

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE							
2 - Applied Research	0602720A - Environmental Quality Technology							
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	17570	19605	15809	15223	14925	14896	14965	15092
048 IND OPER POLL CTRL TEC	2748	2977	2996	3044	3076	3099	3167	3237
835 MIL MED ENVIRON CRIT	2949	3220	3268	3320	3355	3380	3454	3530
895 POLLUTION PREVENTION	3264	4542	3728	4062	3817	4011	4099	4189
896 BASE FAC ENVIRON QUAL	6979	6987	5817	4797	4677	4406	4245	4136
F35 Environmental Quality Applied Research (CA)	1630	1879						

A. Mission Description and Budget Item Justification: The objective of this applied research program element is to provide technologies that support the long-term sustainment of Army training and testing activities by improving the Army's ability to comply with requirements mandated by federal, state, and local environmental/health laws reducing the cost of this compliance. This program provides the Army with capabilities to decontaminate or neutralize Army-unique hazardous and toxic wastes at sites containing waste ammunition, explosives, heavy metals, propellants, smokes, chemical munitions, and other organic contaminants; as well as technology to avoid the potential for future hazardous waste problems, by reducing hazardous waste generation through process modification and control, materials recycling, and substitution. This program matures technologies to predict and mitigate range and maneuver constraints associated with current and emerging weapon systems, doctrine, or regulations. Research is transitioned to PE 0603728A (Environmental Quality Technology Demonstrations). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research, and Development Center, headquartered at Vicksburg, Mississippi, the Center for Health Promotion and Preventive Medicine located at Aberdeen, Maryland, and the Army Research Laboratory located at Aberdeen, Maryland, execute the project work.

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<u>B. Program Change Summary</u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	17859	17923	17131	16650
Current BES/President's Budget (FY 2008/2009)	17570	19605	15809	15223
Total Adjustments	-289	1682	-1322	-1427
Congressional Program Reductions		-75		
Congressional Rescissions				
Congressional Increases		1900		
Reprogrammings	-289	-143		
SBIR/STTR Transfer				
Adjustments to Budget Years			-1322	-1427

One FY07 congressional add totaling \$1821 after adjustment for Congressional Undistributed Reductions was added to this PE.

(\$1821) Chemical Materials and Environmental Modeling Proj

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BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602720A - Environmental Quality Technology					PROJECT 048		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
048 IND OPER POLL CTRL TEC	2748	2977	2996	3044	3076	3099	3167	3237	

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide technologies to enable the Army to reduce or eliminate environmental impacts both in the United States and abroad. These technologies reduce the impact of legal and regulatory environmental restrictions on installation facilities, training and testing lands and ranges, as well as avoid fines and facility shutdowns within the United States and reduce environmental impacts to the warfighter abroad. New and innovative technologies are essential for the effective control and reduction of military unique hazardous and non-hazardous wastes on military installations worldwide. Efforts include a focus on the impacts of new materiel that will enter the Army inventory within the next decade and beyond. This project focuses on industrial pollution sources from production facilities, facility contamination, and other waste streams providing compliance through sustainable environmental protection technologies. Efforts abroad include a focus on technologies to provide deployed forces with environmentally safe and cost effective technologies and/or processes to achieve maximum diversion, minimization, or volume reduction of basecamp/field waste. Additional work is focused on environmental risk assessment for ranges. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Industrial Compliance and Pollution Prevention Readiness: In FY06, matured bench treatment technologies, isolated and characterized common acetogens capable of RDX degradation and developed in situ bioremediation methods for ammonium perchlorate in soils and groundwater. In FY07, maximize adhesive and agglomerative properties of cellulosic component and will transfer polymer component to reduce barrier/fortification requirements. Initiate reductive treatment/transformation studies for Dinitro Anisole (DNAN) and Methyl Nitro para Aniline (MNA), and use structural activity analysis to predict fate and treatment effectiveness. Develop improved physics-based algorithms for blast and small arm noises through comprehensive measurements and application of non-linear wave steepening and time/frequency modeling. In FY08, will complete development of a Structural Activity Relationship (SAR) Predictive Model for insensitive munition treatment kinetics and will begin research in chemical/physical characteristics of fugitive industrial particulates. In FY09, design dose-response metrics for low frequency, peak pressure from blast noise on ranges and characterize pathways of fugitive industrial particulates.	2748	2928	2996	3044
Small Business Innovative Research/Small Business Technology Transfer Programs		49		
Total	2748	2977	2996	3044

