Permit

ENTERED

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTERS OF:

THE APPLICATION OF THE UNITED STATES DEPARTMENT OF ENERGY AND LOS ALAMOS NATIONAL SECURITY LLC FOR A HAZARDOUS WASTE FACILITY PERMIT FOR LOS ALAMOS NATIONAL LABORATORY and the NOTICE OF INTENT TO DENY A PERMIT FOR OPEN BURN UNITS TA-16-388 AND TA-16-399 FOR LOS ALAMOS NATIONAL LABORATORY	**HWB 09-37 (P)** **HWB 10-04 (P)** **Consolidated**

TESTIMONY OF RALPH HAYES

Concerned Citizens for Nuclear Safety (CCNS) and Honor Our Pueblo Existence (H.O.P.E.) present Ralph Hayes, President and Founder of El Dorado Engineering, in support of the New Mexico Environment Department (NMED) denial of the application for open burning activities at Los Alamos National Laboratory (LANL) in the above-referenced matter.

Q1: Please state your name and address.

A1: Ralph Hayes, 4500 South 3200 West, Salt Lake City, Utah.

Q2: What is your professional background?

A2: I am the President and Founder of El Dorado Engineering, based in Salt Lake City, Utah. I have a BS and MS in Mechanical Engineering from Brigham Young University. My C.V. is attached as Exhibit RH/EDE-1.

I have over 39 years of professional experience as the President and Founder of a science and engineering firm and as Deputy Director and Chief Engineer for the Army's major engineering officer for the design, fabrication, and testing of equipment and systems for the disposal, renovation, maintenance, and surveillance of conventional and chemical munitions. I have managed major complex explosive and hazardous waste

RH/EDE-4

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incineration design, fabrication, and testing, as well as complex machine design and pilot plant projects.

I have authored and presented over 50 papers on the topic of demilitarization. I am recognized as one of the world's foremost experts for incineration of explosives.

Q3: Have you received awards for your work?

A3: Yes. I can cite two examples. In 1989, I received a Public Service Award from the National Aeronautics and Space Administration for my work on "A Superb Job in Putting the Advanced Solid Rocket Motor Project Back on Schedule."

In 1998, I received a national Tibbetts Award, through the Small Business Innovation Research (SBIR) program, for an outstanding Small Business Research Project involving developing a computer model for estimating downwind environmental impacts for air emissions from rocket motor firing and open burning explosives and propellants and other energetic materials.

Q4: Please describe the work of El Dorado Engineering (EDE).

A4: EDE is a full service engineering design and build firm that specializes in the treatment and disposal of energetic materials. We are not just a vendor of equipment. We work with our clients to tailor the facilities to fit the specific needs of their operations. We are not predisposed to contained burning. However, it offers significant advantages in many situations. EDE recently performed a Feasibility Study for the Corps of Engineers/U.S. Missile Command under a contract with ECC where contained burn/confined burn was selected for disposal of the Army's solid fuel missile motors. Other sample projects and projects on our evaluation of open burning are attached as Exhibit RH/EDE-2.

Q5: Please describe your work at El Dorado Engineering.

A5: Besides the resume offered, please note that EDE has recently been awarded a multi-million dollar contract to design and construct a confined burn/contained burn to treat all types of ammonium perchlorate missile motors at a rate of 10,000 motors per year. EDE has also been awarded a $43 million program to support demilitarization development throughout the U.S. See link:
http://www.defenseindustrydaily.com/Up-to-876M-in-Contracts-for-NAVSEA-Weapons-Demilitarization-06316/

EDE is the leading developer of contained burn technology by private industry. We were never approached by LANL as to applications of our known contained burn technology or other technologies for treatment of their waste. EDE would welcome the opportunity to work with LANL to develop effective and economical processes for treatment of most of the materials currently open burned by LANL. EDE would

welcome working with LANL and NMED to evaluate existing and future disposal requirements so that the equipment and/or facility would be flexible to the needs of the client and regulator.

Q6: Have you reviewed the open burning testimony in this matter of James Bearzi, NMED Hazardous Waste Bureau Chief?

A6: Yes.

Q7: Do you have an opinion about the definition of open burning?

A7: I agree with the description offered by James Bearzi in his testimony on page 71. I quote, "Open burning is the process of burning of any materials that produces gases that are directly emitted into the air without first passing through a stack or chimney from an enclosed chamber."

Q8: Have you reviewed the open burning testimony in this matter of Lucianna Vigil-Holterman?

