ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	58745	23569	23018	25521	26860	27935	30676
048	IND OPER POLL CTRL TEC	2269	1311	2883	3397	3585	3739	3824
835	MIL MED ENVIRON CRIT	2738	2361	3056	3306	3695	3807	3883
896	BASE FAC ENVIRON QUAL	5019	2891	7804	8589	7662	6574	6726
91G	TECHNOLOGIES TO REDUCE NON-HAZARDOUS WASTE	4807	0	0	0	0	0	0
946	ELECTRONIC EQUIPMENT DEMANUFACTURE	12017	0	0	0	0	0	0
947	SUSTAINABLE GREEN MANUFACTURING	5287	0	0	0	0	0	0
EM1	WASTE MINIMIZATION AND POLLUTION RESEARCH	0	2000	0	0	0	0	0
EN8	MOLECULAR & COMPUTATIONAL RISK ASSESSMENT	0	1400	0	0	0	0	0
EN9	TRANSPORTABLE DETONATION CHAMBER VALIDATION	0	6000	0	0	0	0	0
F25	MIL ENV RESTOR TECH	3536	3339	9275	10229	11918	13815	16243
F28	RANGE SAFETY TECH DEMO	4807	4267	0	0	0	0	0
F31	ENVIRONMENTAL CLEANUP AT PORTA BELLA	2884	0	0	0	0	0	0
F35	ENVIRONMENTAL QUALITY TECHNOLOGY	5768	0	0	0	0	0	0
F36	ARMY HEAVY METALS OFFICE	5768	0	0	0	0	0	0
F37	PROTON EXCHANGE MEMBRANE (PEM) FUEL CELL	3845	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to provide technologies that will improve the Army's ability to comply with regulations mandated by all Federal, state and local environmental/health laws and to reduce the cost of this

compliance. Examples of key laws include the Superfund Amendments and Reauthorization Act of 1986 and the Defense Environmental Restoration Act (the Department of Defense equivalent of this law), in addition to the Resource Conservation and Recovery Act of 1984, as amended. This program element provides the Army with a capability 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. This program element also provides 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 element develops pollution control technology, which assists installations in complying with environmental regulations at less cost. The program element also provides technology to mitigate noise impacts and maneuver area damage resulting from Army training activities. The work in this program element is aligned with the Army's vision for the Objective Force and adheres to Defense Reliance Agreements on civil engineering and environmental quality with oversight provided by the Joint Engineers and Armed Services Biomedical Research Evaluation and Management. The cited work is also consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center and the U.S. Army Armament Research, Development and Engineering Center (ARDEC). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	60434	16150	16764
Appropriated Value	60994	23700	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-131	0
b. SBIR / STTR	-1688	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-561	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	6254
Current Budget Submit (FY 2003 PB)	58745	23569	23018

Change Summary Explanation:

FY02 (+$7419) - Congressional adds were made for Waste Minimization and Pollution Research, Project EM1 (+$2000); Molecular and Computational Risk Assessment, Project EN8 (+$1400), Transportable Detonation Chamber Validation, Project EN9 (+$6000); and Rangesafe Demonstration Project, Project F28 (+$4300). Congressional reductions totalling $6281 were made to this Program Element.

FY03 (+$6254) - Project 048 (+$199) was increased for civilian personnel plus-ups. Project 835 (-$30) received a general reduction in funding. Project 896 (+$2549) and Project F25 (+$3536) funding was increased to address high priority Army training range environmental quality technology requirements, and for civilian personnel plus-ups.

Projects with no R-2As include:
- ($2000) Waste Minimization and Pollution Research, Project EM1: The objective of this one year Congressional add is to develop and demonstrate innovative technologies that create operational cost reductions and compliance in the areas of waste minimization and pollution research. No additional funding is required to complete this project.
- ($1400) Molecular and Computational Risk Assessment, Project EN8: The objective of this one year Congressional add is to perform molecular and computational risk assessment research. No additional funding is required to complete this project.
- ($6000) Transportable Detonation Chamber Validation, Project EN9: The objective of this one year Congressional add is to demonstrate and validate a transportable detonation chamber for destruction of unexploded chemical ordnance. No additional funding is required to complete this project.
- ($4300) Rangesafe Demonstration Project, Project F28: The objective of this one year Congressional add is to develop and evaluate technologies for remediation of Army firing ranges. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**048**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
048	IND OPER POLL CTRL TEC	2269	1311	2883	3397	3585	3739	3824