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A - Environmental Quality Technology					PROJECT 835			
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
835 MIL MED ENVIRON CRIT	2949	3220	3268	3320	3355	3380	3454	3530	

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide quantitative means to determine the environmental and human health effects resulting from exposure to explosives, propellants, and smokes produced in Army industrial, field, and battlefield operations or disposed of through past activities. The end results of this research are determinations of acceptable residual Munitions Constituents (MCs) and Munitions and Explosives of Concern (MECs) contaminant concentration levels that minimize adverse effects on the environment and human health. This research is supported by the previously developed Army Risk Assessment and Modeling System (ARAMS) that links models and databases of expected result and transport to the exposure and effects of explosives and their degradation by-products. The Long-Term Monitoring program reduces or eliminates the costly and lengthy operation of off-site analyses and enhances overall monitoring capabilities by providing continuous/autonomous detection/analysis. The program of Characterization/Assessment of Distributed Source MCs on ranges yields knowledge and technologies to quantify MC transport and fate in terrestrial range environments. New research in toxicogenomics, nanomaterial technologies, and computational/molecular modeling tools for toxicity and exposure assessment further reduces the uncertainty associated with both the probability of exposure and the ultimate effect if exposed. Interim products are U.S. Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. The Army uses these criteria during negotiations with regulatory officials to set scientifically and economically appropriate cleanup and discharge levels at Army installations. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, manages execution of the project work.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
FY06, identified rapid, statistically based sampling and innovative analytical methods and protocols for MCs assessment on Army ranges, identified novel contaminant extraction and field measurement methods for on-site long term monitoring (LTM) and designed a computational biology virtual simulation for predictive toxicology for mammalian organisms. In FY07, will identify novel contaminant detection systems and measurement protocols for near-real-time, on-site LTM, integrate a distributed source contaminant transport model into the ARAMS, and further refine computational biology virtual simulations. In FY08, will design a laboratory-scale gene signature array microchip sensor, evaluate field negative ion miniature mass spectrometry for detection of MCs, define statistically valid range characterization/sampling protocols for MC sources, construct a toxicogenomic assessment framework as a modeling platform, identify methods for computational chemistry prediction of effects of water dissolved explosives, and identify analytical approaches to characterize nanomaterial properties to support toxicological and remediation approaches. In FY09, will evaluate LTM in situ biosensor technologies for direct push wells, finalize protocols for MC residue reduction, complete mathematical modeling of toxicity and effects due to existing, well characterized MECs and devise computational chemistry methods for the prediction of reactivity, and toxicity of water dissolved explosives and decomposition products. Will identify exposure quantification metrics for select representative nanomaterials. Will initiate a common framework to consolidate tools for comprehensive, multi-stressor range environmental risk assessments.	2949	3140	3268	3320
Small Business Innovative Research/Small Business Technology Transfer Programs		80		
Total	2949	3220	3268	3320

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A - Environmental Quality Technology						PROJECT 895		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
895 POLLUTION PREVENTION	3264	4542	3728	4062	3817	4011	4099	4189	

A. Mission Description and Budget Item Justification: The goal of this project is to provide energetics/munitions technologies required to reduce/eliminate the environmental footprint resulting from the manufacture, maintenance, use and surveillance of Army ordnance. This program matures revolutionary technologies to eliminate or significantly reduce the environmental impacts that threaten the sustainment of energetics production and maintenance facilities and training ranges. The project supports the transformation of the Army by ensuring that advanced energetic materials required for the Future Combat System (FCS) high-performance munitions (gun, rocket, missile propulsion systems, and warhead explosives) are devised to meet weapons lethality/survivability stretch goals in parallel with, and in compliance to, foreseeable sustainment requirements. Specific technology thrusts include environmentally-benign designer energetic molecules engineered by molecular modeling and simulation using Department of Defense (DoD) High-Performance Computing resources; novel energetics that capitalize on the unique behavior of nano-scale structures; chemically engineered explosive and propellant formulations produced with minimal environmental waste, long-storage lifetime, rapid/benign environmental degradation properties, and efficient extraction and reuse; and fuses, pyrotechnics, and initiators that are free from toxic chemicals. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP), and supports the Army Strategy for the Environment. Work in this project is performed by the Research, Development, and Engineering Command's (RDECOM) Army Research Laboratory (ARL), Aberdeen, MD, in collaboration with the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ, the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL, and the Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Rocket and Missile Propellants: In FY06, conducted small-scale testing of new environmentally benign prototype rocket propellants and engine concepts. In FY07, characterize decomposition products and environmental properties of new propellants. In FY08, will model performance of propellant-engine combinations. In FY09, will optimize and evaluate performance of propellants in new engine. Conventional Ammunition: In FY06, modeled ten new explosives and selected five for gram-scale synthesis and property evaluation. In FY07, synthesize and evaluate five new low-toxicity explosives in gram-scale, and scale-up synthesis of select materials for performance and environmental evaluation. In FY08, will refine green chemistry synthesis procedures, and will perform full chemical and physical characteristic evaluation of new explosives. In FY09, will model performance of new environmentally benign explosives in weapons systems. Pyrotechnics: In FY06, refined perchlorate-free pyrotechnic formulations and composition processing, and identified and evaluated non-polluting manufacturing processes for pyrotechnic and explosive manufacture. In FY07, evaluate environmental characteristics, performance and compatibility of pyrotechnic candidates. In FY08, will optimize low-toxicity smoke formulations. In FY09, will investigate environmentally sustainable simulators, flares, delays and signals.	3264	4414	3728	4062
Small Business Innovative Research/Small Business Technology Transfer Programs		128		
Total	3264	4542	3728	4062