A8: Yes.

Q9: Do you have an opinion about her testimony?

A9: I have clearly reviewed the technical testimony provided by Ms. Vigil-Holterman. I believe that Ms. Vigil-Holterman's testimony is based on incomplete information, citing only government non-open burn facilities known by LANL. Please note that much of the significant advancements in explosive waste treatment is pioneered by private industry, not by the government. EDE was not approached by LANL when they were gathering this information or we would have freely contributed to this data collection effort. We do not agreed with her list of materials identified as non-treatable by other than open burning.

Q10: Please describe the information regarding treatment of materials identified by Ms. Vigil-Holterman as non-treatable by other than open burning.

A10: Metal waste contaminated by explosives are not considered a hazardous RCRA waste and can be treated by simple thermal treatment that eliminates the open burning of dunnage to accomplish this decontamination, and is much more efficient.

It has been noted in the referenced testimony that contained burn technology cannot treat combustibles, wet explosives, or small bulk explosives. This is not true. EDE has designed and built contained burn systems for these types of materials. Contained burn can effectively treat most all of the waste that is open burned by LANL. It should be noted that there are several design variations for contained burn systems.

It should be considered as open burning indoors with capture and treatment of the effluent. The type and size of the equipment can be tailored for the workload.

Q11: What is your experience for permitting contained burn systems?

A11: One of the major advantages of the contained burn facility is that it is not classified as a RCRA hazardous waste incinerator. It can be permitted within a modification to the existing Subpart X RCRA permit as a miscellaneous unit. A recent example was the contained burn for the Shillelagh rocket motors in Nevada at the Nevada Test Site.

Q12: Did you review the chart on page 18 of Ms. Vigil-Holterman's testimony?

A12: Yes.

Q13: Please state your opinion about the chart.

A13: I reviewed the chart on page 18 of Ms. Vigil-Holterman's testimony. I believe that a contained burn facility could accommodate most of the materials shown in this chart. I believe that a flashing furnace would be the best equipment for explosive contaminated metals. The chart categories are very broad and the specifications of waste streams would have to be known in more detail for designing a facility.

Q14: Please describe the EDE Transportable Flashing Furnaces, or TFFs.

A14: Transportable Flashing Furnaces are trailer-mounted ovens specifically designed to heat explosive contaminated metal parts and safely destroy all explosive contamination. EDE has designed and built Transportable Flashing Furnaces (TFF) that have been successfully used in a number of government operations to treat this material. Examples include over 8 million pounds of explosive contaminated metal flashed at Kaho'olawe, Hawaii, in the cleanup of that island for the Navy. Flashing routinely occurs at Anniston Army Depot in support of their missile recycling facility in a furnace designed and built by EDE. Flashing has been performed at both Eglin Air Force Base and Hill Air Force Base utilizing an EDE designed and built flashing furnace.

Q15: Please provide your opinion about LANL's claim that open burning of waste at 1400° F prevents the formation of dioxins and furans.

A15: The DOE/LANL claim that open burning of waste at 1400° F prevents dioxins and furans is in my opinion is flawed. EDE is very familiar with open burning and it is generally impossible to control the temperature of all the materials being open burned. Also the formation of dioxins and furans is still somewhat speculative as to the exact mechanisms involved. Please see EPA discussion at the link provided. http://www.epa.gov/apti/bces/module6/dioxins/formation/formation.htm Exhibit RH/EDE-3.

EDE would agree with DOE and LANL in using non-chlorinated plastic bags and other non-chlorinated materials that would come in contact with the HE which eliminates the formation of dioxins and furans. Please note that EDE has demonstrated carbon filtration on our contained burn equipment for removing any dioxins and furans that are formed in the burning process.

Q16: Please describe your observations about public opposition to open burning and contained burn technology.

A16: EDE has extensively modeled and sampled the pollutants from open burning. It is our belief that in some cases the public opposition to open burning is greater than the actual threat. We believe that where practical open burning should be replaced with other technologies. The contained burn technology has been well received by regulators that see it as an improvement to open burning and no public opposition has been observed.

Q17: Please describe your experience with transporting waste materials contaminated with high explosives.

A17: The stabilization of explosives for over the road transport off government property is very complex and EDE does not offer an opinion on this. I agree with Ms. Vigil-Holterman's oral testimony that the transport of materials has to be according to DOT regulations, which are very strict. One of the problems with transporting waste materials as opposed to new material is that explosive testing must be done on each waste stream for certification for DOT transport. Thus any differences in the waste would require repeat testing.