A. Mission Description and Budget Item Justification: The objective of this project is to research and investigate technologies to enable the Army to reduce or eliminate the effects of legal and regulatory environmental restrictions, as well as avoiding fines and facility shutdowns. These new technologies are essential for the effective control and reduction of unique hazardous and non-hazardous wastes on military installations. Efforts include a focus on new materiel that will enter the Army inventory within the next decade due to Army Transformation. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2269 - Developed measures and criteria to predict and avoid negative community response to noise.
  - Investigated modified absorbent/biosorbent technology as a more effective method to treat Army waste streams containing heavy and toxic metals and explosives.
  - Established guidelines for fluidized-bed granular activated carbon bioreactor to replace carbon absorption for water contaminated with explosives to prevent violations and production stoppage.
  - Investigated reductive electrochemical treatment for destruction of nitroaromatics, nitramine or nitrate esters to ensure compliance with effluent regulations.

Total 2269

FY 2002 Planned Program

- 1311 - Determine physical and chemical interactions between selected energetic materials and building materials under long-term exposure situations, to prevent contamination and minimize hazardous waste.

Total 1311

FY 2003 Planned Program

- 2883 - Develop and test methodology to avoid the confounding influences of ground reflections for large weapon systems that do not have adequate acoustic source data to predict noise levels in the far field.

  - Verify decision trees for both contaminated and uncontaminated excess structures to allow for the safe disposal of buildings during deconstruction.

Total 2883

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**835**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
835	MIL MED ENVIRON CRIT	2738	2361	3056	3306	3695	3807	3883

A. Mission Description and Budget Item Justification: The objective of this 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 and field operations or disposed of through past activities. The end results of this research are determinations of acceptable residual concentration levels that will protect the environment and human health from adverse effects. The main product of this research is the Army Risk Assessment and Modeling System (ARAMS). This PC-based platform links models of fate and transport to the exposure and the effects models and databases of explosives and their degradation by-products on endpoint organisms in both aquatic and terrestrial ecosystems. This will reduce 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. These criteria are used by the Army during negotiations with regulatory officials to set scientifically and economically rational safe cleanup and discharge levels at Army installations. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Center for Health Promotion and Preventive Medicine (CHPPM), and the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 376 - Determined effects of relevant environmental parameters of Earth media on Unexploded Ordnance (UXO) chemical signatures.
  - Designed predictive tools for UXO multi-contaminant transport processes in various Earth media.
- 2362 - Constructed comprehensive risk assessment model and database modules for explosives and their byproducts to be linked with the ARAMS.
  - Established effects information to input into comprehensive ARAMS.
  - Constructed population model for assessment of environmental effects and link to ARAMS.
  - Linked contaminant fate and transport with effects databases for multiple endpoints.
  - Completed design of a comprehensive link between contaminant fate and transport with effects databases for multiple environmental endpoints for incorporation into ARAMS.

FY 2001 Accomplishments: (Continued)

- Enhanced the overall performance and real-world simulation of the ARAMS by development of risk assessment prediction methods for whole populations of plants and animals.

Total 2738

FY 2002 Planned Program

- 381 - Design a comprehensive model for how the various UXO constituents move and chemically transform through the ground (fate and transport) and prepare this quantitative model for inclusion into the ARAMS.
- 1980 - Complete the determination of how explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) and the reference amounts and rates by which explosives become toxic (toxicity) to marine-based organisms. The specific explosives include: TNT, Royal Demolition explosive (RDX), and High Melting explosive (HMX).

  - Describe the ways and means by which the toxic effects of contaminants are transferred into the human body through the skin (dermal uptake) for ultimate use in the ARAMS.

  - Design a comprehensive predictive model of bioaccumulation and toxicity for site scenarios multiple species of organisms and multiple pathways by which the contaminants can reach the organisms.

