensitivity depends on the setting of an area.

Region of Influence. The ROI for Visual Resources includes the entire EMRTC test facility, as well as surrounding portions of Socorro County from which the tests may be visible.

Existing Conditions. EMRTC test sites are located in mountainous terrain just outside of the Community of Socorro. Many of these sites such as the 3K North site are placed in valleys between mountains, out of the direct sight of the community. The 3K North site is not visible to the community of Socorro or Highway 60, and the surrounding mountains provide a natural barrier to the sights and sounds of the typical testing activities occurring at EMRTC. The dominant visual feature at the 3K North site is the rocky mountainous terrain. Surrounding the mountains are areas of rangeland with minimal juniper and grass vegetation. One of the dominant features of the North Range is Strawberry Peak, which is about 2,100 meters (7,000 feet) high and is pictured in Exhibit 3-16 from the vicinity of Socorro. In the background, the Magdalena Mountains are visible, which reach up to 3,030 meters (10,000 feet).

Exhibit 3-16. Strawberry Peak



Source: New Mexico Institute of Mining and Technology, 2004

3.13 Water Resources

Definition of Resource. Water resources in a given basin are usually described within the context of surface water and groundwater availability. Water resources are dependent upon a combination of factors that include precipitation, climate, geology, and topography. Surface waters are defined as waters that are open to the atmosphere, and include oceans, rivers, lakes, streams, estuaries, reservoirs, or other collectors that are influenced by surface waters. Ground water is defined as water, both fresh and saline, that is located beneath the Earth's surface. Typical sources of ground water include aquifers and aquifer sources, such as springs and wells.

The Clean Water Act (CWA) regulates all discharges into "waters of the United States." Wetlands and intermittent streams are both considered waters of the United States. The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Section 404 of the CWA requires consultation prior to the alteration of streams or waters of the U.S., and most alteration activities require permits. Compliance with Section 404 of the CWA within the State of New Mexico is administered by the U.S. Army Corps of Engineers in Albuquerque. The CWA also requires that all point sources discharging pollutants into waters of the U.S. must obtain a National Pollution Discharge Elimination System permit. Construction activities discharging runoff into wetlands, streams, or arroyos may also require a permit.

Pursuant to the State Water Quality Act (§§ 74-6-1 *et seq.*, New Mexico Statutes Annotated 1978), the New Mexico Water Quality Control Commission is the basic authority for water quality in the State. Under this Act, water is defined as "all water, including water situated wholly or partly within or bordering upon the state, whether surface or subsurface, public or private, except private waters that do not combine with other surface or subsurface water" [§ 74-6-2.G, New Mexico Statutes Annotated 1978]. The New Mexico Water Quality Control Commission is responsible for implementing water quality standards related to CWA, the Safe Drinking Water Act, and many other regulations that provide oversight for interstate/intrastate streams, sole source aquifers, and wellhead protection. (New Mexico Water Quality Control Commission, 2004)

Region of Influence. The ROI for Water Resources is divided into two types. The ROI for surface water consists of the on- and off-site areas where PEGEM modeling has predicted TBP droplets could be deposited during a test. The ROI for ground water consists of the entire EMRTC test facility.

Existing Conditions. The primary surface water resource in the Socorro region is the Rio Grande River, as well as its associated floodplain, wetlands, and

reservoirs. Demand characteristically exceeds existing water supplies within the Rio Grande Basin and large quantities of water are lost annually to evaporation. Ground water resources within the Socorro region consist of the Socorro Rio Grande aquifer system. (USGS, 2004b) Both surface and ground water resources within the Socorro region are subject to the Rio Grande Compact, which is a multi-state agreement that dictates water delivery requirements to each signatory state as the Rio Grande flows downstream.

Socorro County is part of the Basin and Range Physiographic Province and is drained by the Rio Grande River. Specifically, Socorro County is located within the Middle Rio Grande Basin. (USGS, 2004b) The region has low relative humidity and little precipitation, resulting in high surface water evaporation rates. The Middle Rio Grande Basin receives approximately 30 to 41 centimeters (12 to 16 inches) of rainfall a year, which primarily occurs between April and September. (USGS, 2004b) Given these rainfall amounts, most crops in the area require irrigation. The Middle Rio Grande is considered a topographically open basin because rainfall in the area is able to flow to the River. Stream flow within this portion of the Rio Grande River is attributed to upstream flow, ground water discharge, and runoff from summer thunderstorms. (USGS, 2004b)

Intermittent arroyos are present within the ROI; however, given the semi-arid nature of the region, these streams are typically dry and only active for a few days following rainfall events during the July and August monsoon season. EMRTC receives 20 centimeters (8 inches) or less of precipitation annually, and much of this is lost to evaporation. No perennial streams or wetlands are present near the 3K North site. While site visits to EMRTC revealed no active arroyos, ponds, or springs, one active spring is thought to be present in Nogal Canyon, located southeast of Strawberry Peak. (Stanley, Pers. comm.)

Surface flows and water supplies are controlled in the Socorro region by the upstream Isleta Diversion Dam, and farther downstream at the Elephant Butte Reservoir. The Isleta Diversion Dam can deliver a water capacity of up to 8.0 cubic meters per second (283 cubic feet per second) to the Socorro Main Canal. (Middle Rio Grande Bosque Initiative, 2004) These surface waters provide the primary source of irrigation for crops in the Socorro community, with surface water withdrawal estimates in the Rio Grande Basin for 2000 totaling 128,976 hectare-meters (1,045,189 acre-feet). (New Mexico Office of the State Engineer, 2004a) In 1995, Socorro County withdrew an estimated 16,064 hectare-meters (130,181 acre-feet) of surface water from the Rio Grande Basin. (Wilson, 1997)

The term floodplain refers to 100-year floodplains as determined by the Federal Emergency Management Agency (FEMA), and as depicted on Flood Insurance Rate Maps for all communities that are members of the National Flood Insurance

Program. The 100-year floodplain designates the area inundated during a storm having a 1 percent chance of occurring in any given year. FEMA also locates the 500-year floodplain in areas designated as Floodways. The 500-year floodplain designates the area inundated during a storm having a 0.2 percent chance of occurring in any given year. Major rivers and waterways, such as the Rio Grande, are classified as Floodways.

The 100-year and 500-year floodplain for the Rio Grande River has been established for the community of Socorro in Flood Insurance Rate Map series 350077. (FEMA, 1988) While portions of Socorro are located within the floodplain, the area containing the EMRTC facility and the proposed 3K North site are several miles west of the established flood zones, and no Flood Insurance Rate Maps exist for the ROI. (FEMA, 1988)

Wetlands in the Socorro region are primarily associated with the Rio Grande River. Because much of the Rio Grande has been channelized, the riverine wetlands in the area (such as those present in the Bosque del Apache Wetland Park) have been constructed by USFWS through the retention and diversion of wastewater effluent. These wetlands offer natural water filtration functions, but are specifically designed to provide critical habitat to birds inhabiting the wetlands. Naturally occurring wetlands are much less frequent in the region and are associated with small streams and isolated springs scattered throughout central New Mexico. Sedillo Spring is located approximately 3.2 kilometers (2 miles) west of Socorro. While the isolated springs and their wetlands provide critical habitat for endangered species, such as the Socorro isopod, many of these wetlands have been degraded or destroyed due to previous agricultural and livestock grazing practices. A review of the USFWS, National Wetland Inventory database in February of 2004, revealed that there are no mapped wetlands within the ROI. (USFWS, 2004a)

The Rio Grande aquifer system that is present in Socorro County consists of unconsolidated gravel, sand, silt, and clay, or partly consolidated sedimentary or volcanic materials. (USGS, 2004b) These materials have filled deep fault-block valleys formed by large vertical displacement across faults. The Rio Grande aquifer system is hydrologically connected, allowing ground water to move from valley to valley in a southward direction toward Texas and Mexico. (USGS, 2004b) While there are some closed system aquifers within the Socorro region, such as the San Agustin Basin, none of these aquifers are located near the community of Socorro or EMRTC. Shallow surficial ground water resources associated with the Rio Grande aquifer system provide the primary source of potable water in the Socorro region, with ground water withdrawal estimates for the year 2000 totaling approximately 26,751 hectare-meters (216,783 acre-feet). (New Mexico Office of the State Engineer, 2004a) In 1995, Socorro County

withdrew an estimated 5,206 hectare-meters (42,184 acre-feet) of ground water from the Rio Grande Basin. (Wilson, 1997)

The New Mexico Office of the State Engineer and the Interstate Stream Commission are the agencies responsible for administering water resources within the State. This includes reservoir holdings and water appropriations for livestock and agricultural practices. The agencies supervise most surface and ground water in New Mexico, including interstate and intrastate streams. (New Mexico Office of the State Engineer, 2004b)

Socorro has six wells that supply its drinking water; two thermal springs and four wells ranging in depth from 97 to 500 feet. (Brandvold, 2004) These wells naturally contain high levels of arsenic (up to 40 parts per billion) and uranium (up to 55 parts per billion), which occur naturally in the ground water supplies. Under the newest EPA standard for arsenic (10 parts per billion), four of the six wells will require treatment. (Brandvold, 2004) Though not a threat to public health, high levels of iron and manganese are also present within the water supplies. (Brandvold, 2004) The Socorro-Sierra Regional Water Plan, administered by New Mexico Office of the State Engineer, addresses issues such as urban and agricultural runoff that can affect water quality within the Socorro area. Typical problems that can affect water quality within the Socorro region include National Pollutant Discharge Elimination System -permitted outfalls, agricultural runoff and associated nitrates, storm water runoff, sediments, and waste effluents.

There are five wells on the EMRTC facility; however, these wells do not provide potable water. In keeping with State regulations, these wells are sampled annually for pollutants such as nitrates that would be associated with ongoing testing activities at EMRTC. To date, all well monitoring results have been within the normal limits for contaminants. (Stanley, Pers. comm.)

4. ENVIRONMENTAL CONSEQUENCES

This section examines the potential environmental impacts that could result from implementing the proposed action, as well as the consequences of taking no action. Existing conditions were described by resource area in Section 3.0 of this EA. Similarly, environmental consequences associated with the proposed action and no action alternatives are discussed within the context of resource areas. The level of detail discussed for a given resource area is proportional to the potential for impacts.

4.1 Air Quality

Potential impacts to air quality resulting from the proposed tests include

- Minor ground disturbing activities;
- Vehicle emissions at the 3K North site;
- Release of TBP, dye, and PBMA into the atmosphere;
- Creation of NO_x emissions associated with gun firing explosives; and
- Emissions from two or three diesel-powered generators that would provide power to the sensors that would monitor the proposed tests for TBP plume dispersion..

Prior to conducting the proposed tests, approximately 9.3 square meters (100 square feet) of the 3K North site would be cleared and graded for the placement of the gun mount. (Stanley, Pers. comm.) These ground disturbing activities would result in short-term PM₁₀ and fugitive dust emissions, and construction equipment would release CO, NO_x, VOCs, and oxides of sulfur (SO_x). In 1995, the EPA estimated that ground-disturbing activities cause the release of 1.08 metric tons (1.2 tons) of uncontrolled fugitive dust emissions per 0.4 hectare (1 acre) per month of ground disturbing activity. (Environmental Protection Agency, 1995, as described in Theater High Altitude Area Defense Pacific Test Flights EA, 2002) Therefore, ground-disturbing activity at the 3K North site would result in the local emission of 2.48×10^{-3} metric tons (2.73×10^{-3} tons) of uncontrolled fugitive dust emissions in a one-month period. Although the amount of vehicle traffic related to site preparation and construction for the gun mount cannot be accurately estimated at this time, the vehicle emissions resulting from three new target launch facilities constructed in Socorro County to support the development of prior missile defense systems and totaling 267.2 hectares plus 1.78 kilometers of new gravel road were determined to be insignificant in the Theater High Altitude Area Defense Initial Development Program EA (1994). Because the land area (9.29×10^{-4} hectares [2.30×10^{-3} acres]) to be cleared for the proposed vertical gun tests is only a minute fraction compared to the impacted area determined in the Theater High Altitude Area Defense Initial Development Program EA and because Socorro is in

attainment for all NAAQS and the nearest Class I area is approximately 32 kilometers (20 miles) from the test site, impacts to air quality from vehicle engine emissions would not be significant.

Similarly, fugitive emissions resulting from vehicle activity during site preparation and breakdown would be considered temporary. Therefore, no significant impacts to air quality would be expected from these activities. The placement of sensors that would be used for the proposed tests would occur in previously disturbed areas and would not require construction. Therefore, no significant air quality impacts would be anticipated.

The thickening agent, PBMA, and the dye added to the TBP are inert; and therefore, no significant impacts to air quality would be expected from their use. During a test TBP would be released as a vapor in the atmosphere and would be subject to rapid photodegradation, which would minimize the time TBP could impact air quality. (JETOC, 2001) TBP is the only substance associated with the proposed tests that would temporarily affect air quality.

The heat generated during the line charge rupture of canisters would not cause the temperature of the TBP to rise more than a few degrees. (Richardson, Pers. comm.) Therefore, toxic phosphine oxides, which rapidly react with oxygen in the presence of water to form phosphoric acid, would not be formed as a result of the proposed tests. Previous horizontal tests using TBP have not revealed phosphine oxides or phosphoric acid byproducts. (Alexander, Pers. comm.)

Wind conditions would determine the concentration and movement of TBP droplets in the atmosphere that would result from the proposed tests prior to ground deposition. There are currently no Federal or State air quality standards for TBP. The OSHA general industry airborne permissible exposure limit-time weighted average for TBP is 5.0 milligrams per cubic meter over an 8-hour time period during a 40-hour workweek. Based on the concentration of TBP expected to be dispersed on the ground and the total quantity of TBP proposed to be used in the tests calculations were made to estimate the quantity of TBP in the air column following a test.

- For deposition levels at 1 milligram per square meter (2.9×10^{-5} ounces per square yard) the concentration in air would be 0.11 milligrams per cubic meter and
- For deposition levels at 0.1 milligrams per square meter (2.92×10^{-6} ounces per square yard) the concentration in air would be 0.01 milligrams per cubic meter and 0.02 milligrams per cubic meter in June and July, respectively.

In no case would the OSHA airborne permissible exposure limit-time weighted average be approached. The relevant assumptions and calculations are provided in Appendix C. Other health-related respiratory standards are considered in Section 4.7 for Health and Safety.

TBP can potentially hydrolyze to form phosphoric acid or dibutylphosphoric acid when combined with water (i.e., precipitation). However, TBP is rather insoluble in water. Previous horizontal launch tests using TBP indicate the aerosol cloud remains visible to the naked eye for less than a minute. (Alexander, Pers. comm.) Lidars and other sensors used to monitor previous tests conducted at EMRTC detected droplets in the atmosphere for approximately 40 seconds. (Alexander, Pers. comm.) Given the rapid ground deposition of the TBP droplets and the facility's remote and open location, no long-term significant air quality impacts would be expected.

The M30 triple base solid propellant used to fire the gun and achieve the intended rupture height for the canister (approximately 500 meters [1,640 feet]) would emit primarily CO₂, water, and elemental nitrogen (N₂) along with small quantities of NO_x and light hydrocarbons upon burning. (Mitchell and Suggs, 1998) Using 54 kilograms (120 pounds) of M30 propellant would result in the emissions of 0.7 kilograms (1.57 pounds) of NO₂. The relevant assumptions and calculations are provided in Appendix C. Explosives and energetic materials testing using materials similar to M30 has been conducted at EMRTC for over 50 years. Given the small quantity of M30 propellant proposed to be used (approximately 54 kilograms [120 pounds]) in up to six tests, the emissions from the propellant would not exceed air quality limits and would not pose a significant impact to air quality.

Two to three diesel-powered generators would operate continuously for approximately 24 hours per test event. Power provided by the generators would support test-related activities and provide electricity for the sensors. The diesel fuel burned by the generators would emit CO₂, NO_x, CO, PM₁₀, and SO_x. Emissions estimates for each of these pollutants are shown in Exhibit 4-1 and the calculations and assumptions used to estimate the emissions are contained in Appendix C. Because EMRTC is located in an attainment area, the emissions of the applicable criteria pollutants are not subject to *de minimis* threshold values (measured in metric tons [tons] per year) under the Clean Air Act. Even if EMRTC were designated as being in nonattainment, the threshold values

Exhibit 4-1. Estimated Generator Emissions

Pollutant	Emission Factor in pounds per horsepower hour	Estimated Emissions per Test in Kilograms (pounds)	Total Estimated Emissions for Six Tests in kilograms (pounds)	Total Estimated Emissions for Six Tests in metric tons (tons)
CO ₂ ^a	1.15	420.27 (926.53)	2,521.6 (5,559.18)	2.52 (2.78)
NO _x	0.031	11.33 (24.98)	67.98 (149.88)	0.068 (0.075)
CO	6.68 E-3	2.44 (5.38)	14.64 (32.28)	0.015 (0.016)
PM ₁₀ ^b	2.20 E-3	0.80 (1.77)	4.82 (10.62)	0.0048 (0.0053)
SO _x	2.05 E-3	0.75 (1.65)	4.35 (9.6)	0.0044 (0.0048)

^aAssumes 99 percent conversion of carbon in fuel to CO₂ with 87 weight percent carbon in diesel, average BSFC of 7,000 Btu/hp-hr, and diesel heating value of 19,300 Btu/lb

^bPM₁₀ = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be less than or equal to 1 µm in size

are far greater than the small quantities of emissions released by the operation of the generators. For example, the total annual emissions of CO from the operation of the generators would be a negligible 0.015 metric tons (0.016 tons) compared to the *de minimis* threshold of 91 metric tons (100 tons) for nonattainment areas. The CO emissions would account for less than half of one percent of the *de minimis* value for CO. The remaining pollutant emissions are similarly insignificant. Therefore, no significant air quality impacts would be expected from the operation of generators.

In the unlikely event of a test-failure scenario, it is possible that a TBP filled canister would fail to rupture after the gun was launched. The TBP canister would fall over the cleared gun pad and rupture upon impact with the ground. It is also possible that a spill would occur and release the entire contents of the canister in one location. Under these scenarios, the receiving environment for TBP would be primarily limited to soils at the 3K North site, and there would be no significant air quality impacts.

4.2 Airspace

If the line charge fails to rupture the canister, the canister would reach its maximum ascent altitude (2,438 meters [8,000 feet]). The proposed tests would not affect airspace above 2,438 meters (8,000 feet). NOTAMs would be issued 48 hours prior to the proposed tests, and no Restricted Areas or MOAs in the surrounding region would be affected. In addition, airspace would not be affected in the event of a spill. Therefore, no significant impacts to airspace would be expected.

4.3 Biological Resources

According to the worst case scenario considered in PEGEM models, the greatest concentration of TBP that vegetation or wildlife could be exposed to would be 100 milligrams per square meter. However, exposure to this concentration would be limited to species located in the area surrounding the vertical gun and the immediate 3K North site, see Exhibit 2-4.

TBP's defoliant properties could produce short-term effects to juniper vegetation present within the ROI, resulting in increased leaf dehydration and premature leaf shedding. However, any such defoliation impacts would not be anticipated to result in long-term harm to vegetation or result in plant death. Conducting tests under low wind conditions would help ensure that the TBP plume would remain primarily at the 3K North site, which would be cleared of vegetation. Additionally, TBP is known for its rapid photodecomposition properties. Should any TBP droplets come in contact with water, the droplets would likely photodecompose prior to mixing with the water and would not be absorbed by plants. (Alexander, Pers. comm.)

Given the environmental setting at EMRTC and the frequency of other testing, the noise created from the proposed tests would be similar to other noises created at the facility on a daily basis. Thus, it is unlikely that the proposed tests would elicit startling or behavioral disturbances in wildlife present in the ROI. Wildlife may vacate the immediate 3K North site prior to the tests due to increased human activity, including noise produced by vehicles and generators.

Although it is unlikely that birds would come in contact with the aerosol TBP cloud produced by the proposed tests, PEGEM model runs indicate that concentrations of the simulant would not approach the toxic levels described in Section 2.1.4. As shown in Exhibits 2-4 and 2-5, TBP levels of up to 100 milligrams per square meter would be present closest to the vertical gun, and decrease to 0.1 milligrams per square meter as distance from the gun approaches 5 kilometers (3 miles). (Richardson, 2004) Exposure to TBP can result in eye, respiratory, and skin irritation based on previous laboratory studies, see Appendix D. However, Material Safety and Data Sheets (MSDS) data and toxicology data presented in Section 2.1.4 do not indicate that concentrations of TBP associated with the proposed tests would harm species. Research included in MSDSs for TBP indicates that the compound can affect cholinesterase activity; however, in laboratory species this phenomenon was reversed when exposure to TBP stopped. (Appendix D) It is improbable given TBP's rapid photodegradation that the compound would be orally ingested by wildlife.