Q18: Do you recommend any changes to LANL's open burning activities?

A18: Yes. I believe a study could be performed that could readily identify which waste streams of the open burning operations could be treated with contained burning with existing technology. From this study, equipment could be designed and built to provide more environmentally friendly and public acceptable disposal operations.

Exhibits

Exhibit RH/EDE-1	C.V. of Ralph Hayes
Exhibit RH/EDE-2	Sample projects and EDE projects on thermal treatment of explosive wastes and evaluating open burning
Exhibit RH/EDE-3	Module 6: Air Pollutants and Control Techniques – Dioxins and Furans – Formation Mechanisms

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AFFIDAVIT OF RALPH HAYES

I, RALPH HAYES, hereby submit this Affidavit in support of my Rebuttal Technical Testimony in the above-captioned matter.

I hereby swear under penalty of perjury under the laws of the United States of America and the State of Utah that the above statement is true and correct to the best of my knowledge.

Date: May _____, 2010.

_____
Ralph Hayes

Salt Lake City, UT
phone

RH/EDE-5

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AFFIDAVIT OF RALPH HAYES

I, RALPH HAYES, hereby submit this Affidavit in support of my Statement of Intent to Present Technical Testimony in the above-captioned matter.

I hereby swear under penalty of perjury under the laws of the United States of America and the State of Utah that the above statement is true and correct to the best of my knowledge.

Date: May 4, 2010

R W Hayes

Ralph Hayes

Salt Lake City, UT
801-966-8288

COMPANY: El Dorado Engineering, Inc.

NAME: Ralph W. Hayes

EDUCATION: Brigham Young University, Mechanical Engineering, B.S. 1971
Brigham Young University, Mechanical Engineering, M.S. 1971
Ph.D. Level Courses 1971

Summary of Experience:

Mr. Hayes has over thirty-nine years of professional experience. This includes President and Founder of a science and engineering firm, and Deputy Director and Chief Engineer for the Army's major engineering office for the design, fabrication, and testing of equipment and systems for the disposal, renovation, maintenance, and surveillance of conventional and chemical munitions. He has managed major complex explosive and hazardous waste incineration design, fabrication, and testing as well as complex machine design and pilot plant projects.

His superb leadership style combined with his technical capability led to him receiving the National Tibbetts Award for his work in developing a computer model for estimating downwind environmental impacts for air emissions from rocket motor firing and open burning explosives and propellants and other energetic materials. He has also been the recipient of two Public Service Awards from NASA and he has authored and presented over fifty papers on the topic of demilitarization. Between 1979 and 1981 he served as the Technical Director for the U.S. Army's Incineration Programs, which was in support of the U.S. Army Armament Materiel & Readiness Command (ARRCOM), the U.S. Army Depot System Command (DESCOM), and the Huntsville Corps of Engineers (COE). His many contributions and achievements in the area of incineration of explosives, has gained him recognition as one of the world's foremost experts in his field.

EL DORADO ENGINEERING, INC. 1981 – Present

- Mr. Hayes served from 2005 – 2007 as the lone demilitarization representative on the ICAP (Industrial Committee of Ammunition Producers) that provides consulting to the military regarding ammunition programs.

- Serves as Program Manager for ECC/EDE Huntsville Corps of Engineers program to design and build a multi-million dollar facility at Letterkenny, PA, to use confined burn/contained burn technology to treat all types of ammonia perchlorate/aluminum rocket motors at a rate of 10,000 motors per year.

- Program Manager for contract with Naval Surface Warfare Center in Indian Head, MD, performance-based, indefinite-delivery/indefinite-quantity, multiple-award, cost-plus-fixed-fee contract worth up to $43 million to provide engineering and demilitarization of munitions.

EXHIBIT
RH/EDE-1

- Program Manager for the development of contained burn technology for simplified combustion and treatment of energetic materials.

- Program Manager for design and construction of the contained burn Shillelagh Rocket Motor Disposal System at Nevada Test Site.

- Program Manager for NATO contract for turnkey conventional munitions, bulk propellant, and Explosive Waste Incinerator demilitarization facilities in Albania and Ukraine.

- Program Manager for risk assessment of the consolidation of Air Force Phillips Laboratories Rocket Motor Testing Facilities for both planned and unplanned events.
- Program Manager for conceiving, designing, fabricating, and delivering a Transportable Flashing Furnace for thermal processing of explosive contaminated metal parts for the U.S. Army, Air Force, and Navy.