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A - Environmental Quality Technology					PROJECT 896		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
896 BASE FAC ENVIRON QUAL	6979	6987	5817	4797	4677	4406	4245	4136

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide environmental risk assessment, analysis, monitoring, modeling, and mitigation technologies to support sustainable use of the Army's facilities, training lands, firing ranges, and airspace to reduce or eliminate environmental constraints to military missions. This project provides the Army the technical capability to manage, protect, and improve the biophysical characteristics of training and testing areas needed for realistic ranges and training lands to accommodate the Current and Future Force. Technologies within this project enable users to match mission events and training schedules with the resource capabilities of specific land areas and understand how the use of those resources effect mission support and environmental compliance. The project provides advanced methods and technologies to restore lands damaged during training activities and allow sustained use of installation facilities and training land resources. The project also provides tools and technologies to avoid training restrictions and costs due to training and testing noise. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Threatened and Endangered Species (TES) Management to Reduce Operational Constraints: In FY06, completed spatial assessment technology for high priority species on Army lands and mature new inventory and monitoring protocols for select species to reduce TES management costs. In FY07, complete new techniques for preparation of population goals on Army lands to ensure the Army is responsible for its fair share of species recovery. Complete initial groundwork in improving species at risk (SAR) detection capability. In FY08, will complete projects identifying effects of noise and physiological stress of transient training activities on the Indiana Bat and Gopher Tortoise, research in support of a Candidate Conservation Agreement for Gopher Tortoise, and enhanced LIDAR applications for habitat assessment. Completion of these projects will reduce potential constraints on military training associated with the Indiana Bat Recovery Plan currently in revision and under Army review and a possible listing petition for the Gopher Tortoise. In FY09, will evolve research from reactive, single species research applications for currently listed species to a multi-species approach for improved detection of Species at Risk (SAR) and predictive synthesis models for effects of military disturbance on SAR. This will assist the Army in reducing the number of future listed species and their associated constraints on military training.	3809	3000	3115	2495
Predictive Risk Assessment and Management for Army Ranges and Training Lands: In FY06, completed integration of munitions carrying capacity model as a component platform consistent with the Installation Training and Maintenance (ITAM) Army Training and Testing Area Carrying Capacity (ATTACC) methodology. Environmental Impacts on Joint/Army Ranges: In FY06, conducted cost benefit analysis for land rehabilitation projects that improved erosion control practices and prioritization of sites for training land rehabilitation. Identified culturally influenced components for incorporation into Future Force urban ranges. Matured improved guidance on noise complaint risk associated with training noise levels. In FY07, complete initial groundwork for studies on impacts of discrete noise on ranges to meet new regulatory requirements and mature ATTACC protocols that incorporate non-military land and natural resource stressors. In FY08, will begin developing and evaluating strategies to mitigate high priority invasive species impact on training, and the cumulative interaction of training activities and multiple use on natural resources. In FY09, will complete initial algorithms for	3170	3931	2702	2302

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weather and nonlinear effects on sound propagation and initial stimulus and response metrics and procedures for determining discrete noise impacts.				
Small Business Innovative Research/Small Business Technology Transfer Programs		56		
Total	6979	6987	5817	4797