Based on previous studies (that included algae, gammarid, rainbow trout, fathead minnow, *Daphnia magna*, and amphipod), aquatic organisms are thought to be the most sensitive receptors for TBP. (Appendix D) Aquatic toxicity levels for these species to TBP ranged from 1.7 milligrams per liter to 13.0 milligrams per liter. (Appendix D) One spring is located near the 3K North test site within Nogal Canyon; however, it is a small spring with limited potential to support aquatic species. Additionally, no threatened or endangered species such as the Socorro isopod or spring snails, are known to be present at the 3K North site. Therefore, no significant impacts to aquatic species would be expected.

TBP was selected for use in the proposed tests because of its ability to mimic the properties of chemical weapons, with minimal impacts to natural resources, including plant and animal species. Given the short timeframe and limited duration of the proposed tests and the general lack of wildlife or aquatic environs near the 3K North site, no significant impacts to wildlife would be expected. The use of spill prevention and containment measures implemented at the 3K North site during the loading and launch of the vertical gun would also reduce or eliminate potential impacts to biological resources. In addition, there would be no effects to endangered, threatened, or proposed species, New Mexico Species of Concern, or designated or proposed critical habitat as a result of this proposed action.

4.4 Cultural Resources

There are several known archaeological sites at EMRTC; however, tests are designed to avoid these sites. None of the known archaeological sites are located near the 3K North test site. (Stanley, Pers. comm.) The test site was investigated for archaeological remains when the site was developed in 1986, and it was determined that activities at the site would have no effect on historic properties. (Stanley, Pers. comm.) Additionally, ground disturbances at the site for the proposed tests would be limited to stabilizing the structure that would hold the vertical gun. Should any ground disturbances reveal previously undiscovered archaeological artifacts or remains, activities at the site would be halted until coordination with the SHPO could occur. In the unlikely event of a failed test scenario or a spill, the TBP would be released in a small area and would have the potential to impact cultural resources located in the area of impact. However, under a failed test scenario or a spill, the TBP would be released within the 3K North site where no cultural resources are known to exist. Therefore, activities associated with the proposed tests would not be expected to impact cultural resources.

4.5 Geology and Soils

Soil and ground disturbing activities associated with the proposed tests would consist of gun placement and setup. A 9.3-square meter (100 square-foot) area would be cleared of vegetation. (Stanley, Pers. comm.) A 6.1- by 7.6-meter (20- by 25-foot) area within the larger area would be leveled, and gravel would be placed to accommodate the vertical gun. The area where the gun would be placed has already been disturbed by other tests, and this type of activity is consistent with EMRTC's standard operations. No other ground disturbing activities would be associated with the proposed tests; and therefore, no significant geology and soils impacts would be expected.

TBP droplets that fall onto the ground would be expected to photodegrade within a few hours when exposed to the sun's ultraviolet rays. The dye would also break down rapidly; however, some dye may be visible for up to a few months. These estimates are based on observations from previous horizontal experiments with TBP at EMRTC. (Stanley, Pers. comm.)

During a successful test, only a limited concentration of TBP would be deposited in any one area; and therefore, it is unlikely that there would be a significant amount of TBP absorbed into the ground in any location. Many exposed soil surfaces in the area are extremely hard due to the limited rainfall; this would limit the absorption of TBP into the ground. If all the TBP were deposited in one spot (due to a spill or a failed test), the EMRTC crew would clean up the spill according to existing procedures. (Stanley, Pers. comm.) Therefore, no significant geology and soils impacts would be expected.

4.6 Hazardous Materials and Hazardous Waste Management

TBP is not a regulated compound under the Comprehensive Environmental Response, Compensation, and Liability Act; Resource Conservation and Recovery Act; Department of Transportation or the New Mexico Hazardous Waste Act. In addition, there are no reportable quantities or cleanup standards established for TBP. TBP would be supplied by the Battelle Memorial Institute in pre-filled canisters. Battelle has supplied EMRTC with pre-filled TBP canisters for previous horizontal gun tests and would follow their existing handling, safety, storage, and transportation protocol. (Stanley, Pers. comm.) EMRTC would generate standard operating procedures (SOPs) for the proposed tests that would include handling and loading TBP canisters into the gun at EMRTC. In the unlikely event of a failed test or the inadvertent spill of TBP, hazardous materials and hazardous debris protocols at the facility would be implemented by the EMRTC staff. Because existing MSDS safety guidelines, handling, storage, spill prevention, and

transportation protocols for TBP at the facility would be followed, no significant hazardous materials impacts would be expected from the use of TBP.

Approximately 54 kilograms (120 pounds) of explosives would be used in the vertical gun per test and 1.4 kilograms (3 pounds) of explosives would be used for each line-charge in the canisters. EMRTC currently maintains SOPs for the handling of energetic materials, which are updated annually. (Stanley, Pers. comm.) The use of explosives for the proposed tests would be consistent with the standard operations of the test facility. Similarly, diesel-powered generators that would be used to support the proposed tests are frequently used to support testing operations at the facility. Therefore, no significant hazardous materials impacts would be expected from the use of explosives or diesel-powered generators. Hazardous waste materials and test byproducts at EMRTC, including products that result from failed tests or inadvertent spills, are disposed of in accordance with Federal, State, and local regulations. (Stanley, Pers. comm.) Any hazardous wastes resulting from the proposed tests would be disposed of according to all applicable laws and regulations. Therefore, no significant hazardous waste management impacts would be anticipated.

4.7 Health and Safety

EMRTC would generate test specific SOPs to include the loading and operation of the vertical gun. All persons associated with the test would be briefed on the SOPs prior to any testing activity. Personnel present for the proposed tests would be located in bunkers, the closest of which would be approximately 1,500 meters (1,650 yards) from the gun mount. (Stanley, Pers. comm.) The limited amount of construction required to set up the gun is within the normal operations of the test facility, and the personnel conducting these operations would follow existing SOPs.

Access to EMRTC is restricted by a security checkpoint at the entrance of the grounds. Gates that restrict access to sites during active test periods are present along the access roads throughout the facility. Gates surrounding the 3K North site would be closed during the vertical gun launches to prevent EMRTC employees not associated with the test from inadvertently entering the site.

The closest private property is located to the north of the proposed test site and consists of sparsely populated ranchlands that are cordoned off with cattle fencing. This fencing serves as a barrier to prevent public access to EMRTC property. (Stanley, Pers. comm.) The area to the west of the test range is an open semi-arid desert area with no apparent private dwellings. Property to the south and east of the site consists of the EMRTC field laboratory. All of these factors serve to prevent individuals not associated with the test from gaining access to the test

range, thus limiting the hazard to the public. The proposed tests would be conducted in the morning, when low wind velocities would limit the dispersion of the TBP plume.

The proposed tests are similar to other defense-related testing operations at EMRTC in terms of risks to health and safety. In the unlikely event of a test-failure scenario or inadvertent spill, EMRTC staff would adhere to health and safety protocols defined in the facility's health and safety plan. Therefore, no significant health and safety impacts would be expected.

4.8 Land Use

The proposed tests would not result in changes to land use patterns at EMRTC, the NMT campus, or the community of Socorro. The proposed tests are typical of the intended and ongoing land use activities at the EMRTC facility. The remote location and designated land use patterns of the facility accommodate test-failure scenarios and inadvertent spills. Therefore, no significant land use impacts would be expected.

4.9 Noise

The proposed tests would use two to three generators to power sensors and test support equipment. Two of these generators are considered to be quiet when operating, and no hearing protection or noise dampening shrouds would be required. If a third and louder generator is required to support testing activities, personnel operating the machinery would be required to wear hearing protection. To calibrate sensor equipment and prepare for the tests, the generators would likely run for up to 24 hours on test days. (Stanley, Pers. comm.) The use of these generators would be consistent with existing operations at EMRTC. The noise produced by the generators would be temporary and would not be heard in the community of Socorro. Therefore, no significant noise impacts would be expected from the use of generators during the proposed tests.

The primary noise associated with each test would be from firing the vertical gun. Noise produced from the gun is expected to be around 140 decibels. (Stanley, Pers. comm.) This is similar to the noise produced by the firing of tank artillery or jet flyovers at low altitudes. Given that the line charge used to rupture the canister uses significantly less explosives than the amount of explosives used to fire the gun and the fact that the line charge will go off 0.33 seconds after the gun is fired, the only perceived sound from the test would be from the gun. The extremely short flight time of the canister and its relatively small size would prevent any sonic boom generated from the canister's supersonic flight from being louder than the sound generated from the gun.

During the time that on-site research was being conducted to assess the potential impacts of the proposed vertical gun launches, EMRTC was conducting artillery tests at a distance of approximately 1.7 kilometers (1 mile). This testing is characteristic of the noises that would be produced from the firing of the vertical gun. This noise was not loud enough to cause auditory pain or startle personnel at the site. The community of Socorro would be further buffered from the noise generated during the proposed tests by the mountainous topography surrounding the facility, and it is highly unlikely that the noise associated with the gun would be audible at that distance. Sounds produced from firing the gun are consistent with normal operations of EMRTC, and a test failure would not alter the noise levels anticipated to result from the proposed tests. Therefore, no significant noise impacts would be expected.

4.10 Socioeconomics and Environmental Justice

Operational activities at EMRTC serve as an economic stimulus for the community of Socorro. NMT and the affiliated EMRTC facility add to the salary base of the region. Visiting scientists, researchers, and individuals receiving training at the facility contribute income to the local service industries, including hotels and restaurants. While the local economic benefits to the community from the proposed tests would not be considered significant, visitors and test-related activities would provide short-term economic financial benefits to the region.

Property surrounding the 3K North site is undeveloped, and adjacent properties either belong to NMT, BLM, or private ranchers. The closest residence is located several miles to the north of the proposed test site. Additionally, demographic data, as discussed in Section 3.10, does not reveal the presence of disproportionately low-income or minority populations adjacent to EMRTC property boundaries. Therefore, no adverse impacts to minority or low-income populations would be expected.

4.11 Transportation and Infrastructure

The additional demand placed on the existing transportation network surrounding the Socorro community from the addition of approximately 25 people to support and observe the proposed tests for a period of roughly two weeks would be minimal. No significant impacts to road, rail, or air transportation would be expected.

The additional demand placed on EMRTC's electricity, water supplies, and wastewater and solid waste disposal services by the proposed action would not result in adverse impacts. The presence of approximately 25 people for a period of roughly two weeks would be inconsequential compared to the existing infrastructure capacities.

One or two generators operating over approximately 24 hours per test at a maximum capacity of 60 kilowatts would be used to power the sensors. A third generator may be employed if necessary, and existing hard-line electricity would supply power for operation of the vertical gun. Energy needs for the proposed tests would be met by mobile sources and preexisting power capacity located at the test site. Therefore, no significant transportation or infrastructure impacts would be expected.

4.12 Visual Resources

Because of the mountain ranges surrounding EMRTC, it is unlikely that the dye-enhanced TBP plume would be visible from the community of Socorro. (Stanley, Pers. comm.) If the plume rose to heights that make it visible to the community, an aesthetic impact could occur. However, this impact would be temporary because the TBP plume would dissipate rapidly. Further, brief visibility of the TBP plume would be characteristic of visual cues produced during other tests at EMRTC that are occasionally perceptible by the community.

The TBP plume is expected to deposit dye droplets on the mountain ranges around the site. Based on past experiments at EMRTC with dye enhanced TBP, the droplets would remain visible on the ground for only a few days in most locations, though the dye may be observed for up to a few months on hard surfaces such as exposed rock. (Stanley, Pers. comm.) A test-failure or inadvertent spill could result in the deposition of test debris and dye in one location that could temporarily affect visual resources. However, any such impacts would be consistent with the facility's intended operations. Therefore, no significant visual resource impacts would be expected from the TBP, dye, or test debris.

4.13 Water Resources

As discussed in Section 3.13, surface water resources at the EMRTC facility and the 3K North site are limited given the semi-arid climate and mountainous topography. Due to its location, the proposed tests would not have the potential to affect floodplain or wetland resources. While several arroyos are present near the test site, these remain dry except during or immediately following rain events that typically occur in July or August. Therefore, no significant impacts to surface water would be expected.

During the month of June, winds are typically from the south. If tests were conducted when winds were from the south, modeling indicates the spring located in Nogal Canyon could possibly serve as a receptor for TBP droplets. PEGEM models indicate that TBP concentrations at that distance would be approximately 1

to 10 milligrams per square meter, which would be unlikely to significantly impact the water quality of the spring.

Though not used for potable water sources, ground water associated with the Rio Grande aquifer system provides water to the five wells present at EMRTC. Depth to ground water at the facility is typically several hundred feet. Annual monitoring for testing-related contaminants in ground water would continue. However, no published studies regarding TBP's potential to contaminate ground water have been identified, though the compound is reported to break down within moderate time periods in acidic, neutral, or alkaline water. Given the amount of TBP that would be used and its likelihood to photodegrade in ultraviolet light, no significant impacts to ground water resources would be expected. In the unlikely event of a test failure or spill, it is possible for the TBP to impact soils in one location rather than being dispersed, as is proposed to happen during a test. Because of spill prevention and cleanup protocols, soil impermeability, and the depth to ground water, no significant ground water impacts would be expected.

4.14 Cumulative Impacts

According to 40 CFR § 1508.7, cumulative impacts can be defined as "...the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

For this analysis, cumulative impacts include impacts from the proposed tests and reasonably foreseeable tests at EMRTC. Because the proposed test activities would occur at EMRTC, an existing facility designated for testing explosives, munitions, and other defense related experiments, no cumulative impacts are anticipated from the six proposed vertical gun launches using TBP as a threat simulant. Cumulative impacts would not be anticipated when viewing the proposed action in conjunction with current facility operations. However, should the nature of testing at EMRTC or testing procedures be altered in the future to include different test activities, repetitive tests, different threat simulants, or other activities that would result in the release of additional emissions, the potential for cumulative environmental impacts would need to be reevaluated on a facility-wide basis for each resource area.

Air Quality. No exceedances of air quality standards for criteria pollutants or health-based standards for non-criteria pollutants would be anticipated from the proposed tests. Given the limited number of tests (at most six tests), the short duration of each test (a few hours), and the short timeframe for completion of all tests (two weeks), impacts to air quality would be localized and temporary. Thus, the TBP would photodegrade and decompose in the open environment, and any

test-related emissions would be dispersed. No cumulative air quality impacts would be expected from the proposed tests.

Airspace. NOTAMs would be issued prior to any proposed tests, and air traffic would be temporarily rerouted to avoid the test site. Given the operational characteristics of the EMRTC facility, NOTAMs are issued for other test events that have the potential to affect aircraft. Because the proposed tests would be limited, short-term events, no cumulative impacts to airspace would be expected.

Biological Resources. Given the facility's size and mountainous location, it is unlikely that operational activities at EMRTC would affect the regional diversity of animal and plant species or their habitat. Additionally, no known threatened or endangered species or critical habitats are present at the facility. Cumulative biological impacts would not be anticipated when considering the proposed tests in conjunction with other current facility operations.

Cultural Resources. Known archaeological sites at the facility would be avoided and coordination with the SHPO would occur prior to any future ground disturbing activities. No cumulative impacts would be expected to result from the proposed tests or reasonably foreseeable test-related activities at EMRTC.

Geology and Soils. Given that soils at the site are previously disturbed and no invasive ground disturbing activities are associated with the proposed action, no cumulative geological or soil impacts would be anticipated.

Hazardous Materials and Hazardous Waste. No cumulative impacts would be expected to result from the proposed tests, as EMRTC handles, stores, transports, and disposes of all hazardous materials and hazardous wastes in accordance with applicable Federal, State, and local regulations.

Health and Safety. Existing facility-wide SOPs for health and safety, SOPs developed specifically for loading and operating the vertical gun would mitigate the potential for adverse effects. No cumulative health and safety impacts would be expected.

Land Use. No cumulative land use impacts would be expected at EMRTC, the NMT campus, or the community of Socorro.

Noise. While the proposed tests would result in temporary noise effects, no long-term or cumulative noise impacts would be expected.

Socioeconomics and Environmental Justice. No cumulative socioeconomic or environmental justice impacts would be expected from the proposed tests.

Transportation and Infrastructure. No cumulative transportation or infrastructure impacts would be expected.

Visual Resources. Because the proposed tests would be limited to a maximum of six events, no cumulative visual resource impacts would be expected. The proposed tests in conjunction with other reasonably foreseeable tests would have no significant visual resource impacts.

Water Resources. Because the proposed tests would be limited to six test events, no cumulative water resource impacts would be expected.

4.15 No Action Alternative

Under the no action alternative, the proposed tests using TBP would not occur from the 3K North site. Other unrelated tests at EMRTC would continue to occur and would have the potential to impact the environment.

Air Quality. There would be no impacts to air quality associated with the proposed tests, including impacts from the use of TBP. Socorro County is in attainment for all criteria pollutants; however, testing activities at the facility would remain status quo, resulting in the release of NO_x, particulate matter, and other emissions characteristic of mobile sources and explosives, controlled burning, and munitions testing at EMRTC. The facility would continue to coordinate these releases with NMED, as appropriate.

Airspace. Under the no action alternative, the proposed tests would not occur, and no NOTAMs associated with the proposed tests would be required. Other unrelated tests at the EMRTC field laboratory may have the potential to impact airspace and could require NOTAMs.

Biological Resources. Under the no action alternative, no proposed tests at the 3K North site using TBP would occur. Consequently, no biological resource impacts would be expected.

Cultural Resources. Under the no action alternative, no proposed tests using TBP as a simulant would occur, and no cultural resource impacts would be expected. Operations at EMRTC would continue on a status quo basis, and the facility would coordinate with the SHPO prior to ground disturbing activities. Existing archaeological sites at EMRTC would be avoided, and should future testing activities reveal archaeological remains, EMRTC would cease activity at the site and coordinate with the SHPO.

Geology and Soils. Under the no action alternative any potential impacts to geology and soils related to the proposed tests would not occur.

Hazardous Materials and Hazardous Waste. Under the no action alternative, hazardous materials and waste associated with the proposed tests would not be produced. However, hazardous materials and waste associated with explosives, munitions, and artillery testing would continue at the facility.

Health and Safety. Under the no action alternative, there would be no proposed tests using TBP; and therefore, none of the potential impacts to health and safety would occur. The purpose of the proposed action is to allow MDA to better predict the dispersion of simulated chemical weapon threats that could compromise public health and safety. Without data obtained from the proposed tests using TBP as a threat simulant, MDA would be unable to verify necessary data and would be forced to rely on data produced from computer-based simulation rather than field-tested observations.

Land Use. The no action alternative would result in the continuation of current land use patterns surrounding the NMT campus, EMRTC, and the community of Socorro, and no land use impacts would be expected.

Noise. Under the no action alternative, noise associated with the proposed tests would not occur. However, noises associated with explosives, munitions, and artillery testing would continue at the facility.

Socioeconomics and Environmental Justice. Under the no action alternative, no proposed testing would occur at the 3K North site, and it is unlikely that the vertical gun would be developed or used for future tests. Revenue generated by research, testing, and training activities at EMRTC supply a large portion of the income for the community of Socorro. Local hotels and restaurants benefit substantially from the number of scientists, researchers, and individuals receiving training at the facility that visit the community annually. Although the no action alternative would not affect employment trends in the region, it would place limitations on the current and future test capabilities of EMRTC. This phenomenon could inadvertently result in adverse economic effects for the community.

Under the no action alternative, there would be no Federal action and therefore, no compliance with Executive Order 12898 would be considered.

Transportation and Infrastructure. There would be no transportation and infrastructure impacts under the no action alternative.

Visual Resources. Under the no action alternative, no visual resource impacts from the proposed tests would occur. However, other testing and operations would continue at EMRTC that may produce smoke or other events that may be visible to the community of Socorro.

Water Resources. Under the no action alternative, no proposed tests using TBP as a simulant would occur. Thus, no water resource impacts would occur. Other testing activities at EMRTC would continue on a status quo basis, and monitoring of the five wells present at the facility for testing-related contaminants would continue with NMED, as required.

4.16 Adverse Environmental Effects that Cannot be Avoided

Adverse environmental effects that cannot be avoided include minor short-term impacts to air quality, noise, visual resources, and hazardous materials. Products from the degradation of TBP, TBP itself, and emissions from generator and gun use would enter the atmosphere. Any hazardous wastes or debris generated would be managed in compliance with applicable regulations.