- Program Manager for modeling the plumes for NASA's Space Shuttle Booster Program to assess downwind risks from pollutants and obtain environmental permits.

- Program Manager for design, fabrication, and startup of Explosive Waste Incinerators for Republic of China Army (Taiwan), Former East Germany, United Kingdom, Albania, and Korea.

- Served as Project Manager for extensive modeling and air emissions test program for permitting disposal of Pershing Missile Motor as part of INF Treaty.

- Program Manager to design and build a pilot production plant to recovery and recycle magnesium from obsolete flares for Crane NSWC/TPL.

- Program Manager to design/build pilot production plant at Hawthorne Army Depot, Nevada, to demonstrate the use of automated equipment to use dielectric heating to recover explosive from mortars for recycling.

- Managed EDE's multiple contracts for developing alternative technologies for chemical munitions demilitarization.

- 37 years experience in the development and fielding of Chemical Agent Munitions Demil equipment.

- Principal in Charge of Explosive Safety Activities for cleanup and restoration of Weldon Springs Ordnance Plant including excavation and incineration of explosive contaminated soils.

- Named to Utah Governor's Scientific Review Committee for over-site of operations at Dugway Proving Ground.

- Program Manager for RCRA environmental permits and closure plan development at military and military contractor locations throughout the U.S.

- Principal Investigator on a successful SBIR program to demonstrate using microwave energy to melt and recover explosives form obsolete bombs.

- Program Manager for EDE support of "Drill & Drain" Russian Chemical Munitions Disposal Program with substantial work in Moscow, Russia.

- Program Manager for multi-year, multi-million dollar task order studies contract for Huntsville COE to support the Chemical Agent Munitions Disposal System (CAMDS).

- Served as Lead Explosive Safety Officer for 2 major remediation programs in the U.S. at Savanna Army Ammunition Plant and Childersburg, AL, for treating explosive contaminated facilities and soils and closing facilities.

- Named to the ASTM Committee for establishing standards and test methods for hazardous waste treatment and disposal.

- Course instructor for Masters of Management Program for graduate program, Westminster College, Salt Lake City, Utah.

- Serves on Industry Advisory Board to Brigham Young University, Mechanical Engineering Department (volunteer).

Ammunition Equipment Office 1971 – 1981

- Mr. Hayes was Chief Engineer for the Army's major engineering office (100 technical personnel and $19.2 million yearly budget) for the design, fabrication, and testing of equipment for the disposal, renovation, maintenance, and surveillance of conventional, toxic, and chemical munitions.

- Original technical director of many of the incineration programs being done in a worldwide effort to support the U.S. Army. DoD agencies, and the private sector in general, have all sought his personal technical advise on ammunition and hazardous chemical disposal.

- Supervised a 35-man level of effort in support of the startup of CAMDS. Activities supervised by Mr. Hayes included final design revisions and startup of the rocket demil machine (SAW), design and test of the shearing concept for M55 rockets, final fabrication and inert checkout of the 4.2 mortar machine, finalization and startup of the nonburstered projectile demil machine, design

revision and fabrication to the M23 land mine machine, engineering evaluations of the deactivation furnace loading mechanism, i.e., tipping valves, conveyors, etc.

- Member of a Joint Army, Navy, and Air Force panel (JCAP) that reviewed, cataloged, and evaluated emerging technology for the disposal of ammunition related items throughout the Department of Defense.

Professional Achievements

Received two Public Service Awards from NASA.
Over 50 professional paper publications and presentations.
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- Principal in Charge of Explosive Safety Activities for cleanup and restoration of Weldon Springs Ordnance Plant including excavation and incineration of explosive contaminated soils.

- Named to Utah Governor's Scientific Review Committee for over-site of operations at Dugway Proving Ground.

- Program Manager for RCRA environmental permits and closure plan development at military and military contractor locations throughout the U.S.

- Principal Investigator on a successful SBIR program to demonstrate using microwave energy to melt and recover explosives form obsolete bombs.

- Program Manager for EDE support of "Drill & Drain" Russian Chemical Munitions Disposal Program with substantial work in Moscow, Russia.

- Program Manager for multi-year, multi-million dollar task order studies contract for Huntsville COE to support the Chemical Agent Munitions Disposal System (CAMDS).