  - Develop hazard/risk assessment procedures for both land-based and aquatic ecosystems which link exposure, accumulation and the toxic effects of explosives and their byproducts to the organisms.

  - Improve the user interface with the ARAMS by the design of a multi-media version.

Total 2361

FY 2003 Planned Program

- 118 - Complete the design of a comprehensive model for how the various UXO constituents move and chemically transform through the ground (fate and transport) and integrate this quantitative model into the ARAMS.
- 2938 - Integrate the dynamic mechanisms (kinetics) by which explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) with those factors that determine how toxic the chemicals are to the specified organisms (toxicity) into the ARAMS.

  - Develop and complete a comprehensive predictive model of bioaccumulation and toxicity for site scenarios, multiple species of organisms, and multiple pathways by which the contaminants can reach the organisms.

FY 2003 Planned Program (Continued)

- Develop hazard/risk assessment procedures for both land-based and aquatic ecosystems which link exposure, accumulation and the toxic effects of explosives and their byproducts to the organisms.

- Improve the user interface with the ARAMS by the development of a multi-media version.

Total 3056

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**896**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
896	BASE FAC ENVIRON QUAL	5019	2891	7804	8589	7662	6574	6726

A. Mission Description and Budget Item Justification: The objective of this project is to provide assessment, monitoring, and modeling technologies to support sustainable use of the Army's training facilities, lands, firing ranges, and airspace to reduce or eliminate environmental restrictions on military uses. The Army will have the technical capability to protect and improve the biophysical characteristics of training and testing areas needed for realistic ranges and training lands to accommodate force transformation, and to support the Objective Force. Technologies within this project will enable users to match mission events and schedules of training forces with the capabilities of specific land areas. It will also provide advanced methods to restore lands damaged during training activities. Technologies will allow operation and maintenance of installation facilities and training range resources, complying with the many environmental requirements without interrupting operations or training activities. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4299 - Validated the use of remote monitoring instrumentation and methods to evaluate changes in animal activity that may be caused by military activities.

  - Incorporated information on the potential of land (soils and vegetation) to be effectively rehabilitated to reduce erosion and sustain land resources into decision support processes for land rehabilitation and maintenance.
  - Formulated management and recovery protocols for endangered species that are consistent with an adaptive ecosystem management approach.

  - Identified the proximate effects and protocols to determine effects of smokes and obscurants on endangered species.
  - Investigated impact of contaminated lumber on the recyclability/reusability of deconstructed material.
- 720 - Provided hazardous air pollutant (HAP) control technologies for toxic combustion sources to maximize incinerator capacity.

Total 5019

FY 2002 Planned Program

•	2460	- Establish methodological and statistical protocols for determination of endangered species population viability to prevent training restrictions.
		- Identify adaptive mitigation techniques to reduce constraints on mission activities as a result of endangered species.
•	431	- Create technologies for controlling and/or recycling organic hazardous air pollutant emissions to ensure continuation of coating operations.
Total	2891	

FY 2003 Planned Program

•	4591	- Develop techniques to analyze endangered species population goals to determine critical spatial thresholds that will not impede sustainment of training.
		- Develop particulate matter emission estimation models for tactical vehicle engines and chemical/physical PM control technologies for unpaved surfaces.
•	204	- Complete analysis of rotating sponge media biofilter technology as an effective Army high volume method to mitigate low volatility hazardous air pollutant concentration air streams.
•	1821	- Develop a risk assessment quantification methodology and apply this methodology to evaluate environmental risk of training range design elements.
•	1188	- Expand impact assessment protocols developed for the Red-cockaded Woodpecker to examine habitat impacts from land management practices.
Total	7804	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**F25**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
F25	MIL ENV RESTOR TECH	3536	3339	9275	10229	11918	13815	16243