4.17 Irreversible or Irretrievable Commitment of Resources

No impacts to threatened or endangered species or critical habitat would be expected. The amount of raw materials required for program-related activities would be small. Some irreversible or irretrievable commitment of resources would occur, such as dedication of raw materials or labor required for proposed test events. This commitment of resources is not significantly different from that necessary for other research and development programs carried out at EMRTC. The proposed action would temporally limit the use of the 3K North site during set up and testing. However, once the tests are complete, the gun mount could be dismantled to allow for other test equipment at the test site. Proposed activities would not commit natural resources in significant quantities.

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Personal Communications

Alexander, Dr. Carl, 2004. Senior Research Leader, Battelle Memorial Institute, with Maggie O'Connor, ICF Consulting, March 15, 2004.

Banks, Marvin, 2004. Program Manager, Hazardous Testing, EMRTC, with Maggie O'Connor, ICF Consulting Inc., March 8, 2004.

Richardson, Dr. Martin B., 2004. Project Manager, BAE Systems Analytical Solutions Inc., with Pam Schanel and Maggie O'Connor, ICF Consulting Inc., February 3, 2004.

Sanchez, Rick, 2004. City of Socorro, with Jennifer Cregar and Maggie O'Connor, ICF Consulting Inc., February 20, 2004.

Stanley, Mike, 2004. Associate Director, Applied Technology and Test Division, EMRTC, with Peter Frantz and Maggie O'Connor, ICF Consulting Inc., March 2, 2004.

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6. LIST OF PREPARERS

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Contractor Preparers

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Experience: 29 years of environmental assessment management experience

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Affiliation: ICF Consulting
Education: BA Environmental Public Policy
Experience: Seven years of environmental assessment experience

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Affiliation: ICF Consulting
Education: BS Biology
Experience: Two years of toxicology and environmental assessment experience

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Education: BA Environmental Science and Environmental Management
Experience: One year of environmental assessment experience

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Affiliation: ICF Consulting
Education: BA Earth Sciences and Environmental Studies
Experience: Seven years of natural resource management and environmental assessment experience

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7. AGENCIES CONTACTED

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New Mexico Ecological Services Field Office
Ms. Joy Nicholopoulos
U.S. Fish and Wildlife Service
2105 Osuna Road, NE
Albuquerque, New Mexico 87113

New Mexico State Historic Preservation Office
Historic Preservation Division, Office of Cultural Affairs
Ms. Katherine Slick
228 East Palace Avenue
Santa Fe, New Mexico 87503

Office of the Secretary, New Mexico Environment Department
Mr. Gedi Cibas
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, New Mexico 87502



DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

February 12, 2004

Gedi Cibas
Office of the Secretary, New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

RE: Proposed vertical gun launch experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Test Center Socorro, New Mexico

Dear Mr. Cibas:

In accordance with the National Environmental Policy Act, the Missile Defense Agency (MDA) is preparing an Environmental Assessment to evaluate the potential environmental consequences of using thickened tributyl phosphate (TBP) as a threat agent simulant in a maximum of six tests at the Energetic Materials Research Test Center's (EMRTC) 3 K North site. The EMRTC is part of the New Mexico Institute of Mining and Technology (NMT), which is located near Socorro, New Mexico. The objective of the tests is to provide MDA with data regarding drop size and dispersion of simulated threat agents. This test series is a separate action from that addressed at the White Sands Missile Range in the on-going Intercept Debris Measurement Program Environmental Assessment.

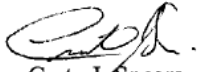
Under the Proposed Action, canisters containing 50 kilograms (110 pounds) of dye-enhanced thickened TBP would be launched from the EMRTC 3 K North site and discharged at an altitude of approximately 0.5 kilometers (1,600 feet). Aerosol and droplet debris resulting from the launches would be monitored by sensors including radars and lidars. Approximately one dozen witness cards would also be placed on the ground to receive TBP droplets and would be used as a secondary data source. No new construction or ground disturbances would be required to accommodate the proposed tests. Additionally, go/no go test conditions would be established based on meteorological conditions. The tests are proposed to occur in June or July, 2004. A location map identifying the test site and the potential region influence (ROI) has been included for your reference. The ROI was determined based on "worst case" scenario modeling that included temperatures, wind direction and velocities based on historic data.

To assist MDA in assessing the potential for this project to result in environmental impacts, we are requesting a list of special status species or habitats that may be present in the ROI, as well as information pertaining to any other environmentally sensitive

issues within the ROI. Please indicate any such items present within the ROI on the enclosed map and return it via mail to the address indicated on the shipping label.

Thank you for your assistance in this matter. If you require further information to complete this request, please contact me directly at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,



Crate J. Spears
Environmental Manager

Cc: Deborah K. Shaver, ICF
Edgar Deskins, MDA

Enclosures as stated

Hola Pam,

Regarding our phone conversation on endangered and threatened species in New Mexico information, here are a couple of links to the Threatened and Endangered Species of New Mexico Biennial Review 2000 and Draft Biennial Review 2002.

www.gmfsh.state.nm.us/PageMill_TExt/NonGame/endangered.html

www.gmfsh.state.nm.us/PageMill_Images/NonGame/biennial2000.pdf

www.gmfsh.state.nm.us/PageMill_Images/NonGame/biennial5-13-02.pdf

Additional and more specific information, with references, on the individual species listed in these two documents can be found at

<http://fwie.fw.vt.edu/states/nm.htm>

If you have any additional or more specific questions please feel free to contact me.

Thanks,

Shann



DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

February 12, 2004

Ms. Katherine Slick
New Mexico State Historic Preservation Office
Historic Preservation Division, Office of Cultural Affairs
228 East Palace Avenue
Santa Fe, NM 87503

RE: Proposed vertical gun launch experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Test Center Socorro, New Mexico

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Pursuant to 36 CFR 800, MDA is requesting the view of the State Historic Preservation Officer on the on the proposed actions. Additionally, MDA is requesting that the State Historic Preservation Officer identify historic properties that are listed in, or are eligible for listing in the National Register of Historic Places that are present within the ROI.

Included with this letter is a return shipping label. Please identify any potentially affected properties and return the map via mail to the address indicated on the shipping label.

Thank you for your assistance in this matter. If you require further information to complete this request, please contact me directly at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,



Crate J. Spears
Environmental Manager

Cc: Deborah K, Shaver, ICF
Edgar Deskins, MDA

Enclosures as stated

February 25, 2004

Crate J. Spears
Environmental Manager
Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington, DC 20301-7100

Re: *Proposed vertical gun launch experiments using tributyl phosphahate as a threat agent stimulant at New Mexico Institute of Mining and Technology's Energetic Materials Research Test Center Socorro, New Mexico.*

Dear M. Spears:

We have received your request for information pertaining to the known historic properties within the proposed project area for the above undertaking. For your planning use, enclosed you will find a list from the State of New Mexico's Archaeological Records Management Section (ARMS) of the known and documented archaeological sites within the project's area of potential effect (APE). We have also enclosed a map showing their distribution. This locational information is protected and not to be disclosed to the public.

You will note that there has been some block survey work for cultural resources west and southwest of Strawberry Peak. However, most of the APE appears to have not been surveyed for archaeological or historic properties. Also enclosed you will find a list of information we ask to receive in order to conduct a Section 106 review under the National Historic Preservation Act. We are also enclosing for your use a list of Tribal Government officials, and list of their geographic areas of interest.

If you have any further questions regarding our eligibility determinations or our comments, please feel free to contact me at (505) 827-6314.

Sincerely,

Phillip A. Young
Staff Archaeologist
enclosures
Log # 70388

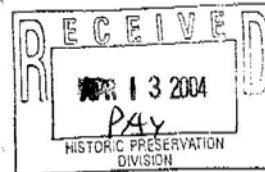


DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

070858

April 5, 2004

Ms. Katherine Slick
New Mexico State Historic Preservation Office
Historic Preservation Division, Office of Cultural Affairs
228 East Palace Avenue
Santa Fe, NM 87503



Reference Number: 70388

Re: Proposed vertical gun test experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Testing Center Socorro, New Mexico

Dear Ms. Slick:

The Missile Defense Agency (MDA) has identified information on historic properties that are listed or are eligible for listing on the National Register of Historic Places as well as other historic sites designated by the State of New Mexico, which may occur in the Area of Potential Effects (APE)/Region of Influence (ROI). The MDA considered impacts to cultural resources and included a discussion on cultural resources in the *Draft Vertical Gun Test Environmental Assessment* scheduled to be released for public review in April 2004. This letter and associated exhibits identified in the letter are intended to address required items identified in the New Mexico State Historic Preservation Office's *Standard Information Needed for Section 106 Consultation*.

The proposed tests would occur at the New Mexico Institute of Mining and Technology (NMT) which is located near Socorro, New Mexico, approximately 120 kilometers (75 miles) south of Albuquerque. Socorro County is located in central New Mexico and encompasses approximately 17,220 square kilometers (6,649 square miles). Aside from the Rio Grande River, the setting is semi-arid Chihuahuan Desert that includes mountains, valleys, high plains, and grasslands. NMT's Energetic Materials Research Testing Center (EMRTC) is located in the mountains adjacent to NMT, and has more than 30 test facilities located on a 104 square kilometer (40 square mile) field research complex. EMRTC performs 200 to 300 field tests per year for clients such as the Department of Defense, U.S. Environmental Protection Agency, and Lockheed-Martin Corporation. EMRTC's location in the mountains allows for natural containment and shielding of tests performed at the facility given topographic and climatic conditions.

NMT and its affiliated research and development facilities are closely tied to land use within the County. Its institutions include: the Langmuir Laboratory for Atmospheric Research, EMRTC, the Geophysical Research Center, the Bureau of Mines and Mineral Resources, and the Petroleum Research and Recovery Center.

The EMRTC facility consists of multiple buildings that house its research and development activities, which typically pertain to the design, development, and testing of weapons, munitions, and other defense related projects. The EMRTC field laboratory is located near Socorro Peak and occupies 83 square kilometers (32 square miles). The 3K North test site is located within the northwestern portion of the EMRTC field laboratory. Please see Exhibit A for photos of the proposed test location.

Nestled between mountains, land surrounding the proposed 3K North site belongs to EMRTC and remains undeveloped except for facilities such as bunkers or platforms associated with testing activities. The closest private property is located to the north of the 3K North site, and is used for ranching. Only one residence is located within this area, and it is located several miles from the EMRTC facility. Although cattle fencing separates much of the EMRTC boundary, cattle grazing has been known to overlap onto EMRTC property.

The APE/ROI for the proposed tests consists of the area where Post-Engagement Ground Effects Model (PEGEM) modeling has predicted TBP droplets would be deposited during a test. PEGEM modeling shows the potential for the APE/ROI to extend into off-site locations under some test scenarios. The APE/ROI would not include the Community of Socorro because tests would not be conducted such that TBP droplets could be deposited in the Community of Socorro. The APE/ROI for any one test would be significantly smaller than the area indicated in Exhibit B.

The proposed tests are similar to existing testing operations at EMRTC. MDA proposes to conduct up to six vertical gun tests within a two-week period at the NMT 3K North site. Canisters containing tributyl phosphate (TBP) would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and dry conditions persist which would prevent the TBP from dispersing over a wide area and prevent deposited TBP from being absorbed in surface water. The canisters would contain approximately 50 kilograms (110 pounds) of TBP thickened using polybutyl methacrylate enhanced with blue dye for observation purposes. A small amount of explosives would be used to rupture the canister tanks during ascent at an altitude of approximately 500 meters (1,640 feet), resulting in the creation of a brief aerosol debris cloud and the subsequent dispersion of TBP droplets. TBP droplets would be monitored using several remote sensing methods.

According to the National Park Service, there are currently 49 historic properties located in Socorro County that are listed on the National Register of Historic Places (NHRP). Of

these 40 sites, 10 sites are Pueblo archaeological sites of the Chupadera Arroyo, located approximately 40 kilometers (25 miles) east of Socorro, near the town of Bingham, New Mexico. NRHP sites in or near the community of Socorro include the Hammel Illinois Brewery, the Val Verde Hotel, Fort Craig, Fitch Hall, and the Garcia Opera House.

Two national monument sites are present within Socorro County. The Salinas Pueblo Missions, also known as the Gran Quivira National Monument, occupies 10,769 acres (4,358 hectares), and is located east of the Rio Grande River in the eastern portion of the County. With civilization at the site dating between 1,000 and 1,700 AD, it is a former village of the Pueblo Indians that contains the remains of early dwellings and religious structures. The second national monument site within Socorro County is known as the Trinity Site, located in the southeastern portion of the County at the White Sands Missile Range, approximately 193 kilometers (120 miles) south of Albuquerque. The site was added to the NRHP in 1966 and has been a National Historic Landmark since 1975 due to its military significance to the nation. The Trinity Site occupies 364,800 acres (147,627 hectares), and served as the site of world's first nuclear bomb detonation on 16 July 1945.

A search of the New Mexico State Register of Cultural Properties revealed 86 listed cultural properties in the Community of Socorro. None of these properties are located within the 3K North Test Site and none of the sites appear to be located within the APE/ROI.

Several archaeological sites are located throughout the EMRTC facility, and archaeological investigations are ongoing; however, tests are designed to avoid these areas. The 3K North site was investigated for archaeological remains upon its development in 1986. It was determined that no archaeological resources were present at the location. Although the entire APE/ROI has not been surveyed for archaeological or historic properties; no known or documented properties are located within the APE/ROI for the proposed action.

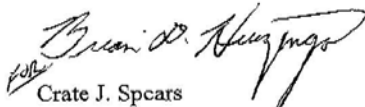
Ground disturbances at the 3K North site for the proposed tests would be limited to stabilizing the structure that would hold the vertical gun. Should any ground disturbances reveal previously undiscovered archaeological artifacts or remains, activities at the site would be halted until coordination with the SHPO could occur. In the unlikely event of a failed test scenario or a spill, the TBP would be released in a small area and would have the potential to impact cultural resources located in the area of impact. However, under a failed test scenario or a spill, the TBP would be released within the 3K North site where surveys have been conducted and no cultural resources are known to exist. TBP that falls onto the ground would be expected to photodegrade within a few hours when exposed to the sun's ultraviolet rays. Therefore, activities associated with the proposed tests would not be expected to impact cultural resources.

The proposed tests would not change the existing land uses at the 3K North site or within the APE/ROI. The proposed tests would not have consequences for Native American interests or concerns. There would be no expected impacts to traditional places of cultural or religious concern to Native American groups. The MDA has made a good faith effort to identify sensitive cultural or religious properties of significance to Native American groups. Therefore, no additional actions or consultations are proposed regarding Native American interests or concerns.

Based on the MDA's review of the proposed project under Section 106 of the National Historic Preservation Act, it has been determined that this project will have no adverse effect on historic properties. No sub-surface excavation activities would occur as a result of the proposed undertaking, therefore, no impacts would occur to potential archeological resources within the APE/ROI. Finally, no historic structures exist at the 3K North site and no historic properties within the APE/ROI would be impacted by the proposed operations.

The MDA requests your comments on the determination that the geographic area associated with the proposed undertaking does not contain historic properties that would be affected. If we do not hear from you within 30 days, we will assume that you concur with our determination and will proceed accordingly. Thank you for your assistance in this matter. If you require further information to complete this request, please contact me at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,


Crate J. Spcars
Environmental Manager

Cc: Phillip Young, Historic Preservation Division
Deborah K. Shaver, ICF
Edgar Deskins, MDA

Enclosures as stated

This undertaking will not have an adverse effect on registered or eligible properties.

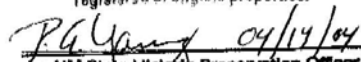

for NM State Historic Preservation Officer

Exhibit A: Photos of the Proposed Test Location

View to the South from the Proposed Test Location



1

Exhibit A: Photos of the Proposed Test Location

View to the East from the Proposed Test Location



Exhibit A: Photos of the Proposed Test Location

View to the North from the Proposed Test Location



Exhibit A: Photos of the Proposed Test Location

View to the West from the Proposed Test Location



Exhibit A: Photos of the Proposed Test Location

View from the South West Hills

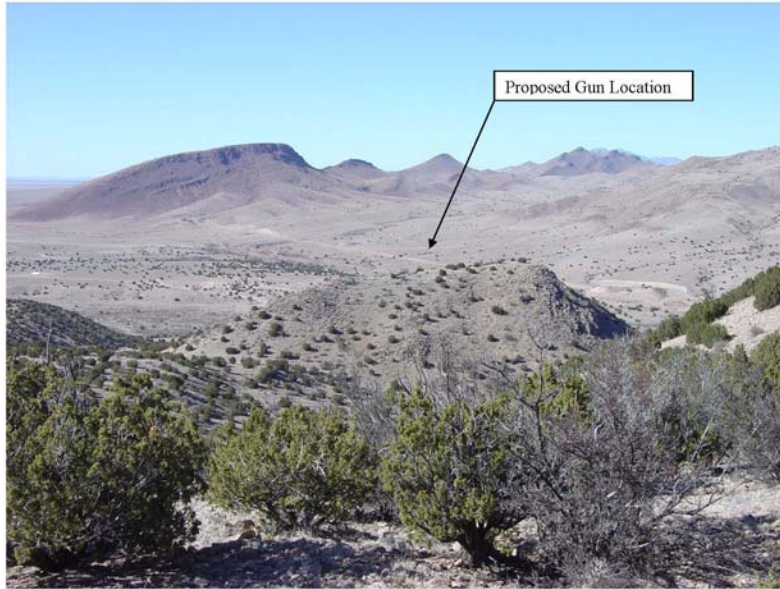
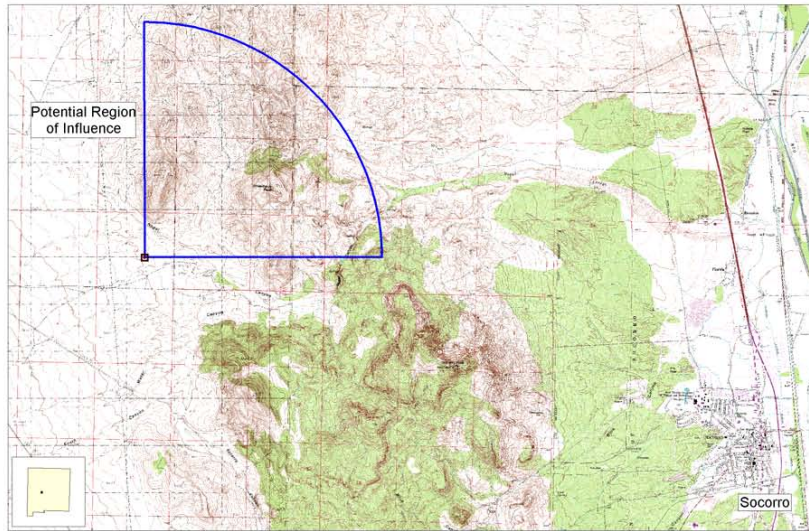


Exhibit B: Area of Potential Effect/Region of Influence





DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

February 12, 2004

Ms. Joy Nicholopoulos
U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
2105 Osuna Road, NE
Albuquerque, NM 87113

RE: Proposed vertical gun launch experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Test Center Socorro, New Mexico

Dear Ms. Nicholopoulos:


In accordance with the National Environmental Policy Act, the Missile Defense Agency (MDA) is preparing an Environmental Assessment to evaluate the potential environmental consequences of using thickened tributyl phosphate (TBP) as a threat agent simulant in a maximum of six tests at the Energetic Materials Research Test Center's (EMRTC) 3 K North site. The EMRTC is part of the New Mexico Institute of Mining and Technology (NMT), which is located near Socorro, New Mexico. The objective of the tests is to provide MDA with data regarding drop size and dispersion of simulated threat agents. This test series is a separate action from that addressed at the White Sands Missile Range in the on-going Intercept Debris Measurement Program Environmental Assessment.

Under the Proposed Action, canisters containing 50 kilograms (110 pounds) of dye-enhanced thickened TBP would be launched from the EMRTC 3 K North site and discharged at an altitude of approximately 0.5 kilometers (1,600 feet). Aerosol and droplet debris resulting from the launches would be monitored by sensors including radars and lidars. Approximately one dozen witness cards would also be placed on the ground to receive TBP droplets and would be used as a secondary data source. No new construction or ground disturbances would be required to accommodate the proposed tests. Additionally, go/no go test conditions would be established based on meteorological conditions. The tests are proposed to occur in June or July, 2004. A location map identifying the test site and the potential region influence (ROI) has been included for your reference. The ROI was determined based on "worst case" scenario modeling that included temperatures, wind direction and velocities based on historic data.