- Served as Lead Explosive Safety Officer for 2 major remediation programs in the U.S. at Savanna Army Ammunition Plant and Childersburg, AL, for treating explosive contaminated facilities and soils and closing facilities.

- Named to the ASTM Committee for establishing standards and test methods for hazardous waste treatment and disposal.

- Course instructor for Masters of Management Program for graduate program, Westminster College, Salt Lake City, Utah.

- Serves on Industry Advisory Board to Brigham Young University, Mechanical Engineering Department (volunteer).

Ammunition Equipment Office 1971 – 1981

- Mr. Hayes was Chief Engineer for the Army's major engineering office (100 technical personnel and $19.2 million yearly budget) for the design, fabrication, and testing of equipment for the disposal, renovation, maintenance, and surveillance of conventional, toxic, and chemical munitions.

- Original technical director of many of the incineration programs being done in a worldwide effort to support the U.S. Army. DoD agencies, and the private sector in general, have all sought his personal technical advise on ammunition and hazardous chemical disposal.

- Supervised a 35-man level of effort in support of the startup of CAMDS. Activities supervised by Mr. Hayes included final design revisions and startup of the rocket demil machine (SAW), design and test of the shearing concept for M55 rockets, final fabrication and inert checkout of the 4.2 mortar machine, finalization and startup of the nonburstered projectile demil machine, design

revision and fabrication to the M23 land mine machine, engineering evaluations of the deactivation furnace loading mechanism, i.e., tipping valves, conveyors, etc.

- Member of a Joint Army, Navy, and Air Force panel (JCAP) that reviewed, cataloged, and evaluated emerging technology for the disposal of ammunition related items throughout the Department of Defense.

Professional Achievements

Received two Public Service Awards from NASA.
Over 50 professional paper publications and presentations.
National Tibbetts Award for outstanding Small Business Research Project.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
98-03 Shillelagh Motor Contained Burn Nevada Test Site	Design and furnish equipment	Bechtel Nevada Test Site	07/1998	5000	620

El Dorado Engineering, Inc. (EDE) was contracted by Bechtel to design and provide a contained burn system for the demilitarization of Shillelagh rocket motors. This system includes a rocket holder, chamber for containing the combustion gases, a complete pollution control system, and a ventilation control system. EDE provided all electrical controls, hardware, and equipment for the complete system and operation. The system was designed to process 100 rockets per day.

EXHIBIT
RW/EDE-2

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-13 Bechtel Nevada Tactical Missile Study Las Vegas, Nevada	Tactical Missile Study	Bechtel Nevada Las Vegas, Nevada Dennis Jeffrey, 702-295-2192	09/2000	8	8

EDE had previously supplied Bechtel Nevada with a contained burn system for processing Shillelagh rocket motors. This system contained the exhaust and processed the exhaust through a pollution control system. It was designed to process one missile motor every 7-½ minutes. EDE evaluated the U.S. stockpile of tactical missiles currently slated for disposal to determine which missiles besides the Shillelagh were also candidates for disposal in this system.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-19 Charted Ammunition Industries Singapore	Demilitarization Study	Chartered Ammunition Industries Singapore	12/2000	15	15

Chartered Ammunition Industries of Singapore retained EDE to examine their existing demilitarization capabilities, compare it with anticipated workload, and prepare a conceptual plan for equipment, process, and facility upgrades.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address - and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
01-03 Chemical Munitions Demilitarization Russia	Engineering	Ralph M. Parsons Russia thomas.cc@rcwdp.ru	12/2009	660,000	2000

El Dorado Engineering is part of the Ralph M. Parsons team that was awarded the major contract to accomplish the demilitarization of chemical weapons in Russia. Parsons contracted with Russian companies to accomplish major portions of the work. EDE was tasked to assist with technology transfer from the U.S. experience.

El Dorado Engineering was tasked to provide an evaluation of all of the equipment design and procedures associated with handling the chemical munitions, drilling and draining the agent, technical studies, and all other work associated with bringing this project from a concept design up through a proven completely tested system for chemical munitions. This contract has required several trips per year to on-site Russian facilities since the project inception.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
01-04 Eglin Burn Kettles Eglin Air Force Base, FL	Design, fabricate, and furnish a Transportable Burn Kettle System and heat source for processing munitions	Eglin Air Force Base, FL D. Freeman	07-2001	468	468

EDE was tasked to evaluate the existing burn kettles at Eglin Air Force Base used for the disposal of munitions. EDE was to design and develop, fabricate and furnish, a new transportable burn kettle system with an external heat source. EDE furnished a trailer mounted transportable burn kettle processor complete with electrical generator, remote control system, fuel and flame safety system for heating specifically designed burn kettles to contain munitions that are thermally treated. Munitions were recovered from the test range and processed in this system. This system is permitted as part of the existing Subpart X environmental permit. EDE was also responsible for modifications to the permit application for this equipment.