A. Mission Description and Budget Item Justification: The objective of this project is to provide cost effective technologies required to clean up Department of Defense (DoD) hazardous waste sites, including active installations under the Installation Restoration Program, those indicated for closure under the DoD Base Realignment and Closure Program and the Formerly Used Defense Sites Program. Technologies focus on cost-effective and efficient remediation of active training ranges that support enhanced readiness for the Objective Force. The thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures, and ensure that human health and the environment are protected. Research is conducted in several major areas: innovative and cost-effective site identification, characterization, and monitoring technologies, groundwater systems; and treatment technologies to remediate soil and groundwater contaminated with military-unique contaminants such as explosives/energetics, chemical agents, heavy metals, and other organics. Emphasis is placed on the development of in-situ remediation technologies and real or near real-time sensing technologies for Unexploded Ordnance (UXO). Development of existing technologies provides near-term solutions while adding to the knowledge base applicable to successful development of more complex in-situ technologies. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3536 - Developed predictive models for advanced UXO detection sensors (multi-frequency/multi-channel time domain electromagnetic, Ground Penetrating Radar (GPR), vector magnetic, and seismic/acoustic) and conduct advanced UXO sensor data collection effort at a well-documented site.

  - Conducted first-phase of pilot-scale evaluation of in-situ biodegradation for TNT and in-situ reactive barriers and/or reactive barriers coupled with biodegradation for explosives in groundwater.

  - Conducted evaluation of advanced electro-kinetic treatment technologies for lead and evaluate prototype instrumentation for on line detection of metal contaminated unsaturated soils and groundwater.

  - Investigated aggressive chemical metal treatment alternatives for unsaturated soils and groundwater at small arms training ranges.

  - Evaluated processes for the recycling of metal from contaminated unsaturated soils and groundwater treatment systems with emphasis on electro-kinetic treatment extracts.

Total 3536

FY 2002 Planned Program

- 918 - Construct predictive tools for UXO multi-contaminant transport processes in various earth media.
  - Design a predictive model to determine explosives toxicity for avian and marine species.
  - Complete advanced UXO sensor data collection effort at a well documented site.
  - Construct advanced UXO sensor fusion analysis algorithms to be applied to developing UXO detection/discrimination sensing capabilities.
- 941 - Prepare an integrated suite of UXO detection/discrimination multi-sensing and processing modes to be optimized for site-specific environmental characteristics.
- 418 - Prepare an integrated set of web based hazard/risk assessment models.
- 1062 - Determine the dynamic mechanisms (kinetics) by which explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) with those factors that determine how toxic the chemicals are to the specified organisms (toxicity).
  - Complete advanced visualization and model development supporting on-site hazard/risk assessment during all cleanup phases providing a 50% reduction in time (reduce from months to weeks) for data analysis and treatment selections.

Total 3339

FY 2003 Planned Program

- 786 - Complete construction of predictive tools for UXO multi-contaminant transport processes in various earth media.
  - Complete a predictive model to determine explosives toxicity for avian and marine species and apply to the Army Risk Assessment and Modeling System.
- 861 - Evaluate advanced UXO sensor fusion analysis algorithms to be applied to developing UXO detection/discrimination sensing capabilities.
  - Complete detailed evaluation of an integrated suite of UXO detection multi-sensing and processing modes to be optimized for site-specific environmental characteristics.
- 1498 - Optimize multi-sensor and data fusion analysis UXO detection/discrimination capabilities.
  - Conduct pilot-scale evaluation of an optimized multi-sensor and data fusion analysis UXO detection/discrimination system.

FY 2003 Planned Program (Continued)

•	2772	- Conduct final phase of pilot-scale evaluation of in-situ biodegradation for TNT and in-situ reactive barriers and/or reactive barriers coupled with biodegradation for explosives in groundwater.
		- Conduct pilot-scale demonstration of advanced electro-kinetic treatment technologies for lead and of prototype instrumentation for on line detection of metal contaminated soils.
		- Down-select aggressive chemical metal treatment alternatives for small arms training ranges.
		- Evaluate processes for the recycle of metal contaminated extracts for soils treatment systems.
•	2620	- Conduct integrated assessment and evaluation of distributed source contamination on live fire training ranges.
		- Quantify and laboratory evaluate predictive model for distributed source contamination impacts on live fire training ranges.
		- Assess adapting hazardous wastes site restoration processes and techniques for application to distributed contamination sources on live fire ranges.
		- Conduct laboratory scale evaluation of distributed source contamination restoration on live fire ranges.
•	738	- Complete web based hazard risk assessment modeling tools.
Total	9275	