To assist MDA in assessing the potential for this project to result in environmental impacts, we are requesting a list of any species that are listed or proposed to be listed as threatened, endangered, or special status species under the Endangered Species Act that may be present in the ROI, and information regarding the presence of critical habitat. Please indicate any critical habitat that falls within the ROI on the enclosed map and return it via mail to the address indicated on the shipping label.

Thank you for your assistance in this matter. If you require further information to complete this request, please contact me directly at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,



Crate J. Spears
Environmental Manager

Cc: Deborah K. Shaver, ICF
Edgar Deskins, MDA

Enclosures as stated



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

March 18, 2004

Cons. # 2-22-04-I-311

Crate J. Spears, Environmental Manager
Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington, DC 30301-7100

Dear Mr. Spears:

Thank you for your February 12, 2004, letter requesting information on threatened or endangered species or important wildlife habitats that could be affected by the proposed vertical gun launch experiments using tributyl phosphate. The proposed project would include six tests at the New Mexico Institute of Mining and Technology's Energetic Materials Research Test Center near Socorro, Socorro County, New Mexico.

We have enclosed a current list of federally endangered, threatened, proposed, and candidate species, and species of concern that may be found in Socorro County, New Mexico.¹ Under the Endangered Species Act, as amended (Act), it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action "may affect" endangered, threatened, or proposed species, or designated critical habitat, and if so, to consult with us further. If your action area has suitable habitat for any of these species, we recommend that species-specific surveys be conducted during the flowering season for plants and at the appropriate time for wildlife to evaluate any possible project-related impacts. Please keep in mind that the scope of federally listed species compliance also includes any interrelated or interdependent project activities (e.g., equipment staging areas, offsite borrow material areas, or utility relocations) and any indirect or cumulative effects.

Candidates and species of concern have no legal protection under the Act and are included in this document for planning purposes only. We monitor the status of these species. If significant declines are detected, these species could potentially be listed as endangered or threatened.

¹ Additional information about these species is available on the Internet at <<http://nmrareplants.unm.edu>>, <<http://nmnhp.unm.edu/bisonnm/bisonquery.php>>, and <<http://ifw2es.fws.gov/endangeredspecies>>.

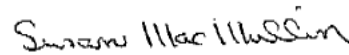
Therefore, actions that may contribute to their decline should be avoided. We recommend that candidates and species of concern be included in your surveys.

The Migratory Bird Treaty Act (MBTA) prohibits the taking of migratory birds, nests, and eggs, except as permitted by the U.S. Fish and Wildlife Service. To minimize the likelihood of adverse impacts to all birds protected under the MBTA, we recommend construction activities occur outside the general migratory bird nesting season of March through August, or that areas proposed for construction during the nesting season be surveyed, and when occupied, avoided until nesting is complete.

We suggest you contact the New Mexico Department of Game and Fish, and the New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division for information regarding fish, wildlife, and plants of State concern.

Thank you for your concern for endangered and threatened species and New Mexico's wildlife habitats. In future correspondence regarding this project, please refer to consultation # 2-22-04-I-311. If you have any questions about the information in this letter, please contact Dennis Coleman at the letterhead address or at (505) 346-2525, ext. 4716.

Sincerely,



JEN Joy E. Nicholopoulos
State Supervisor

Enclosure

cc: (w/o enc)

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry
Division, Santa Fe, New Mexico

FEDERAL ENDANGERED, THREATENED,
PROPOSED, AND CANDIDATE SPECIES
AND SPECIES OF CONCERN IN NEW MEXICO
Consultation Number 2-22-04-I-311
March 18, 2004

Socorro County

ENDANGERED

Black-footed ferret (*Mustela nigripes*)**
Interior least tern (*Sterna antillarum*)
Northern aplomado falcon (*Falco femoralis septentrionalis*)
Southwestern willow flycatcher (*Empidonax traillii extimus*)
Rio Grande silvery minnow (*Hybognathus amarus*) with critical habitat
Socorro isopod (*Thermosphaeroma thermophilus*)
Alamosa springsnail (*Pseudotryonia alamosae*)
Socorro pyrg (springsnail) (*Pyrgulopsis neomexicana*)

THREATENED

Bald eagle (*Haliaeetus leucocephalus*)
Mexican spotted owl (*Strix occidentalis lucida*) with critical habitat
Piping plover (*Charadrius melodus*)
Chiricahua leopard frog (*Rana chiricahuensis*)

CANDIDATE

Black-tailed prairie dog (*Cynomys ludovicianus*)
Yellow-billed cuckoo (*Coccyzus americanus*)
Chupadera pyrg (springsnail) (*Pyrgulopsis chupaderae*)

SPECIES OF CONCERN

Allen's big-eared bat (*Idionycteris phyllotis*)
Desert pocket gopher (*Geomys bursarius arenarius*)
New Mexican meadow jumping mouse (*Zapus hudsonius luteus*)
Organ Mountains Colorado chipmunk (*Eutamias quadrivittatus australis*)
Townsend's big-eared bat (*Corynorhinus townsendii*)
Pecos River muskrat (*Ondatra zibethicus ripensis*)
American peregrine falcon (*Falco peregrinus anatum*)
Arctic peregrine falcon (*Falco peregrinus tundrius*)
Baird's sparrow (*Ammodramus bairdii*)
Bell's vireo (*Vireo bellii*)
Black tern (*Chlidonias niger*)
Mountain plover (*Charadrius montanus*)
Northern goshawk (*Accipiter gentilis*)
Western burrowing owl (*Athene cunicularia hypugea*)

Rio Grande sucker (*Catostomus plebeius*)
 Desert viceroy butterfly (*Limenitis archippus obsoleta*)
 Fugate's blue-star (*Amsonia fugatei*)
 Sandhill goosefoot (*Chenopodium cycloides*)

Index

- Endangered = Any species which is in danger of extinction throughout all or a significant portion of its range.
- Threatened = Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
- Candidate = Candidate Species (taxa for which the Service has sufficient information to propose that they be added to list of endangered and threatened species, but the listing action has been precluded by other higher priority listing activities).
- Proposed = Any species of fish, wildlife or plant that is proposed in the Federal Register to be listed under section 4 of the Act.
- Species of Concern = Taxa for which further biological research and field study are needed to resolve their conservation status OR are considered sensitive, rare, or declining on lists maintained by Natural Heritage Programs, State wildlife agencies, other Federal agencies, or professional/academic scientific societies. Species of Concern are included for planning purposes only.
- ** = Survey should be conducted if project involves impacts to prairie dog towns or complexes of 200-acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*) and/or 80-acres or more for any subspecies of Black-tailed prairie dog (*Cynomys ludovicianus*). A complex consists of two or more neighboring prairie dog towns within 4.3 miles (7 kilometers) of each other.

April 5, 2004

Ms. Joy Nicholopoulos
U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
2105 Osuna Road, NE
Albuquerque, NM 87113

Reference Number: 2-22-04-I-311

RE: Proposed vertical gun launch experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Testing Center Socorro, New Mexico

Dear Ms. Nicholopoulos:

Thank you for your March 18, 2004, letter providing additional information on threatened and endangered species and important wildlife habitats that could be affected by the proposed vertical gun tests using tributyl phosphate (TBP).

The MDA is proposing to use TBP as a chemical agent simulant in experiments to be conducted at the Energetic Materials Research and Testing Center (EMRTC) at the New Mexico Institute of Mining and Technology (NMT), located near Socorro, New Mexico. EMRTC performs 200 to 300 field tests per year for clients such as the Department of Defense, U.S. Environmental Protection Agency, and Lockheed-Martin Corporation. The proposed tests are similar to existing testing operations routinely conducted at EMRTC. The MDA proposes to conduct up to six vertical gun tests within a two-week period at the NMT 3K North site. Canisters containing TBP would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and dry conditions persist, which would prevent the TBP from dispersing over a wide area and prevent deposited TBP from being absorbed in surface water. The canisters would contain approximately 50 kilograms (110 pounds) of TBP thickened using polybutyl methacrylate enhanced with blue dye for observation purposes. A small amount of explosives would be used to rupture the canister tanks during ascent, resulting in the creation of a brief aerosol debris cloud and the subsequent

dispersion of TBP droplets. TBP droplets would be monitored using several remote sensing methods.

The Region of Influence for the proposed tests consists of the area where the Post-Engagement Ground Effects Model (PEGEM) has predicted TBP droplets would be deposited during a test. PEGEM modeling shows the potential for the Region of Influence to extend into off-site locations under some test scenarios. The Region of Influence for any one test would be significantly smaller than the area indicated in Exhibit A. The proposed tests would not impact any listed, proposed, or candidate species or designated critical habitat. TBP that falls onto the ground would be expected to photodegrade within a few hours when exposed to the sun's ultraviolet rays. In addition, noise associated with the proposed tests would not be different from noise produced from other testing activities at EMRTC and therefore would not be expected to have a significant impact on species that may occur within the Region of Influence.

The MDA considered impacts to biological resources including threatened, endangered, candidate, and species of concern in the *Draft Vertical Gun Test Environmental Assessment*, which is anticipated to be released for public review in April 2004. After reviewing the list of species and habitat provided by your office and considering the potential for impact from the proposed action, including indirect or cumulative effects; the MDA has determined that the proposed action would not adversely affect listed, proposed, or candidate species or critical habitat. Formal consultation under Section 7 of the Endangered Species Act does not appear to be warranted for this proposed action. The MDA is requesting your comments on this determination. Thank you for your assistance in this matter. If you require further information to complete this request, please contact me at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,

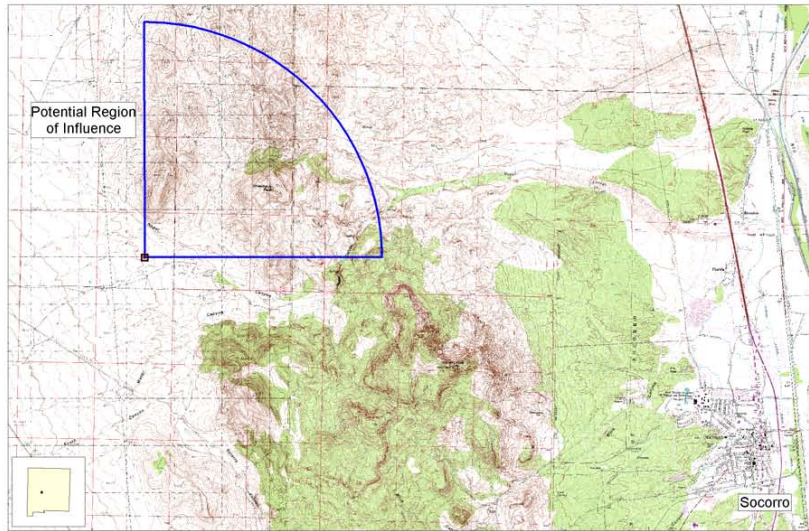
[original signed]

Crate J. Spears
Environmental Manager

Cc: Dennis Coleman, U.S. Fish and Wildlife Service
Deborah K. Shaver, ICF
Edgar Deskins, MDA

Enclosure as stated

Exhibit A: Region of Influence





United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

May 6, 2004

Cons. #2-22-04-I-311

Crate J. Spears, Environmental Manager (Attn: Stacy Zee)
U.S. Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington, D.C. 20301-7100

Dear Mr. Spears:

Thank you for your letter dated April 5, 2004, regarding your proposed project of conducting vertical gun tests using tributyl phosphate as a chemical agent stimulant. The experiments would be conducted at the Energetic Materials Research and Testing Center, which is part of the New Mexico Institute of Mining and Technology, located near Socorro, New Mexico. In order to continue with the informal consultation process, the New Mexico Ecological Services Field Office requests that you send us a letter asking for our concurrence with your determinations of effects on listed species and/or critical habitat from this project. Under the Endangered Species Act, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action "may affect" endangered, threatened, or proposed species, or designated or proposed critical habitat, and if so, to consult with us further. Your determinations of effects should be supported in a document, such as a biological assessment or biological evaluation, which should be included with your letter to us. We have also enclosed information about the contents and preparation of these documents.

We look forward to working with you to minimize or avoid adverse effects to threatened and endangered species. In future correspondence regarding this project, please refer to consultation # 2-22-04-I-311. If we can be of further assistance, please contact Melissa Kreutzian or Patricia Zenone of my staff at (505) 761-4728, or -4718, respectively.

Sincerely,

for Susan MacMullin
Field Supervisor

Enclosure

**U.S. Fish and Wildlife Service
Suggested Contents for Biological Evaluations and Biological Assessments**

When you prepare a Biological Evaluation (BE) or Biological Assessment (BA), keep in mind that the people who read or review this document may not be familiar with the action area or what you are proposing. Your BE or BA should present a clear line of reasoning that explains the proposed project and how you determined the effects of the project on each threatened or endangered species in the action area. Try to avoid technical jargon that is not readily understandable to people outside your agency or area of expertise. Remember, this is a **public document**. Some things to consider and include (if appropriate) in your BE or BA follow.

1. What is the difference between a Biological Assessment and a Biological Evaluation?

By regulation, a Biological Assessment is prepared for "major construction activities" considered to be Federal actions significantly affecting the quality of the human environment as referred to in the National Environmental Policy Act of 1969 (NEPA) [(42 U.S.C. 4332(2)(C))]. A BA is required if listed species or critical habitat may be present in the action area. A BA also may be recommended for other activities to ensure the agency's early involvement and increase the chances for resolution during informal consultation. Recommended contents for a BA are described in 50 CFR §402.12(f).

Biological Evaluation is a generic term for all other types of analyses. Although agencies are not required to prepare a Biological Assessment for non-construction activities, if a listed species or critical habitat is likely to be affected, the agency must provide the Service with an evaluation on the likely effects of the action. Often this information is referred to as a BE. The Service uses this documentation along with any other available information to decide if concurrence with the agency's determination is warranted. Recommended contents are the same as for a BA, as referenced above.

The BAs and BEs should not be confused with Environmental Assessments (EA) or Environmental Impact Statements (EIS), which may be required for NEPA projects. These EISs and EAs are designed to provide an analysis of multiple possible alternative actions on a variety of environmental, cultural, and social resources, and often use different definitions or standards.

2. What are you proposing to do?

- Describe the project. A project description will vary, depending on the complexity of the project. For example, describing the placement and construction of a new microwave tower may be relatively simple, but describing an alternative for improving range management likely would be more detailed and complex. Include sketches if they will help others understand your proposed action and its relationship with the species' habitat.
- How are you (or the project proponent) planning on carrying out the project? What tools or methods may be used? How will the site be accessed?

- Describe the action area. Always include a map (topographic maps are particularly helpful). Provide photographs including aerials, if available. Describe the action area (i.e., topography, vegetation, condition/trend).
- Describe current management or activities relevant to the action area. How will your project change the area?
- Supporting documents are very helpful. If you have a mining plan, research proposal, NEPA or other planning document or any other documents regarding the project, attach them to the BE or BA.

3. What threatened or endangered species may occur in the action area?

A request for a species list may be submitted to the Service, or the Federal action agency or its designated representative may develop the list. If you have information to develop your own lists, the Service should be contacted periodically to ensure that changes in species' status or additions/deletions to the list are included. Sources of information include, but are not limited to, the Forest Service, National Park Service, Bureau of Land Management, or other Federal agencies; State Game and Fish Departments; members of the public or academic community; scientific journals, books and various informational booklets; and the Internet. Due to budget constraints and loss of personnel, some Ecological Services Field Offices only provide general, county-wide species lists.

Use your familiarity with the action area when you develop your species lists. Sometimes a species may occur in the larger regional area near your project, but the habitat necessary to support the species is not in the action area (including areas that may be beyond the immediate project boundaries, but within the area of influence of the project). If, for example, you know that the specific habitat type used by a species does not occur in the action area, it does not need to appear on the species list for the project. However, documentation of your reasoning is helpful for Service biologists or anyone else that may review the document.

4. Have you surveyed for species that are known to occur or have potential habitat in the proposed action area?

The "not known to occur here" approach is a common flaw in many BA/BEs. The operative word here is "known." Unless adequate surveys have been conducted or adequate information sources have been referenced, this statement is difficult to interpret. It begs the questions "Have you looked?" and "How have you looked?" Always reference your information sources.

Include a clear description of your survey methods so that the reader can have confidence in your results. Answer questions such as:

- How intensive was the survey? Did you look for suitable habitat or did you look for individuals? Did the survey cover the entire action area or only part of it? Include maps of areas surveyed if appropriate.
- Who did the surveys and when? Was the survey done during the time of year/day when the plant is growing or when the animal can be found (its active period)? Did the survey follow accepted protocols?
- If you are not sure how to do a good survey for the species, the Service recommends contacting species experts. Specialized training is required before you can obtain a permit to survey for some species.
- *Remember that your evaluation of potential impacts from a project does not end if the species is/are not found in the action area. You still must evaluate what effects would be expected to the habitat, even if it is not known to be occupied.*

5. Provide background information on the threatened or endangered species in the action area.

Describe the species in terms of overall range and population status. How many populations are known? How many occur in the action area? What part of the population will be affected by this project? Will the population's viability be affected? What is the current habitat condition and population size and status? Describe the related items of past management for the species, such as stocking programs, habitat improvements, or loss of habitat or individuals caused by previous projects.

6. How will the project affect the threatened or endangered species or critical habitat that occurs in the action area?

- If you believe the project will not affect the species, explain why.
- If you think the project may affect the species, explain what the effects might be. The Endangered Species Act requires you to consider all effects when determining if an action funded, permitted, or carried out by a Federal agency may affect listed species. Effects you must consider include direct, indirect, and cumulative effects. Effects include those caused by interrelated and interdependent actions, not just the proposed action. Direct effects are those caused by the action and occur at the same time and place as the action. Indirect effects are caused by the action and are later in time but are reasonably certain to occur. Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions have no significant independent utility apart from the action under consideration. Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.

- Describe measures taken to avoid, reduce, or eliminate adverse effects or enhance beneficial effects to the species. Refer to conversations you had with species experts to achieve these results.
- Consider recovery potential if the action area contains historic range for a species.
- Evaluate designated critical habitat areas by reviewing the physical or biological features essential to the conservation of the species. *Even if no critical habitat has been designated for a species, the evaluation of the project effects must include effects to the habitat, not just the species.*

7. What is your decision? The Federal action agency must make a determination of effect.

Quite frequently, effect determinations are not necessarily *wrong*; they simply are not justified in the assessment. The assessment should lead the reviewer through a discussion of effects to a logical, well-supported conclusion. Do not assume that the Service biologist is familiar with the project and/or its location, and there is no need to fully explain the impact the project may have on listed species. If there is little or no connection or rationale provided to lead the reader from the project description to the effect determination, we cannot assume conditions that are not presented in the assessment. Decisions must be justified biologically. The responsibility for making the determination of effect falls on the Federal action agency; however, the Service may ask the agency to revisit its decision or provide more data if the conclusion is not adequately supported by biological information.

You have three choices for each listed species or area of critical habitat:

1. "No effect" means there are absolutely no effects of the project, positive or negative. "No effect" does not include a *small* effect or an effect that is *unlikely* to occur. If effects are insignificant (in size) or discountable (extremely unlikely), a "may affect, but not likely to adversely affect" determination is appropriate.
2. "May affect - is not likely to adversely affect" means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat (i.e., there can not be "balancing," wherein the benefits of the project would be expected to outweigh the adverse effects - see #3 below). Insignificant effects relate to the size of the impact (and should not reach the scale where take occurs). Discountable effects are those extremely unlikely to occur. These determinations require written concurrence from the Service. Based on best judgement, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
3. "May affect - is likely to adversely affect" means that all adverse effects can not be avoided. A combination of beneficial and adverse effects is still "likely to adversely

affect," even if the net effect is neutral or positive. Adverse effects do not qualify as discountable simply because we are not certain they will occur. The probability of occurrence must be extremely small to achieve discountability. Likewise, adverse effects do not meet the definition of insignificant because they are less than major. If the adverse effect can be detected in any way or if it can be meaningfully articulated in a discussion of the results, then it is not insignificant, it is likely to adversely affect. This requires formal consultation with the Service.

A fourth finding is possible for proposed species or proposed critical habitat:

4. "Is likely to jeopardize/adversely modify proposed species/critical habitat" is the appropriate conclusion when the action agency identifies situations in which the proposed action is likely to jeopardize the proposed species, or destroy or adversely modify the proposed critical habitat. If this conclusion is reached, conference is required.

List the species experts you contacted when preparing the BE or BA but avoid statements that place the responsibility for the decision of "may affect" or "no effect" on the shoulders of the species experts. Remember, this decision is made by the Federal action agency.

Provide supporting documentation, especially any agency reports or data that may not be available to the Service. Include a list of literature cited.

Prepared by:
U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
January 1997

Revised by:
U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
April 1997

Edited by:
U.S. Fish and Wildlife Service
National Conservation Training Center
Environmental Conservation Branch
February 1999

**OUTLINE EXAMPLE
FOR A
BIOLOGICAL ASSESSMENT OR BIOLOGICAL EVALUATION**

- A. **Cover letter - VERY IMPORTANT** - Include purpose of consultation, project title, and consultation number (if available). A determination needs to be made for each species. You have three options: 1) a "no effect" determination; 2) requesting concurrence with an "is not likely to adversely affect" determination; 3) a "may affect, is likely to adversely affect" determination, and a request for formal consultation. If proposed species or critical habitat are included, state whether the project is likely to result in jeopardy to proposed species, or the destruction or adverse modification of proposed critical habitat.
- B. **Project description** - Describe the proposed action and the action area. Be specific and quantify whenever possible.
- C. **For Each Species**
 - 1. Description of affected environment (quantify whenever possible)
 - 2. Description of species biology
 - 3. Describe current conditions for each species
 - a. Rangeland
 - b. In action area
 - c. Cumulative effects of State and private actions in action area
 - d. Other consultations of Federal action agency in area to date
 - 4. Describe critical habitat (if applicable)
 - 5. Describe effects of proposed action on each species and/or critical habitat.
 - a. Direct
 - b. Indirect
 - c. Interrelated and interdependent actions
 - d. Incidental take
- D. **Conservation measures (protective measures to minimize effects for each species)**
- E. **Conclusions (effects determination for each species)**
- F. **Literature Cited**
- G. **List of Contacts Made/Preparers**
- H. **Maps/ Photographs**

** TOTAL PAGE.09 **



DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

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May 13, 2004

Ms. Joy Nicholopoulos
U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
2105 Osuna Road, NE
Albuquerque, NM 87113

MAY 18 2004

Reference Number: 2-22-04-I-311

RE: Proposed vertical gun launch experiments using tributyl phosphate as a threat agent simulant at the New Mexico Institute of Mining and Technology's Energetic Materials Research Testing Center Socorro, New Mexico

Dear Ms. Nicholopoulos:

Thank you for your May 6, 2004, letter acknowledging receipt of the MDA's April 5, 2004 letter and providing further guidance on the informal consultation process under Section 7 of the Endangered Species Act.

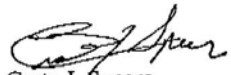
As you are aware, the MDA is proposing to use tributyl phosphate (TBP) as a chemical agent simulant in experiments to be conducted at the Energetic Materials Research and Testing Center (EMRTC) at the New Mexico Institute of Mining and Technology (NMT), located near Socorro, New Mexico. EMRTC performs 200 to 300 field tests per year for clients such as the Department of Defense, U.S. Environmental Protection Agency, and Lockheed-Martin Corporation. The proposed tests are similar to existing testing operations routinely conducted at EMRTC.

The MDA proposes to conduct up to six vertical gun tests within a two-week period at the NMT 3K North site. Canisters containing TBP would be launched at the 3K North site. Tests would occur during the summer months when wind speeds are low and dry conditions persist, which would prevent the TBP from dispersing over a wide area and prevent deposited TBP from being absorbed in surface water. The canisters would contain approximately 50 kilograms (110 pounds) of TBP thickened using polybutyl methacrylate enhanced with blue dye for observation purposes. A small amount of explosives would be used to rupture the canister tanks during ascent, resulting in the creation of a brief aerosol debris cloud and the subsequent dispersion of TBP droplets. TBP droplets would be monitored using several remote sensing methods.

The proposed tests would not impact any threatened, endangered, or proposed species or designated critical habitat. TBP that falls onto the ground would be expected to photodegrade within a few hours when exposed to the sun's ultraviolet rays. In addition, noise associated with the proposed tests would be brief and would not be different from noise produced from other testing activities at EMRTC and therefore, would not be expected to impact species that may occur within the Region of Influence.

The MDA considered impacts to biological resources including threatened, endangered, candidate, and species of concern in the *Draft Vertical Gun Test Environmental Assessment*, which was released for public review on May 1, 2004. The Draft Environmental Assessment is available at the following web site <http://www.acq.osd.mil/bmdo/bmdolink/html/enviro.html>. After reviewing the list of species and habitat provided by your office and based on the analysis conducted for the Environmental Assessment the MDA determined that there would be no effects to endangered, threatened, or proposed species, or designated or proposed critical habitat as a result of the proposed action (see Attachment A). It is our understanding that this satisfies our responsibilities under Section 7 of the Endangered Species Act at this time. If you have any questions regarding this determination or proposed action, please contact me at (703) 697-4123 or Deborah Shaver at (703) 693-1136.

Sincerely,



Crate J. Spears
Environmental Manager

Cc: Melissa Kreutzian, U.S. Fish and Wildlife Service
Patricia Zenone, U.S. Fish and Wildlife Service
Deborah K. Shaver, ICF Consulting
Edgar Deskins, MDA

Enclosure as stated

NO EFFECT FINDING

The described action will have no effect on listed species, wetlands, or other important wildlife resources.

Date 5/19/04

Consultation # 2-22-04-I-311

Approved by Suzanne MacLennan

U.S. FISH and WILDLIFE SERVICE
NEW MEXICO ECOLOGICAL SERVICES FIELD OFFICE
ALBUQUERQUE, NEW MEXICO

Attachment A: Federal Endangered, Threatened, Proposed, and Candidate Species and Species of Concern in New Mexico¹

Common Name	Scientific Name	Status	Potential Affect	Justification ²
Black-Footed Ferret	<i>Mustela nigripes</i>	Endangered	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Interior Least Tern	<i>Sterna antillarum</i>	Endangered	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	Endangered	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Southwestern Willow Flycatcher	<i>Empidonax traillii eximius</i>	Endangered	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Rio Grande Silvery Minnow	<i>Hybognathus amarus</i>	Endangered with Critical Habitat	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.

¹ Based on a list of species for Socorro County, NM provided by U.S. Fish and Wildlife Service dated March 18, 2004.² Further discussion is provided in the *Draft Vertical Gun Test Environmental Assessment* available at <http://www.acq.osd.mil/bmdo/bmdolink/html/erwiro.html>

Common Name	Scientific Name	Status	Potential Affect	Justification ²
Socorro Isopod	<i>Thermosphaeroma thermophilus</i>	Endangered	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.
Alamosa Springsnail	<i>Pseudotrypania alamosae</i>	Endangered	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.
Socorro Pyrg (springsnail)	<i>Pyrgulopsis neomexicana</i>	Endangered	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened with Critical Habitat	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Piping Plover	<i>Charadrius melodus</i>	Threatened	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Chiricahua Leopard Frog	<i>Rana chiricahuensis</i>	Threatened	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.
Black-Tailed Prairie Dog	<i>Cynomys ludovicianus</i>	Candidate	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.

Attachment A-2

Common Name	Scientific Name	Status	Potential Affect	Justification ²
Yellow-Billed Cuckoo	<i>Coccyzus americanus</i>	Candidate	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Chupadera Pyrg (spring snail)	<i>Pyrgulopsis chupaderae</i>	Candidate	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species.
Allen's Big-Eared Bat	<i>Idionycteris phyllootis</i>	Species of Concern	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Desert Pocket Gopher	<i>Geomys bursarius arenarius</i>	Species of Concern	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
New Mexican Meadow Jumping Mouse	<i>Zapus hudsonius luteus</i>	Species of Concern	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Organ Mountains Colorado Chipmunk	<i>Eutamias quadrivittatus anstalis</i>	Species of Concern	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Townsend's Big-Eared Bat	<i>Corynorhinus townsendii</i>	Species of Concern	None	TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other

Attachment A-3

Common Name	Scientific Name	Status	Potential Affect	Justification ²
Pecos Rover Muskrat	<i>Ondatra zibethicus ripensis</i>	Species of Concern	None	testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur. TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur. The concentration of TBP reaching the only small spring near the test site would not be expected to approach toxic levels for aquatic species.
American Peregrine Falcon	<i>Falco peregrinus tundrius</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Baird's Sparrow	<i>Ammodramus bairdii</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Bell's Vireo	<i>Vireo bellii</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Black Tern	<i>Chlidonias niger</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the

Common Name	Scientific Name	Status	Potential Affect	Justification?
				facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Mountain Plover	<i>Charadrius montanus</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Northern Goshawk	<i>Accipiter gentilis</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Western Burrowing Owl	<i>Athene cunicularia hypugea</i>	Species of Concern	None	Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect birds given its rapid photodegradation. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Rio Grande Sucker	<i>Catostomus plebeius</i>	Species of Concern	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species. Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect butterflies given its rapid photodegradation. TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.
Desert Viceroy Butterfly	<i>Limenitis archippus obsolleta</i>	Species of Concern	None	The concentration of TBP potentially reaching the one small spring near the test site would not be expected to approach toxic levels for aquatic species. Aerosol TBP would not reach toxic levels for birds during tests and ground deposition of TBP would not affect butterflies given its rapid photodegradation. TBP would photodegrade within hours of impacting the soil and would not affect species. Noise produced from the test would be the same as for other testing at the facility and would not affect species. No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur.

Attachment A-5

Common Name	Scientific Name	Status	Potential Affect	Justification ²
Fugate's Blue-Star	<i>Amsonia fugatei</i>	Species of Concern	None	No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur. TBP would photodegrade within hours of impacting the soil and would not affect species.
Sandhill Goosfoot	<i>Chenopodium cycloides</i>	Species of Concern	None	No previously undisturbed land would be affected by the proposed action and no impacts to species from construction would occur. TBP would photodegrade within hours of impacting the soil and would not affect species.

TOTAL P.09

Attachment A-6

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8. DISTRIBUTION LIST

Libraries
Joseph R. Skeen Library New Mexico Institute of Mining and Technology Socorro, NM 87801
Socorro Public Library 401 Park Street Socorro, NM 87801

Federal Agencies
Bureau of Land Management State of New Mexico P.O. Box 27115 Santa Fe, NM 87502-0115
U.S. Fish and Wildlife Service New Mexico Ecological Services Field Office 2105 Osuna Road, NE Albuquerque, New Mexico 87113
Attn: Joy Nicholopoulos, New Mexico State Administrator

State/Local Agencies
Energetic Materials Research and Testing Center New Mexico Institute of Mining and Technology 801 Leroy Place Socorro, NM 87801
Attn: Mike Stanley, Associate Director, Applied Research and Technology Division Marvin Banks, Research Engineer II
New Mexico State Historic Preservation Office Historic Preservation Division, Office of Cultural Affairs 228 East Palace Avenue Santa Fe, New Mexico 87503
Attn: Katherine Slick, Director
State of New Mexico Environment Department Office of the Secretary 1190 St. Francis Drive P.O. Box 26110 Santa Fe, New Mexico 87502
Attn: Gedi Cibas, Manager, Border Programs

Congressional Delegation	
Honorable Pete Domenici 328 Hart Senate Office Building Washington, DC 20510	Honorable Jeff Bingaman 703 Hart Senate Office Building Washington, DC 20510
Honorable Steve Pearce 1408 Longworth House Office Building Washington, DC 20515	Honorable Steve Pearce 111 School of Mines Road Socorro, NM 87801

State and Local Officials	
Office of the Governor State Capitol Room 400 Santa Fe, NM 87501	Mayor Ravi Bhasker 111 School of Mines Road Socorro, NM 87801

APPENDIX A
TBP PLUME DISPERSION WHITE PAPER

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APPENDIX A – TBP PLUME DISPERSION WHITE PAPER

Ground Deposition Predictions from a Release of Thickened Tributyl Phosphate at ½ km Above Ground Level Over the NMT 3K North Site

Dr. M. B. Richardson
BAE Systems Analytical Solutions Inc.

14 January 2004

Introduction

This White Paper presents the results and describes the tool and inputs employed for ground deposition calculations at the 3K North Site, located at New Mexico Tech, Socorro, NM. These calculations were done in support of a planned test program to determine drop size distributions from a ruptured missile payload as part of the Small Business Technology Transfer (STTR) effort entitled *Improvements to Directed Energy Lethality and Collateral Effects Modeling*. The calculations were made using the Post-Engagement Ground Effects Model (PEGEM), version 5.1, employing the HPAC transport and dispersion model. The implication of these calculations is that no TTBP will land on or near any populated area. A meteorologically based go – no go criterion is also provided.

PEGEM

PEGEM is one of the Missile Defense Agency's Core Lethality Models (CLMs). The CLMs are a suite of computer-based predictive tools for evaluating missile intercepts, from the point of intercept through collateral and ground effects. These tools are used throughout the missile defense community, on ranges, and in wargames around the world, in support of the Ballistic Missile Defense System.

PEGEM is an expert system toolbox used in the analysis of ground effects caused by chemical, biological, or high explosive weapons or agents distributed in bulk, canister, or bomblet submunition payloads. PEGEM provides the ability to demonstrate the benefit of missile defense capability through estimation of the extent of ground hazards resulting from either an intercepted or functioning missile. PEGEM consists of both internally developed modules as well as interfaces to external codes, such as the transport and dispersion models VLSTRACK (developed by the Navy) and HPAC (developed by DTRA).

Results

A set of ground deposition calculations was performed that included terrain at a 1 km resolution. Monthly averages for June and July (chosen since tests are slated for the last two weeks in June) using the Global Reference Atmospheric Model (GRAM) were used. Time of day was 0800 hrs MST. The scenarios consist of a cylinder containing 50 kg of thickened tributyl phosphate (TTPB) launched

vertically at 1 km/s and opened at 500 meters above ground level. The graphical results, shown in Figures 1 and 2, used a DTED (Digital Terrain Elevation Data)

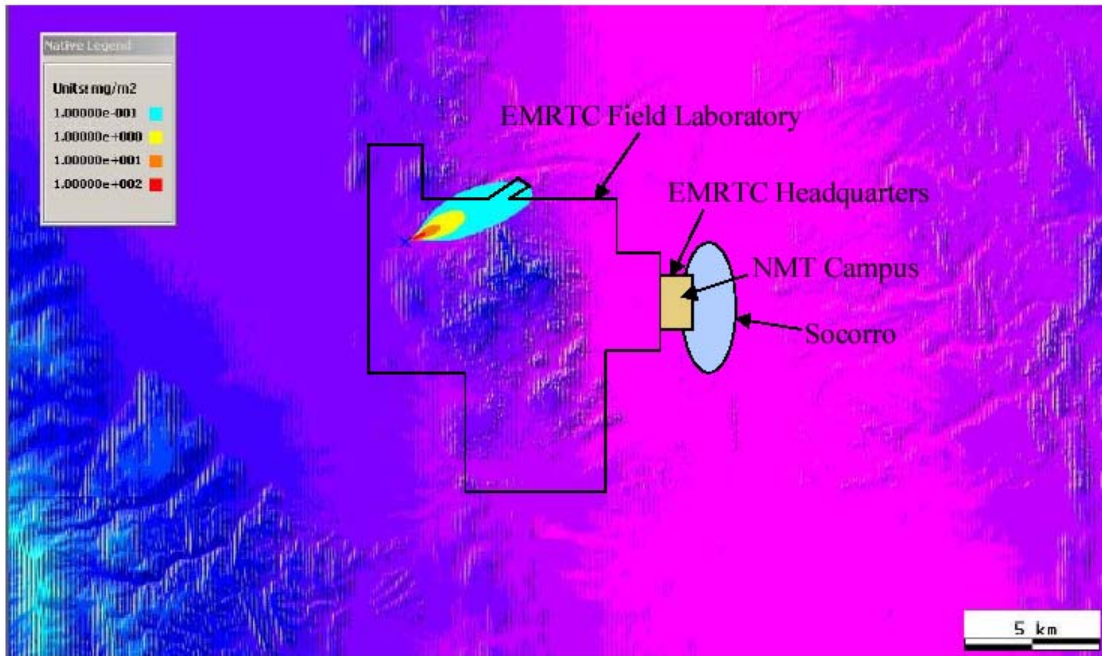


Figure 1. Ground deposition pattern, June meteorological profile EMRTC

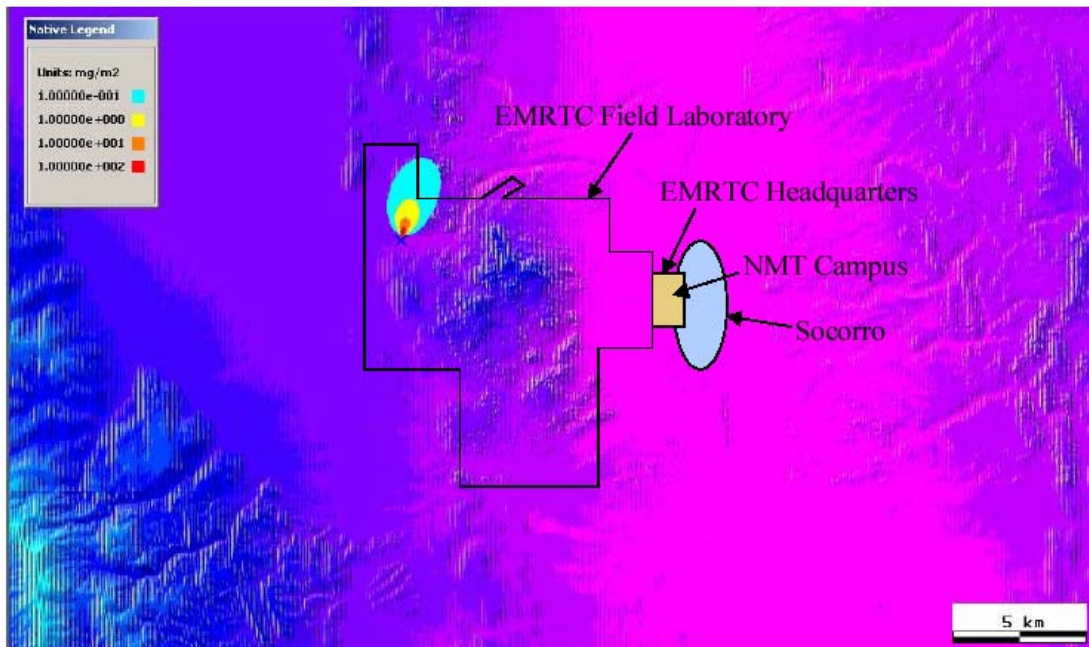


Figure 2. Ground deposition pattern, July meteorological profile

display overlay to indicate terrain. Socorro (the nearest town) is indicated with a blue oval and the New Mexico Tech campus location is indicated with a tan

rectangle. The EMRTC Field Laboratory boundary is delineated by black lines. The results of the calculations indicate a small, localized plume about 5 km long is formed. Peak depositions are 5 g for June and 11.5 g for July. No depositions greater than 100 mg/m² are located farther than 1 km from the launch point. The area coverage at deposition levels greater than 1 mg/m² is about 0.9 km² for both June and July, with areas of 6.4 km² for July and 8.4 km² for June at levels down to 0.1 mg/m². No TTBP was seen at or near any populated area. No bodies of water are located within or near the EMRTC field laboratory, thus no water contamination will occur.

Go – No Go Criterion

In order to ensure that no TTBP deposits within Socorro or NMT property, an extreme scenario was postulated in which the wind direction was directly out of the west (very unlikely for the summer months). A wind speed of 8 mph was employed. Results are presented in Figure 3 below. All of the TBP remains within the EMRTC Field Laboratory boundaries. Thus, the meteorological go – no go criterion would be to not shoot when winds were greater than 8 mph, and traveling in a direction spanning west to southwest (270 to 315 deg).

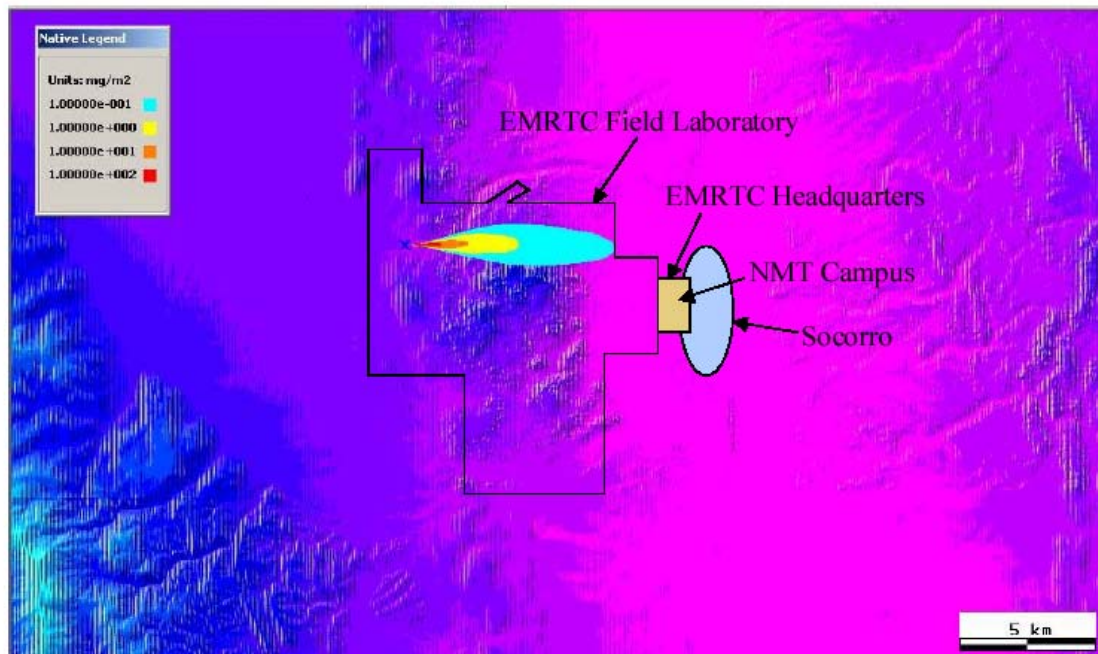


Figure 3. Ground deposition pattern, “worst case” scenario (winds from west, 8 mph)

Summary

Calculations were performed to determine likely ground patterns for 50 kg of thickened tributyl phosphate launched from a vertical tube at 1 km/s and released at one-half kilometer above ground level. Only a miniscule amount (deposition

levels ~ 0.1 mg/m²) was ever seen to extend beyond the EMRTC Field Laboratory boundaries and these small areas are nowhere near populated areas. No bodies of water are present in or adjacent to the EMRTC Field Laboratory.

A go – no go criterion was developed in which a shot would not be performed if winds exceeded 8 mph and was traveling in a direction towards Socorro or the NMT campus. Thus, for the proposed test conditions no TTBP will land on or near any populated area.

APPENDIX B
NEW MEXICO STATE SPECIES OF CONCERN

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APPENDIX B – NEW MEXICO STATE SPECIES OF CONCERN

NEW MEXICO SPECIES of CONCERN

STATUS & DISTRIBUTION

STATE OF NEW MEXICO: THREATENED, ENDANGERED, SENSITIVE,
ENDEMIC

USFWS: THREATENED, ENDANGERED, CANDIDATE, PROPOSED,
SPECIES OF CONCERN

US BUREAU OF LAND MANAGEMENT: SENSITIVE

US FOREST SERVICE: SENSITIVE

EXTIRPATED FROM NEW MEXICO

EXTINCT

State-wide lists: pages 3-12

County lists: pages 13-65

Definitions: pages 66-67

TABLE KEY

FWS ESA	US FISH & WILDLIFE SERVICE; ENDANGERED SPECIES ACT
NM WCA	NEW MEXICO; WILDLIFE CONSERVATION ACT
FS R3	US FOREST SERVICE; REGION 3, NEW MEXICO & ARIZONA (old list, revision in progress)
BLM NM	US BLM, NEW MEXICO (old list, revision in progress)
NM Sen	NEW MEXICO; SENSITIVE (INFORMAL) and/or ENDEMIC TO NM
FWS SOC	US FISH & WILDLIFE SERVICE; SPECIES OF CONCERN (INFORMAL)
E	ENDANGERED
T	THREATENED
P	PROPOSED
C	CANDIDATE
R	RESTRICTED
s	SENSITIVE or SPECIES OF CONCERN (SOC)
g	Cooperative Agreement
n	ENDEMIC TO NEW MEXICO
h	Federal "Critical Habitat" designated
m	Recovery or Management Plan
DM	Delisted from ESA List but monitoring continuing (FWS ESA)
AD	Proposed Delisting (FWS ESA)
EXPN	Nonessential Experimental Population (FWS ESA)
()	In progress or draft

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New Mexico Species of Concern - Socorro County Page 1 of 2

Common Name.....	SCIENTIFIC NAME.....	PWS..	NM..	PS.	BLM..	NM..	PWS.
		ESA	WCA	R3	NH	Sen	SOC
Rio Grande Chub	Gila pandora	-	-	-	-	o	-
Rio Grande Silvery Minnow	Hybognathus amarus	E ghm	E	o	-	-	-
Rio Grande Shiner	Notropis jemezianus	-	-	o	-	o	o
Plathead Chub	Platygobio gracilis	-	-	-	o	-	-
Rio Grande Sucker	Catostoma plebeius	-	-	o	-	-	o
Arizona Toad	Bufo microscaphus microscaphus	-	-	o	o	o	o
Chiricahua Leopard Frog	Rana chiricahuensis	T	-	o	-	o	-
Northern Leopard Frog	Rana pipiens	-	-	o	-	-	-
Big Bend Slider	Trachemys gaigeae	-	-	-	-	o	-
Texas Horned Lizard	Phrynosoma cornutum	-	-	o	o	-	-
Desert King snake	Lampropeltis getula splendida	-	-	o	-	-	-
Clark's Grebe	Aechmophorus clarkii	-	-	o	-	-	-
Neotropic Cormorant	Phalacrocorax brasilianus	-	T	o	-	-	-
American Bittern	Botaurus lentiginosus	-	-	o	-	-	-
Least Bittern	Ixobrychus exilis exilis	-	-	o	-	-	-
Great Egret	Ardea alba egretta	-	-	o	-	-	-
Snowy Egret	Egretta thula brewsteri	-	-	o	-	-	-
Green Heron	Butorides virescens	-	-	o	-	-	-
Black-crowned Night-Heron	Nycticorax nycticorax hoactli	-	-	o	-	-	-
White-faced Ibis	Plegadis chihi	-	-	o	o	-	-
Osprey	Pandion haliaetus carolinensis	-	-	o	-	-	-
White-tailed Kite	Elanus caeruleus majusculus	-	-	o	-	-	-
Mississippi Kite	Ictinia mississippiensis	-	-	o	-	-	-
Bald Eagle	Haliaeetus leucocephalus	AD, T mg	T	o	-	-	-
Northern Goshawk	Accipiter gentilis	-	-	o	o	o	o
Common Black-Hawk	Buteogallus anthracinus anthracinus	-	T	o	-	-	o
Swainson's Hawk	Buteo swainsoni	-	-	o	-	-	-
Scree-tailed Hawk	Buteo albonotatus	-	-	o	-	-	-
Perruginous Hawk	Buteo regalis	-	-	o	o	-	-
Apelomado Falcon	Falco femoralis septentrionalis	E mg	E	o	-	-	-
American Peregrine Falcon	Falco peregrinus anatum	DM m	T	o	-	-	o
Sora	Porzana carolina	-	-	o	-	-	-
Whooping Crane	Grus americana	EXPN, E mg	E	o	-	-	-
Western Snowy Plover	Charadrius alexandrinus nivosus	-	-	o	-	-	-
Piping Plover	Charadrius melodus circumcinctus	T g	E	-	-	-	-
Mountain Plover	Charadrius montanus	PT	-	o	-	o	-
Black-necked Stilt	Himantopus mexicanus	-	-	o	-	-	-
Upland Sandpiper	Bartramia longicauda	-	-	o	-	-	-
Long-billed Curlew	Numenius americanus americanus	-	-	o	-	-	-
Interior Least Tern	Sterna antillarum athalassos	E mg	E	o	-	-	-
Black Tern	Chlidonia niger surinamensis	-	-	o	-	-	o
Common Ground-dove	Columbina passerina pallascens	-	E	o	-	-	-
Yellow-billed Cuckoo	Coccyzus americanus occidentalis	C	-	o	-	o	-
Flammulated Owl	Otus flammeolus	-	-	o	-	-	-
Elf Owl	Micrathene whitneyi whitneyi	-	-	o	-	-	-
Burrowing Owl	Athene cunicularia hypugaea	-	-	o	-	o	o
Mexican Spotted Owl	Strix occidentalis lucida	T hmg	-	o	-	o	-
Violet-crowned Hummingbird	Amazilia violiceps ellioti	-	T	o	-	-	-
Belted Kingfisher	Ceryle alcyon	-	-	o	-	-	-

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New Mexico Species of Concern - Socorro County Page 2 of 2

Common Name	SCIENTIFIC NAME	PWS... ESA	NM... WCA	FS... R3	BLM... NH	NM... Sen	PWS... SOC
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	E h	E	a	-	-	-
Loggerhead Shrike	<i>Lanius ludovicianus</i>	-	-	-	a	a	-
Bell's Vireo	<i>Vireo bellii</i>	-	T	a	-	-	a
Gray Vireo	<i>Vireo vicinior</i>	-	T	a	-	-	-
Gray Catbird	<i>Dumetella carolinensis ruficrissa</i>	-	-	a	-	-	-
American Redstart	<i>Setophaga ruticilla tricolora</i>	-	-	a	-	-	-
Baird's Sparrow	<i>Ammodramus bairdii</i>	-	T	a	a	-	a
McCown's Longspur	<i>Calcarius mccownii</i>	-	-	a	-	-	-
Western Small-footed Myotis Bat	<i>Myotis ciliolabrum melanorhinus</i>	-	-	-	a	a	-
Yuma Myotis Bat	<i>Myotis yumanensis yumanensis</i>	-	-	-	a	a	-
Occult Little Brown Myotis Bat	<i>Myotis lucifugus occultus</i>	-	-	a	a	a	-
Long-legged Myotis Bat	<i>Myotis volans interior</i>	-	-	-	a	a	-
Fringed Myotis Bat	<i>Myotis thysanodes thysanodes</i>	-	-	-	a	a	-
Long-eared Myotis Bat	<i>Myotis evotis evotis</i>	-	-	-	a	a	-
Spotted Bat	<i>Eudexma maculatum</i>	-	T	a	a	-	-
Allen's Big-eared Bat	<i>Idionycteris phyllotis</i>	-	-	-	a	a	a
Pale Townsend's Big-eared Bat	<i>Plecotus townsendii pallescens</i>	-	-	a	a	a	a
Organ Mountains Colorado Chipmunk	<i>Tamias quadrivittatus australis</i>	-	T	-	a	-	a
Ocurea Mountains Colorado Chipmunk	<i>Tamias quadrivittatus ocurensis</i>	-	T	-	a	-	-
White-Mountains Ground Squirrel	<i>Spermophilus tridecemlineatus monticola (AZ,NM)</i>	-	-	a	-	-	-
Gunnison's Prairie Dog	<i>Cynomys gunnisoni</i>	-	-	-	-	a	-
Desert Pocket Gopher	<i>Geomys arenarius brevirrostris</i>	-	-	-	-	a n	-
Pecos River Muskrat	<i>Ondatra zibethicus ripensis</i>	-	-	-	a	a	a
New Mexican Jumping Mouse	<i>Zapus hudsonius luteus</i>	-	T	a	a	-	a
Red Fox	<i>Vulpes vulpes</i>	-	-	-	-	a	-
Ringtail	<i>Bassaris astutus</i>	-	-	-	a	-	-
Western Spotted Skunk	<i>Spilogale gracilis</i>	-	-	-	-	a	-
Common Hog-nosed Skunk	<i>Conepatus macoleucus</i>	-	-	-	-	a	-
Desert Bighorn Sheep	<i>Ovis canadensis mexicana (endangered pops)</i>	-	E	a	-	-	m
Chupadera Springsnail	<i>Pyrgulopsis chupaderae</i>	C	E	-	-	n	-
Socorro Springsnail	<i>Pyrgulopsis neomexicana</i>	E mg	E	a	-	n	-
Alamogosa Springsnail	<i>Tryonia alamogosa</i>	E mg	E	a	-	-	-
Ovate Vertigo Snail	<i>Vertigo ovata</i>	-	T	-	-	-	a
Socorro Mountain Snail	<i>Oreohelix neomexicana</i>	-	-	-	-	a n	-
Socorro Isopod	<i>Thermosphaeroma thermophilum</i>	E mg	E	a	-	n	-
SW Pearly Checkerspot Butterfly	<i>Charidryas acaestus sabina</i>	-	-	-	-	-	a
Obsolete Viceroy Butterfly	<i>Basilarchia archippus obsoleta</i>	-	-	a	-	-	a

NATIVE SPECIES APPARENTLY NO LONGER OCCURRING IN SOCORRO COUNTY

Longnose Gar	<i>Lepisosteus osseus</i>	
American Eel	<i>Anguilla rostrata</i>	(extirpated from NM)
Speckled Chub	<i>Macrhybopsis aestivalis aestivalis</i>	
Blue Sucker	<i>Cycoleptus elongatus</i>	
Phantom Shiner	<i>Notropis orca</i>	(extinct)
Rio Grande Bluntnose Shiner	<i>Notropis simus simus</i>	(extinct)
Gray Redhorse	<i>Moxostoma congestum</i>	
Arizona Black-tailed Prairie Dog	<i>Cynomys ludovicianus arizonensis</i>	
Mexican Gray Wolf	<i>Canis lupus baileyi</i>	
Grizzly Bear	<i>Ursus arctos</i>	(extirpated from NM)
Black-footed Ferret	<i>Mustela nigripes</i>	(extirpated from NM)
Mink	<i>Mustela vison eremicus</i>	(extirpated from NM)
Jaguar	<i>Panthera onca arizonensis</i>	
Merriam's Elk	<i>Cervus elaphus merriami</i>	(extinct)

DEFINITIONS

FWS ESA: Federal Endangered Species Act of 1973; 12-28-73, P.L. 93-205 87 Stat. 884, as amended. Administered by U.S. Fish and Wildlife Service, Department of Interior. List is published as 50 CFR 17.11 and 17.12.

E ENDANGERED: "... any species which is in danger of extinction throughout all or a significant portion of its range ...". A final rule has been published in the Federal Register.

T THREATENED: "... any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." A final rule has been published in the Federal Register.

P PROPOSED: Species that have been officially proposed for listing as threatened or endangered by the Secretary of the Interior. A proposed rule has been published in the Federal Register.

C CANDIDATE: Species that have been studied and the Fish and Wildlife Service has concluded should be proposed for listing. Formally referred to as Category 1 Candidate species. Those species for which the Fish and Wildlife Service has sufficient information to support issuance of a proposed rule is precluded.

EXPN NONESSENTIAL EXPERIMENTAL POPULATION: A geographically described group of reintroduced animals that is isolated from other existing populations of that species. It is further determined that the experimental population is nonessential to the survival of the species.

NM WCA: New Mexico Wildlife Conservation Act; NM Chapter 17 Statutes Annotated 1973, 17-2 Part 3. The list of Threatened, Endangered and Restricted Species is published as Title 19 of New Mexico Administrative Code, Chapter 33, Part 1 (19 NMAC 33.1). Administered by State of New Mexico, Department of Game and Fish.

E ENDANGERED: "... any species [or subspecies] of fish or wildlife whose prospects of survival or recruitment within the state are in jeopardy due to any of the following factors: (1) the present or threatened destruction, modification or curtailment of its habitat; (2) over utilization for scientific, commercial or sporting purposes; (3) the effect of disease or predation; (4) other natural or man-made factors affecting its prospects of survival or recruitment within the state; or (5) any combination of the foregoing factors." 17-2-38-D, NMSA, 1978.

T THREATENED: "... any species [or subspecies] which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range in New Mexico; ..." 17-2-38-M, NMSA, 1978.

R RESTRICTED: "... any listed large exotic cat species or subspecies" (19 NMAC 33.1). The jaguar is the only Restricted species in this document, it is native to New Mexico.

FS R3: United States Forest Service, Department of Agriculture, Region 3 (Southwest Region; Arizona and New Mexico), Albuquerque, NM. Taxa listed in this category are from the old USFS list developed in 1988. A new list has been developed and is under revision. The new list includes federal ESA listed species and taxa listed by the Heritage Program as globally Rare/Imperiled, regardless of whether they occur on or near Forest lands. It does not include: many at risk taxa which are state-listed in NM, bats (a group generally in trouble) and other taxa which are not yet imperiled but may be significantly impacted by Forest management activities. As soon as a new list is available which meets the definition, it will be coded into BISON and included in updates of this document.

s SENSITIVE: "those species that are likely to occur or have habitat on Nation Forest System lands and that have been identified by the Regional Forester as of concern for reduction in population viability as evidenced by: significant current or predicted downward trends in population numbers or density, or; significant current or predicted downward trends in habitat capability that would reduce a species' distribution (Forest Service Manual 2670.5). The Forest Service Manual (2672.11) provides the following criteria for potential (but not mandatory) listing of sensitive species: USFWS Candidate species; State lists of endangered, threatened, rare, endemic, unique, or vanishing species; Other sources as appropriate in order to focus conservation management strategies and to avert the need for

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Federal or State listing as a result of National Forest management activities. These "other sources" have been interpreted by Regional [R3] TES Program managers to include: Species that have been federally delisted within the last 5 years; Species on State Heritage Databases that indicate global and/or regional rarity and/or imperilment (GTN1-3;S1-2).

BLM NM: U.S. Bureau of Land Management, Dept. of the Interior, New Mexico State Office, Santa Fe. State Offices were directed by the Wash, DC Office to develop sensitive species lists. The directive indicated lists would include former USFWS Candidate C2 species until a state office developed their own list. Currently, most of the taxa on the NM list are former C2 species. See USFWS Species of Concern above.

s SENSITIVE: "... are those designated by a State Director, usually in cooperation with the State agency responsible for managing the species, as sensitive. They are those species that are: (1) under status review by the FWS/NMFS; or (2) whose numbers are declining so rapidly that Federal listing may become necessary; or (3) with typically small and widely dispersed populations; or (4) those inhabiting ecological refugia or other specialized or unique habitats." [BLM Manual, Rel. 6-116, 9/16/88, 6840 - SPECIAL STATUS SPECIES MANAGEMENT, Glossary page 6]

NM Sen: New Mexico Department of Game and Fish, informal category which carries no legal requirements.

s SENSITIVE: Taxa which, in the opinion of a qualified NMDGF biologist, deserve special consideration in management and planning, and are NOT listed Threatened or Endangered by the state of New Mexico. These may include taxa that are listed Threatened, Endangered or Sensitive by other agencies; taxa with limited protection; and taxa without any legal protection. The intent of this category is to alert land managers to the need for caution in management where these taxa may be affected.

FWS SOC: U.S. Fish and Wildlife Service, SPECIES OF CONCERN. An informal category which carries no legal requirements except as designated in manuals of other agencies.

s SPECIES OF CONCERN: most of these taxa are former Candidate Category 2 which was defined: "Category 2 comprises taxa for which information now in possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules."

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APPENDIX C
ASSUMPTIONS AND CALCULATIONS

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APPENDIX C – ASSUMPTIONS AND CALCULATIONS

C.1 TBP Concentration Assumptions and Calculations

Estimates for the concentration of TBP in air following a test is a factor of the volume of the air column and the amount of TBP released. To calculate the concentration of TBP in air it was assumed that the entire mass of TBP released during the test would be deposited in the area associated with each deposition level (the concentration of TBP expected to be deposited on the ground) and that instantaneous mixing and dispersion occurs. However, the entire mass of TBP released when the canister ruptures does not stay within the area associated with one ground-based deposition level estimate. Therefore, the actual volume of TBP in air following a test would be lower than calculated in this analysis. Although these assumptions are overly conservative, they can be used to compare with the OSHA standard.

For ground-based deposition levels at 1 milligram per square meter, PEGEM showed that within a worst-case scenario the area covered on the ground would be 0.9 square kilometers. The canisters launched during a test would contain 50 kilograms of thickened TBP which would be released at an altitude of 500 meters (i.e., the height of the air column for this calculation). Therefore, the following calculations can be made

Step 1: Amount of TBP released equals 50 kilograms times 1,000 grams per kilogram times 1,000 milligrams per gram = **50,000,000 milligrams**

Step 2: Area equals 0.9 square kilometers = **900,000 square meters**

Step 3: Volume = area (900,000 square meters) x height of air column (500 meters) = **450,000,000 cubic meters**

Step 4: Concentration within Air Column = amount of TBP released (50,000,000 milligrams)/volume (450,000,000 cubic meters) = **0.11 milligrams per cubic meter**

The concentration of TBP that would be present in air following a test has been calculated in Exhibit C-1 based on these assumptions and the PEGEM predicted concentration on ground.

Exhibit C-1. Concentration Calculations in Air*		
	Concentration on Ground (milligrams per square meter)	Concentration in Air (milligrams per cubic meter)
June	0.1	0.01
July	0.1	0.02
June and July	1**	0.11

*OSHA industry standard for TBP exposure in air is 5 milligrams per cubic meter

** Replicate analyses could not be made with the information available for concentrations on the ground of 100 milligrams per square meter, although they would be expected to be on the same order of magnitude as those predicted for 1 milligram per square meter.

As these calculations show, the concentration of TBP in air following a test would be significantly lower than the OSHA industry standard for TBP exposure.

C.2 Estimated Generator Emissions

Estimates for the emission of applicable criteria pollutants and CO₂ from the operation of generators with a combined power output of 60 kilowatt (44.76 horsepower)⁶ used to power the sensors are listed in Exhibit C-2 (same as Exhibit 4-1) below. While CO₂ is not immediately dangerous human health and is not regulated under the Clean Air Act, it contributes to global warming and is the primary component of diesel generator exhaust. A 75 percent workload was assumed for the generators over a period of 24 hours for each test, and the EPA's *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources* was consulted for the emission factors for each pollutant. The estimated emissions were calculated using the following equation:

Power output (44.76 horsepower) **x percent workload** (0.75) **x emission factor** (pounds/horsepower-hour) **x hours operation** (24 hours) = **emission total** (pounds)

In order to present the results in units that can be compared to the *de minimis* threshold values for nonattainment areas, the emission estimates were determined on an annual basis and converted to total tons of each pollutant released over six

⁶ 1 kW = 0.746 hp

Exhibit C-2. Estimated Generator Emissions

Pollutant	Emission Factor (pounds/horsepower-hour)	Estimated Emissions per Test (pounds)	Total Estimated Emissions for Six Tests (pounds)	Total Estimated Emissions for Six Tests (metric tons (tons))
CO ₂ ^a	1.15	926.53	5,559.18	2.52 (2.78)
NO _x	0.031	24.98	149.88	0.068 (0.075)
CO	6.68 E-3	5.38	32.28	0.015 (0.016)
PM ₁₀ ^b	2.20 E-3	1.77	10.62	0.0048 (0.0053)
SO _x	2.05 E-3	1.65	9.6	0.0044 (0.0048)

^aAssumes 99 percent conversion of carbon in fuel to CO₂ with 87 weight percent carbon in diesel, average BSFC of 7,000 Btu/hp-hr, and diesel heating value of 19,300 Btu/lb.

^bPM₁₀ = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be less than or equal to 1 µm in size.

24-hour periods of generator operation. The *de minimis* threshold values for the criteria pollutants for nonattainment areas are presented in Exhibit C-3.

Exhibit C-3. De Minimis Threshold Values for Nonattainment Areas

Pollutant	Degree of Nonattainment	De Minimis Level (metric tons/year (tons/year))
Ozone (VOCs and NO _x)	Serious	45 (50)
	Severe	23 (25)
	Extreme	9 (10)
	Marginal/Moderate (outside ozone transport regions)	45 (50 VOC)
	Marginal/Moderate (inside ozone transport region)	91 (100 NO _x)
CO	All	91 (100)
PM	Moderate	91 (100)
	Serious	64 (70)
SO ₂ or NO ₂	All	91 (100)
Pb	All	23 (25)

Source: EPA regulations 40 CFR 93.153(b)

C.3 Calculations of NO₂ from Using M30 Gun Propellant

The following presents the calculations and assumptions used to determine the amount of NO₂ released when using 54 kilograms (120 pounds) of M30 propellant.

Step 1: Determine percentage of nitrocellulose (NC), nitroglycerin (NG), and nitroguanadine (NQ) in M30

The web site www.dtic.mil/ndia/2001gun/Paulin.pdf listed the percentages as follows

$$\text{NC} = 27.9\%$$

$$\text{NG} = 22.4\%$$

$$\text{NQ} = 46.8\%$$

The web site

www.sainc.com/onr/detsyp/PaperSubmit/FinalManuscript/pdf/Weigand-179.pdf listed the percentages as follows

$$\text{NC} = 27.61\%$$

$$\text{NG} = 22.67\%$$

$$\text{NQ} = 47.96\%$$

Taking an average of these percentages results in the following break down

$$\text{NC} = 27.8\%$$

$$\text{NG} = 22.5\%$$

$$\text{NQ} = 47.4\%$$

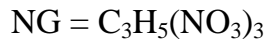
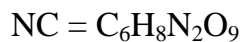
Step 2: Determine how much of the total M30 is each component when using 120 pounds of M30

$$\text{NC} = 33.36 \text{ pounds}$$

$$\text{NG} = 27 \text{ pounds}$$

$$\text{NQ} = 56.88 \text{ pounds}$$

Step 3: Determine the chemical formulas for NC, NG, and NQ



Step 4: Determine the weight fraction of nitrogen (N) per component by taking the relative weight of nitrogen divided by the total weight of the component.

$$\text{NC} = 2 \text{ N@14 grams/mole} / (6 \text{ carbon [C]@12 grams/mole} + 8 \text{ hydrogen [H]@1 gram/mole} + 2 \text{ N@14 grams/mole} + 9 \text{ oxygen [O]@16 grams/mole}) = 0.11 = \mathbf{11\%}$$

$$\text{NG} = 3 \text{ N@14 grams/mole} / (3 \text{ C@12 grams/mole} + 5 \text{ H@1 gram/mole} + 3 \text{ N@14 grams/mole} + 9 \text{ O @16 grams/mole}) = 0.19 = \mathbf{19\%}$$

$$\text{NQ} = 4 \text{ N@14 grams/mole} / (\text{C@12 grams/mole} + 4 \text{ H@1 gram/mole} + 4 \text{ N@14 grams/mole} + 2 \text{ O@16 grams/mole}) = 0.54 = \mathbf{54\%}$$

Step 5: Determine the total amount of N by weight in M30 by multiplying the percent N of each component (in Step 4) by the pounds of each component of M30 (in Step 2).

$$\text{NC} = 0.11 * 33.36 \text{ pounds} = 3.67 \text{ pounds} = 1,664.69 \text{ grams}$$

$$\text{NG} = 0.19 * 27 \text{ pounds} = 5.13 \text{ pounds} = 2,326.93 \text{ grams}$$

$$\text{NQ} = 0.54 * 56.88 \text{ pounds} = 30.72 \text{ pounds} = 13,934.36 \text{ grams}$$

$$\text{Total N in M30} = \text{NC} + \text{NG} + \text{NQ} = 3.67 + 5.13 + 30.72 = \mathbf{39.52 \text{ pounds}}$$

Step 6: Of the total N, the percent that is used in forming NO₂ is approximately 1.2% (see EPA report: Emission Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation http://www.mineaction.org/stockpile_destruction/_refdocs.cfm?doc_ID=161). Determine the amount of N that is used in forming NO₂ by multiplying the total N by (0.012) 1.2%.

$$\text{N used to form NO}_2 = 39.52 \text{ pounds} * 0.012 = 0.47 \text{ pounds} = \mathbf{215.6 \text{ grams}}$$

Step 7: Determine the pounds of O₂ used to form NO₂ by first determining the number of moles of N by dividing the grams of N by 14 grams/mole, then using 2 moles of O for every mole of N, determine pounds of O needed.

$$\text{Number moles N} = 215.6 \text{ grams} / 14 \text{ grams/mole N} = \mathbf{15.4 \text{ moles N}}$$

$$15.4 \text{ moles N} * 2 \text{ mole O/mole N} * 16 \text{ gram/mole O} = 493 \text{ grams} = \mathbf{1.1 \text{ pounds O}}$$

Step 8: Determine the total pounds of NO₂ released by adding pounds of N used in forming NO₂ (in step 6) to the pounds of O in forming NO₂ (in step 7).

$$\text{Total NO}_2 = 0.47 \text{ pounds N} + 1.1 \text{ pounds O} = \mathbf{1.57 \text{ pounds (0.7 kilograms)}}$$

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APPENDIX D
MATERIAL SAFETY AND SIMULANT DATA*

* Research was conducted in accordance with the “Guide for Laboratory Animal Facilities and Care” prepared by the National Academy of Sciences – National Research Council.

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APPENDIX D – MATERIAL SAFETY AND SIMULANT DATA



Performance Chemicals
Business Group



phosphorus
chemicals

Tributyl phosphate (TBP)

Tributyl phosphate is a very strong, polar solvent which can be used in the production of plastics, hydraulic fluids, extraction agents and antifoam agent.

Chemical name	tri-n-butylphosphate (TBP), phosphoric acid tri-n-butylester
CAS Reg. No.	126-73-8
Structural formula	$\begin{array}{c} \text{O}-\text{C}_4\text{H}_9 \\ \\ \text{O}=\text{P}-\text{O}-\text{C}_4\text{H}_9 \\ \\ \text{O}-\text{C}_4\text{H}_9 \end{array}$
Empirical formula	C ₁₂ H ₂₇ O ₄ P
Molecular weight	266.32 g/mol
Physical form	clear, colorless, low viscosity liquid with a slightly pungent odor
Health and safety information	Safety data and precautions which must be observed under all circumstances are to be found in EU Safety Data Sheet No. 006436. Hazard label: harmful

Specified Properties

Property	Nominal Value	Unit	Test Method
TBP content	≥ 99.0	% by mass	2011-0584201-00D
n-Butanol content	≤ 0.1	% by mass	2011-0584201-00D
Acid value	≤ 0.05	mg KOH / g	DIN 53 402
Water content	≤ 0.2	% by mass	DIN 51 777
Hazen color	≤ 50	-	ISO 6271
Density at 20°C	0.975 - 0.980	g /cm ³	DIN 51 757
Refractive index at 20°C	1.423 - 1.425	-	DIN 53 491



TIB Tributyl phosphate
2004-01-14
Page 1 of 3



Additional Information

Property	Typical Value	Unit	Test Method
TBP content	99.7	%	2011-0584201-00D
n-Butanol content	< 0.01	%	2011-0584201-00D
Acid value	0.005	mg KOH / g	DIN 53 402
Water content	0.06	%	DIN 51 777
Hazen color	10		ISO 6271
Density at 20°C	0.977	g / cm ³	DIN 51 757
Refractive index at 20°C	1.424		DIN 53 491
Viscosity at 20°C	3.8	mPa · s	DIN 53 015
Surface tension	27	mN / m	DIN 53 914
Fusion point	ca. -50	°C	
Flash point (Pensky-Martens)	152	°C	DIN 22 719
Flash point (Cleveland)	187	°C	DIN 2592
Boiling point at 5 mbar at 1013 mbar (decomposition)	approx. 130 approx. 289	°C	
Solubility TBP in water at 25°C water in TBP at 25°C	0,04 6.6	%	

These material properties are typical properties and, unless specifically indicated otherwise, are not to be considered as specified properties.

Solubility

Tributyl phosphate is soluble in common organic solvents such as aliphatic, aromatic and chlorinated hydrocarbons, alcohols, esters, ketones, and glycol ethers.

TBP is only slightly soluble in water (0.04 % by weight at 20°C).

Materials

Metallic materials such as stainless steel and aluminum, as well as ceramic apparatus components have proved suitable. Materials suitable for seals are polyethylene, poly-(tetrafluoro)ethylene (PTFE), and graphite.

Strong swelling may occur when plastic (PVC in particular) and rubber components are used as well as upon contact with the interior coatings of vessels. Testing of the resistance is therefore recommended.

Storage

Where material is stored under the appropriate conditions, the product can be stored for a period of at least two years in the tightly sealed original packaging.

Packaging

road tanker / ISO tank container
1000 kg IBC container
200 kg metal drum

Peculiarity

In accordance with the international "Responsible Care" initiative, Bayer AG requires that a declaration of End Use is completed even where not explicitly stipulated by legislation.





Applications

TBP is a very strong, aprotic, polar solvent. As such, it is used in the production of solutions of synthetic resins and natural rubber. In both cellulose based plastics and synthetic resins, TBP is used as a flame-retarding plasticizer.

TBP is employed as a pasting agent for pigment pastes.

Due to the limited influence of temperature on the viscosity of TBP, it also serves as an important component in the manufacture of hydraulic fluids for aircraft.

As a very strong wetting agent, TBP is used in the textile industry and in the field of adhesives.

TBP is used as an extraction agent (solvent) in liquid-liquid extraction processes. It is suitable for the separation and isolation of

rare earths, platinum group metals and in the enrichment of uranium and thorium. TBP is also widely used in the purification of phosphoric, nitric and hydrofluoric acids (see our TIB Baysolvex® TBP).

TBP is a powerful solvent for organic acids as well. It can therefore be used to extract organic acids from aqueous solutions and to separate acidic organic components from gaseous mixtures.

The ability of TBP to absorb gases such as H₂S and NO is utilized in gas scrubbing processes.

TBP can also be used as a defoaming agent (see our TIB Antifoam T).



TRIBUTYL PHOSPHATE
0584

October 1997

CAS No: 126-73-8
 RTECS No: TC7700000
 UN No:
 EC No: 015-014-00-2

Tri-n-butyl phosphate
 Butyl phosphate
 Phosphoric acid, Tributyl ester
 $C_{12}H_{27}O_4P / (C_4H_9)_3PO_4$
 Molecular mass: 266.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION			

EXPOSURE		PREVENT GENERATION OF MISTS!	
Inhalation	Cough. Headache. Nausea. Sore throat. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Burning sensation.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety goggles, or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place (extra personal protection: A/P2 filter respirator for organic vapour and harmful dust).	Xn Symbol R: 22 S: (2-)25

EMERGENCY RESPONSE	STORAGE
NFPA Code: H2; F1; R0;	Ventilation along the floor.

IPCS
 International
 Programme on
 Chemical Safety



Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission
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SEE IMPORTANT INFORMATION ON THE BACK.

0584

TRIBUTYL PHOSPHATE

IMPORTANT DATA

Physical State; Appearance

COLOURLESS, ODOURLESS VISCOUS LIQUID.

Chemical Dangers

The substance decomposes on heating and on burning producing toxic fumes including phosphorous oxides. Reacts with warm water producing corrosive phosphoric acid and butanol. Attacks some forms of plastics, rubber and coatings.

Occupational Exposure LimitsTLV: 0.2 ppm; 2.2 mg/m³ (as TWA) (ACGIH 1997).**Routes of Exposure**

The substance can be absorbed into the body by inhalation of its vapour.

Inhalation Risk

A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C.

Effects of Short-term Exposure

The substance irritates severely the eyes, the skin, and the respiratory tract.

Effects of Long-term or Repeated Exposure

See Notes.

PHYSICAL PROPERTIES

Boiling point (decomposes): 289°C
 Melting point: -80°C
 Relative density (water = 1): 0.98
 Solubility in water: poor
 Vapour pressure, kPa at 177°C: 17

Relative vapour density (air = 1): 9.2
 Flash point: 146°C o.c.
 Auto-ignition temperature: 410°C
 Octanol/water partition coefficient as log Pow: 4.0

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Animal data have shown weak anticholinesterase activity.

ADDITIONAL INFORMATION

LEGAL NOTICE

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible for the use which might be made of this information

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PHOSFLEX 4

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product label name Tri-n-butyl phosphate
Supplier Akzo Nobel Functional Chemicals bv
Stationsplein 4
PO Box 247
NL-3800 AE Amersfoort
Tel.: +31-334676767
Emergency telephone + 31 570679211 (Fax. + 31 570679801)
Akzo Nobel Chemicals-Deventer-NL

+ 1-914-693-6946
Dobbs Ferry, NY USA
Intended use plasticizer

2. COMPOSITION/INFORMATION ON INGREDIENTS

This product is to be considered as a substance in conformance to EC directives
Information on hazardous ingredients

Chemical description Tri-n-butyl phosphate

Composition / information on ingredients

Number	% w/w	CAS-number	Chemical name		
1	100	126-73-8	Tributyl phosphate		
Number	EC-number	Annex-1 number	Symbol(s)		Risk-phrase(s)
1	204-800-2	015-014-00-2	Xn		R22

3. HAZARDS IDENTIFICATION

Harmful if swallowed.

4. FIRST AID MEASURES

Symptoms and effects headache, nausea (inhalation). Mildly irritating (eyes).

First aid

General

Always seek medical advice in case of significant exposure.

Inhalation

Move to fresh air, rest, half upright position, loosen clothing. Oxygen or artificial respiration if there is difficulty in breathing.

Skin

Wash immediately with soap and water. Remove contaminated clothing/shoes. Launder clothes before reuse.

Eye

Rinse thoroughly with plenty of water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Seek medical advice if irritation develops.

Ingestion

Rinse mouth, give water to drink. Do NOT induce vomiting. Seek medical advice.

Advice to physician

Symptomatic treatment is advised.

5. FIRE-FIGHTING MEASURES

Extinguishing media waterspray, Carbon dioxide, powder.

Unsuitable extinguishing media none known.

Special exposure hazards May emit toxic and irritating fumes under fire conditions.

Hazardous decomposition/ combustion products Does not present a serious fire hazard. If involved in a fire it may support combustion and may decompose to give off toxic materials. The product is selfextinguishing once the source of ignition is removed.

Protective equipment Wear self contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions For personal protection see Section 8.

Environmental precautions Do not empty into drains.

Methods for cleaning up Collect as much as possible in a clean container for (preferable) reuse or disposal. Cover the remainder with inert absorbent (e.g. vermiculite) for disposal.

7. HANDLING AND STORAGE

Handling Avoid inhalation

Fire and explosion prevention Does not present a serious fire hazard.

Storage requirements .

PHOSFLEX 4

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limits

Name

Tributyl phosphate	OES-TWA	5.0 mg/m ³
	OES-STEL	5.0 mg/m ³

Personal protection

Respiratory	In case of insufficient ventilation, wear suitable respiratory equipment.
Hand	The usual precautions for handling chemicals should be observed.
Eye	Wear safety goggles.
Skin and body	The usual precautions for handling chemicals should be observed.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	liquid
Colour	colourless to pale yellow
Odour	not determined
Boiling point/range	approx. 180 °C (2930 Pa)
Melting point/range	< -80 °C
Flash point	146 °C (Cleveland open cup)
Flammability	not determined
Autoignition temperature	> 482 °C
Explosive properties	not applicable
Explosion limits	not applicable
Oxidizing properties	not relevant
Vapour pressure	1.8 kPa (20 °C)
Density	approx. 978 kg/m ³
Bulk density	not applicable
Solubility in water	1 g/l (20 °C)
Solubility in other solvents	organic solvents
pH value	not determined (acid number 0.2 mgKOH/g max.)
Partition coefficient n-octanol/water	not determined
Relative vapour density (air=1)	9.2
Viscosity	4.5 mPa.s (25 °C)
Active oxygen content	not applicable
Peroxide content	not applicable
SADT	not applicable

10. STABILITY AND REACTIVITY

Stability	Hydrolyses slowly under weak alkaline or acidic conditions.
Conditions to avoid	Generation of heat.
Materials to avoid	acids, alkalis.
Hazardous decomposition products	No typical hazardous decomposition products known. If involved in a fire it may support combustion and may decompose to give off toxic materials
Other information	No typical hazardous reactions known.

11. TOXICOLOGICAL INFORMATION

Name	Tributyl phosphate
Acute toxicity	
Oral LD50	rat: 3160 mg/kg (Akzo Nobel A-file)
Dermal LD50	rabbit:> 4640 mg/kg (Akzo Nobel A-file)
Irritation	
Skin	Non-irritating (Akzo Nobel A-file)
Eye	Mildly irritating (Akzo Nobel A-file)
Sensitization	Not sensitizing (Akzo Nobel A-file)

PHOSFLEX 4

Genotoxicity	Ames test: Not mutagenic (Akzo Nobel A-file) Not teratogenic (mouse, rabbit) (Akzo Nobel A-file) Not neurotoxic (rat) (Akzo Nobel A-file)
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12. ECOLOGICAL INFORMATION

Name	Tributyl phosphate
Ecotoxicity	
fish	Acute toxicity, 96h-LC50 (Oncorhynchus mykiss): 13 mg/l (Akzo Nobel A-file)
daphnia	Acute toxicity, 48h-EC50: 2.6 mg/l (Akzo Nobel A-file)
algae	Acute toxicity, 96h-IC50: 4.4 mg/l (Akzo Nobel A-file)
Fate	
Degradation Biotic	Readily biodegradable (Lit.)

13. DISPOSAL CONSIDERATIONS

Product	According to local regulations (most probably controlled incineration).
Contaminated packaging	According to local regulations.

14. TRANSPORT INFORMATION

<i>Land transport (ADR/ RID)</i>			
ADR class	not restricted	ADR/RID item no.	not relevant / not relevant
RID class	not restricted	ADR/RID packing group	
Hazard Identification No.	not relevant	Substance Identification No.	not relevant
TREM-Card	not relevant	UN number	none
Proper Shipping Name	not relevant		
<i>Sea transport (IMDG-code/ IMO)</i>			
IMO/IMDG code	not restricted	Class	not restricted
Packing group	not relevant	UN number	none
EMS	not relevant	MFAG	not relevant
Marine pollutant	no		
Proper Shipping Name	not relevant		
<i>Air transport (ICAO-TI/ IATA-DGR)</i>			
ICAO-TI/IATA-DGR		UN number	none
Class	not restricted	Packing group	not relevant
Proper Shipping Name	not relevant		

15. REGULATORY INFORMATION

Chemical description	Tri-n-butyl phosphate
-----------------------------	-----------------------

Labelling according to EC directives



Symbol(s)	HARMFUL (Xn)
R(isk) phrase(s)	R22: Harmful if swallowed
S(afety) phrase(s)	S25: Avoid contact with eyes
Wassergefährdungsklasse (WGK)	2 (VwVwS Anhang 2 No. 196)

PHOSFLEX 4

16. OTHER INFORMATION

This information only concerns the above mentioned product and does not need to be valid if used with other product(s) or in any process. The information is to our best present knowledge correct and complete and is given in good faith but without warranty. It remains the user's own responsibility to make sure that the information is appropriate and complete for his special use of this product.

R-phrase information

Chemical name	Risk-phrase(s)	
Tributyl phosphate	R22	Harmful if swallowed

History

Date of printing/ pdf file generated	09-09-2002	
Revision	0.36	
Composed by	Dr. D.J. Buckland	Dr. M. Verploegh
Changes were made in section	1	

SIDS INITIAL ASSESSMENT PROFILE

CAS No.	126-73-8
Chemical Name	Tributyl phosphate
Structural Formula	$(C_4H_9O)_3PO$
RECOMMENDATIONS	
The chemical is a candidate for further work under conditions specified below.	
SUMMARY CONCLUSIONS OF THE SIAR	
Human Health	
<p>The toxicology database for tributyl phosphate (TBP) is large and well documented. There are adequate data with which to evaluate the potential hazard to human health of this compound. Acute oral toxicity values in rodents range from 1390 to 3350 mg/kg-bw in rats and from 400 to 1240 mg/kg-bw in mice. A rat six-hour LC50 of > 4.2 mg/L (highest dose tested) was reported. Dermal studies exist in rabbits (LD50s of >3100 mg/kg-bw and > 10,000 mg/kg-bw) and in guinea pigs (LD50 of 9700 – 19,400 mg/kg-bw). Repeat dose studies have been performed in animals via the inhalation (4 month studies in rats and rabbits) and oral (gavage studies in rats [one week to 18 weeks] and rabbits [two weeks] and dietary feeding studies in rats [nine weeks to two years] and mice [four weeks to two years]) routes. Effects observed in the inhalation studies were depressed cholinesterase levels (reversible after exposure stopped) at the highest tested dose (13.6 mg/m³) in both rats and rabbits. Overall, the results of the rodent dietary/gavage studies consistently showed cellular and/or weight changes in the liver, kidney, and bladder. In the rat, two-year dietary study, the NOAEL is 200 ppm (9 mg/kg-bw/day males and 12 mg/kg/day females) for cytotoxicity/hyperplasia in the urinary bladder. In an 18 month dietary study using CD-1 mice the NOAEL was 150 ppm (28.9 mg/kg/day for females and 24.1 mg/kg/day for males), the lowest dose tested. TBP did not affect reproductive performance in a two-generation feeding study in rats (NOAEL of > 225 mg/kg-bw/day). Developmental toxicity was observed in the two-generation study, but only at levels at which maternal toxicity was observed (NOAEL < 15 mg/kg-bw/day; reduced pup weights along with reduced maternal body weight gain and decreased food consumption). In three separate teratology experiments (two with rats and one with rabbits), teratogenic (delayed ossification and rudimentary ribs) and developmental (reduced fetal weights) effects were observed only at maternally toxic doses and only in rats (NOAEL in rabbit study was the highest dose tested – 400 mg/kg-bw/day). The NOAEL for teratogenic effects was 750 mg/kg-bw/day, but the NOAEL for maternal toxicity was 62.5 mg/kg-bw/day. TBP is an animal carcinogen when administered in the diet at levels greater than 200 ppm in rats (9 mg/kg-bw/day) or 150 ppm in mice (24 mg/kg-bw/day). Overall the results of genetic toxicity studies indicate that TBP is not genotoxic. These include <i>in vitro</i> and <i>in vivo</i> data. A mechanistic study in rats found that the effects of TBP on the bladder were reversible upon withdrawal of treatment and thus likely due to the direct urothelial cytotoxicity of the chemical itself (or its metabolites), and not a result of urinary changes. The neurotoxicity of TBP has been studied in several species including the rat, hen, and rabbit. In these studies, TBP produced either no signs of neurotoxicity or only slight or transient effects on measured endpoints. TBP is irritating to the skin and eye of humans and laboratory animals but does not cause sensitization in humans. The primary exposure to TBP is through dermal contact in the occupational setting. Based on this exposure route and the NOAEL levels reported, the most likely effects of TBP exposure are irritation of the skin and eyes.</p>	

Environment

In both soil and water, TBP is expected to adsorb to sediments or particulate matter and biodegrade. In the atmosphere, TBP will exist as a vapour and will be subject to rapid photodegradation. Bioconcentration is not expected to occur. Numerous acute and chronic toxicity data are available for fish, invertebrates, and algae. The acute toxicity values for fish (96-hr LC50) from over a dozen studies range from 4.2 to 18 mg/L. Toxicity values for six species of algae ranged from a 72-hr EC50 (biomass) of 1.1 mg/L (*Scenedesmus subspicatus*) to a 48 hr EC50 of 5-10 mg/L (*Chlorella emersonii*). Algal NOECs have been reported in two different studies (0.37 mg/L as an EC10 for biomass in *Scenedesmus subspicatus* and 2.2 mg/L in a 96-hr study with *Selenastrum capricornatum*). Daphnid chronic NOECs range from 0.87 mg/L (21-day study) to 3.1 mg/L (14-day study). The lowest fish NOEC occurred at a concentration of 0.82 mg/L (95-day early life-stage study). Using an assessment factor of 10, since long-term NOECs are available for three species representing three trophic levels (fish, *Daphnia*, and algae), and the lowest valid NOEC (0.37 mg/L for algae, the resulting aquatic predicted no-effect concentration (PNEC) is 0.037 mg/L.

Exposure

The production volume of TBP is estimated at 3,000 – 5,000 tonnes worldwide. The major uses of TBP in industry are as a component of aircraft hydraulic fluid and as a solvent for rare earth extraction and purification. Minor uses of TBP include use as a defoamer additive in cement casings for oil wells, an anti-air entrainment additive for coatings and floor finishes, as well as a carrier for fluorescent dyes. The major uses of TBP comprise over 80 percent of the volume produced. No current consumer product uses of TBP have been identified. The primary occupational exposure to TBP results from its use as an ingredient in aircraft hydraulic fluids. The potential for exposure to TBP varies with the type of maintenance activity, but is almost always via a dermal pathway.

NATURE OF FURTHER WORK RECOMMENDED

The chemical is considered a candidate for further work, in the context of a risk assessment, if it is used as a herbicide or has other dispersive uses.

 <p>SOLUTIATM Applied Chemistry, Creative Solutions</p>	<p><i>Material Safety Data Sheet</i></p>	 <p>Responsible Care[®] A Public Commitment</p>
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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: DIBUTYL PHENYL PHOSPHATE
MSDS Number: 002528361 Date: July 22, 1998
Chemical Family: phosphate esters

SOLUTIA INC., 10300 OLIVE BOULEVARD, P.O. BOX 66760, ST. LOUIS, MO 63166-6760

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
Call CHEMTREC - Day or Night - 1-800-424-9300 Toll free in the continental U.S., Hawaii, Puerto Rico,
Canada, Alaska, or Virgin Islands. For calls originating elsewhere: 703-527-3887 (collect calls accepted)

For additional non-emergency information, call: 314-674-6661

2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS No.</u>	<u>% by weight</u>
dibutyl phenyl phosphate	2528-36-1	70
tributyl phosphate	126-73-8	15
butyl diphenyl phosphate	2752-95-6	15

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance and Odor: clear slightly yellow liquid with a butanolic odor

WARNING STATEMENTS

WARNING!
CAUSES EYE, SKIN AND RESPIRATORY TRACT IRRITATION
CONTAINS TRIBUTYL PHOSPHATE WHICH MAY CAUSE URINARY BLADDER DAMAGE BASED ON ANIMAL DATA

POTENTIAL HEALTH EFFECTS

Likely Routes of Exposure: skin contact and inhalation

EYE CONTACT: With some formulations of this material contact has been reported to produce severe eye pain without eye damage.

SKIN CONTACT: This product removes oils from the skin causing drying and cracking following repeated or prolonged contact. This product is no more than slightly toxic if absorbed.

INHALATION: Inhalation of this product as an aerosol, or as a vapor produced at high temperatures, has been reported to cause nose and throat irritation accompanied by coughing and wheezing. Inhalation of tributyl phosphate, a component, at concentrations above the recommended TLV may cause nausea and headache.

INGESTION: This product is no more than slightly toxic. Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.

NOTE: Tributyl phosphate may cause urinary bladder damage based on animal studies.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES OR ON SKIN, immediately flush the area with plenty of water. If easy to do so, remove any contact lenses. Remove contaminated clothing. Get medical attention. Wash clothing before reuse.

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. Remove material from eyes, skin and clothing.

IF SWALLOWED, immediate first aid is not likely to be required. A physician or Poison Control Center can be contacted for advice. Wash contaminated clothing before reuse.

5. FIRE FIGHTING MEASURES

Flash Point:	350 degrees F (177 degrees C) 265 degrees F (129 degrees C)	Method:	Cleveland Open Cup Pensky-Martin Closed Cup
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Hazardous Products of Combustion: Not uniquely hazardous products of combustion are expected.

Extinguishing Media: In case of fire, use water spray (fog), foam, dry chemical, or CO₂.

Unusual Fire and Explosion Hazards: None known

Fire Fighting Equipment: Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Contain large spills with dikes and transfer the material to appropriate containers for reclamation or disposal. Absorb remaining material or small spills with an inert material and then place in a chemical waste container.

Refer to Section 13 for disposal information and Section 15 for reportable quantity information.

7. HANDLING AND STORAGE

Avoid contact with eyes, skin and clothing.

Avoid breathing vapor or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is destroyed. DO NOT REUSE THIS CONTAINER.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Where there is significant potential for eye contact, wear chemical goggles and have eye flushing equipment available.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear face shield and chemical resistant clothing such as a rubber apron when splashing is likely. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling.

Respiratory Protection: This product is not likely to present an airborne exposure concern under normal use. Use NIOSH/MSHA approved respiratory protection equipment (full facepiece recommended) if needed for vapor exposure during high temperature processing or mist exposure if released as an aerosol. If used, full facepiece replaces the need for faceshield or chemical goggles. Consult the respirator manufacturer to determine the appropriate type of equipment for a given application. Observe respirator use limitations specified by NIOSH/MSHA or manufacturer. Respiratory protection programs must comply with 29 CFR 1910.134.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

AIRBORNE EXPOSURE LIMITS:

<u>Product/Component</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>
dibutyl phenyl phosphate	None established	3.5 mg/m ³ (0.3 ppm) 8-hour TWA
tributyl phosphate	2.5 mg/m ³ (0.2 ppm) 8-hour TWA	2.2 mg/m ³ (0.2 ppm) 8-hour TWA
butyl diphenyl phosphate	None established	None established

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: clear slightly yellow liquid
Odor: butanolic odor
Boiling Point: 153-155 degrees C (2.3 mm Hg)
Specific Gravity: 1.069 @ 25/25 degrees C
Solubility in Water: very low (wt. %)

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Solutia Material Safety Data Sheet

DIBUTYL PHENYL PHOSPHATE

MSDS No.: 002528361

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Stability: Product is stable under normal conditions of storage and handling.

Materials to Avoid: None known.

Hazardous Decomposition Products: Oxides of phosphorus (phosphoric acid).

Hazardous Polymerization: Does not occur.

11. TOXICOLOGICAL INFORMATION

Data from Solutia studies and from the available scientific literature are given below:

Single-dose (acute) toxicity studies indicate:

Oral -Slightly Toxic, (Rat LD50 - 2,620 mg/kg)

Dermal -Practically Nontoxic, (Rabbit LD50 - >5,000 mg/kg)

Eye Irritation -Practically Nonirritating, (Rabbit, 1.1/110.0, 24-hr. exp.)

Skin Irritation -Nonirritating, (Rabbit, 0.0/8.0, 24-hr. exp.)

No potential for skin irritation or skin allergy was observed in controlled skin contact studies with human volunteers. Rabbits exposed to this product by repeated skin application showed skin irritation but no symptoms associated with the observed decreases in plasma, red blood cell, and brain cholinesterase levels. Adverse effects reported in two separate studies with rats given this material in their diets for 3 months include blood changes, decreased body weight gains, and increased liver weights. Liver, kidney, bladder, and ovary changes were also reported. A similar study using lower dosages reported no adverse effects in the rats.

No evidence of changes in nervous system tissues or delayed effects were observed in chickens following single or repeat oral dosing with this product; however, the exposed animals displayed cholinergic signs (pupil constriction, salivation, and diarrhea) following exposure. Another study with chickens reported a decrease in plasma butylcholinesterase, equivocal changes in neurotoxic esterase and no changes in brain acetylcholinesterase.

No birth defects were observed in rats given this product orally during pregnancy. In a multigenerational study, this product did not alter reproductive performance, but survival of offspring was reduced and, in parental animals, a decrease in body weights and an increase in bladder changes was observed.

No adverse genetic changes were reported in standard tests using animals or bacterial, yeast, and animal cells.

Components

Data from Solutia studies and from the available scientific literature on the components of this product which have been identified under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) are discussed below:

Tributyl Phosphate

Tributyl phosphate administered as a single dose was slightly toxic orally (rat), practically nontoxic dermally (rabbit), mildly irritating to rabbit eyes and severely irritating to rabbit skin. No skin allergy was observed in guinea pigs following repeated skin exposure. Animal studies indicate that tributyl phosphate may be absorbed through the skin. Adverse effects reported in several studies with rats exposed to tributyl phosphate by repeated oral administration include decreased body weights, increased liver, kidney, and spleen weights, blood changes, and kidney and testis damage. Adverse effects reported in several studies with rats and/or mice given tributyl phosphate in their feed include decreased body weight, increased liver, kidney, testis, and brain weights,

decreased uterus weight, blood changes, increased brain cholinesterase levels, and bladder hyperplasia (increased cell growth). No increase in cholinesterase activity was observed in rat cells or serum when exposed to tributyl phosphate.

Tributyl phosphate administered by injection to rats produced serum chemistry changes with no change reported in serum cholinesterase activity. No evidence of changes in nervous system tissues or delayed effects were observed in chickens following repeated oral doses. An increase in plasma butylcholinesterase levels was reported in chickens following exposure to tributyl phosphate in a study designed to measure brain enzyme changes. Tributyl phosphate administered to rats for 14-days produced decreased body weights and altered nerve function and some structural changes. There was no indication of neurotoxicity to rats following single or repeated (90-day) oral exposures to tributyl phosphate. Lifetime administration of tributyl phosphate to mice in their feed increased the incidence of benign liver and lung tumors in high-dose male mice but were determined not to be treatment related. Mid- and high-dose male and female rats demonstrated epithelial hyperplasia and benign urinary bladder tumors (papilloma), and high-dose male and female rats developed malignant urinary bladder tumors following lifetime dietary administration of tributyl phosphate. No adverse genetic changes were reported in standard tests using bacterial or animal cells.

Dibutyl Phenyl Phosphate/Butyl Diphenyl Phosphate

Dibutyl Phenyl Phosphate mixture contains dibutyl phenyl phosphate and butyl diphenyl phosphate. Monsanto has not conducted toxicity studies on these components as pure materials but only as part of a mixture with tributyl phosphate. (See above) In addition, no toxicity information for these pure chemicals was found in a reasonably extensive search of the scientific literature. However, based on their chemical structure, dibutyl phenyl phosphate and butyl diphenyl phosphate may contribute to the toxicity of Dibutyl Phenyl Phosphate mixture as reported above.

12. ECOLOGICAL INFORMATION

The following data have been classified using the criteria adopted by the European Economic Community (EEC) for aquatic organism toxicity. A legend summarizing the classification scheme appears below.

Dibutyl Phenyl Phosphate mixture

48-hr EC50 <u>Daphnia magna</u> :	Ranged from 0.50 to 1.15 mg/l, Very Toxic
96-hr EC50 Algae (Cell Count):	6.0 mg/l, Toxic
96-hr EC50 Algae (Chlorophyll):	5.4 mg/l, Toxic
96-hr LC50 Fathead minnow:	3.0 mg/l, Toxic
96-hr LC50 Rainbow trout:	2.0 mg/l, Toxic
96-hr TL50 Bluegill sunfish:	Estimated to be between 1 and 10 ppm, Toxic
14-Day LC50 Rainbow trout:	2.4 mg/l, Toxic

Daphnia magna were exposed to this product at concentrations of 0.014, 0.028, 0.055, 0.092 and 0.25 mg/l through one generation (21 days). Increased mortality, reductions in the total length of Daphnia at 7 days and reductions in the percent of gravid females were observed at 0.25 mg/l. The maximum acceptable toxicant concentration was greater than 0.092 mg/l and less than 0.25 mg/l.

Rainbow trout eggs were exposed to this product at concentrations ranging from 0.007 to 0.110 mg/l. No treatment-related effects were observed on hatchability of eggs or on growth and survival of the fry. The maximum acceptable toxicant concentration was greater than 0.110 mg/l.

This product had a primary degradation rate of greater than 95% in a semi-continuous activated sludge test; this material was classified as readily degraded. In a river die-away study, this product was classified as being readily degradable.

tributyl phosphate

48-hr EC50 <i>Daphnia magna</i> :	2.4 mg/l, Toxic
96-hr LC50 Fathead minnow:	6.4 mg/l, Toxic
96-hr LC50 Rainbow trout:	13.0 mg/l, Harmful
96-hr LC50 Amphipod:	2.4 mg/l, Toxic
96-hr EC50 Algae:	4.4 mg/l, Toxic
96-hr LC50 Gammarid:	1.7 mg/l, Toxic

Tributyl phosphate was evaluated in a semi-continuous activated sludge test, the Thompson-Duthie-Sturm biodegradation assay and in a river die-away test. Based on results from these assays, tributyl phosphate was classified as readily degradable.

Legend for Aquatic Organism Toxicity (Journal of the European Communities, Annex VII A, Section 5.2.1)

Values	Classifications
LC50 or EC50 < or = 1.0 mg/L	Very Toxic
LC50 or EC50 > 1.0 mg/L and < or = 10 mg/L	Toxic
LC50 or EC50 > 10 mg/L and < or = 100 mg/L	Harmful
LC50 or EC50 > 100 mg/L	Practically Nontoxic

13. DISPOSAL CONSIDERATIONS

This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261. Dispose of by incineration or recycle in accordance with local, state and federal regulations. Consult your attorney or appropriate regulatory officials for information on such disposal.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

This product is not hazardous under the applicable DOT, ICAO/IATA, or IMDG regulations.

15. REGULATORY INFORMATION

TSCA Inventory: All components are listed.

SARA Hazard Notification

Hazard Categories Under Title III Rules (40 CFR 370): Immediate, Delayed
Section 302 Extremely Hazardous Substances: Not Applicable
Section 313 Toxic Chemical(s): Not Applicable

CERCLA Reportable Quantity: Not Applicable

California Proposition 65: Not Applicable

Refer to Section 11 for OSHA Hazardous Chemical(s) and Section 13 for RCRA classification.

16. OTHER INFORMATION

Reason for revision: Routine review and company name change to Solutia. Supersedes MSDS dated 10/03/95.

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