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				Entire Project	Work For Which Firm Was/Is Responsible
02-01 Thermal Processor Unit for Kaho'olawe, Hawaii	Design, fabricate, and install transportable thermal processor	Parsons UXB Tom McCabe, 808-471-4303	May 2002	450	450

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a transportable thermal processing unit for processing explosive contaminated ordnance debris as part of the cleanup and restoration of the Island of Kaho'olawe. Kaho'olawe was used as a Naval Test Range for a number of years had an estimated 10 million pounds of potentially explosive contaminated munition parts and target debris. Parsons/UXB was contracted by the Navy to restore the island to deliver it back to Hawaii. EDE's Transportable Flashing Furnace (TFF) allowed all of the metal parts and target debris to be safely treated so that it could be sold as scrap metal as it was removed from the island. The TFF was successfully designed, fabricated, installed and commissioned, and processed over 2 tons of material per hour and complete processing over 8 million pounds of material.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
02-02 Total Solution Design Blue Grass Army Depot	Equipment system and process Design	Eco Logic Canada B. Morse 281-376-2190	01/02	10,000	1,000

U.S. Army PMACWA determined that there were three viable technologies for accomplishing the demilitarization of the chemical munitions stored at Blue Grass Army Depot using non-incineration technologies. The contract was awarded to each one of the technology providers to provide a total solution design based on their technology. Eco Logic had proposed the technology utilizing chemical neutralization of the agent followed by supercritical water oxidation of waste liquids, and thermal/hydrogen reduction system for processing combustible materials and in treating contaminated metal parts. EDE was contracted to perform all engineering to develop all of the equipment required for disassembly of the munitions to accommodate the various chemical process technologies. EDE also developed and tested a system to grind rocket propellant underwater to accommodate downstream processes. EDE designed all material handling equipment to move energetic materials, slurries, metal parts and chemical agent throughout the entire plant. EDE provided mass and material balances, P&ID diagrams, and equipment layout drawings for the entire process. EDE provided preliminary designs for all of the equipment required to perform the munition disassembly. EDE provided the safety and hazard analysis for the entire plant design. EDE also performed cost estimating for design build construction and operations of this equipment. The entire project was estimated at 1-½ billion dollars.

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				Entire Project	Work For Which Firm Was/Is Responsible
03-01 Rocket Dismantling Machine Component Tests	Design, build, and test Equipment	Eco Logic Canada Doug Gray, 519-856-9591 ext. 214	01/03	1,500	1,300

As part of the non-incineration demilitarization plan for chemical munitions stored at Blue Grass Army Depot, a new M55 rocket dismantling machine needed to be designed for two of the three proposed processes. EDE was tasked to design and test various components that would be required by the dismantling machine. This included:

- Washout of the explosive filled burster using a high pressure washout system
- A low pressure washout system to washout gelled agent from the rocket warhead
- A system to punch and drain the agent and accommodate warhead washout
- A system to extract anti-resonator rods from the rocket propellant
- Develop equipment using sophisticated tube cutters to cut through the fiberglass outer container and the rocket metal parts without leaving an indentation or burr in the metal parts to enable extraction of the rocket motor grain

EDE designed and fabricated each of the equipment components as described and built simulated munitions. EDE utilized the simulated munitions to successfully test each of the components that were developed and write a comprehensive report of the program. All work was completed on schedule despite major changes to the criteria during the project.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-01 Action Manufacturing Contained Burn Construction Atglen, PA		Action Manufacturing Atglen, PA Tony Taylor, 610-593-6905 ext. 9	03-2004	215	215

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a contained burn thermal treatment system for processing Action Manufacturing's energetic waste materials. The Contained Burn Unit includes air pollution control equipment to meet the Pennsylvania environmental permitting requirements.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-02 Decontamination of Air Force Test Range Metal Debris Using a Transportable Flashing Furnace Eglin Air Force Base	Demonstration Test Program	U.S. Army Corps of Engineers Scott Millhouse, 256-895-1607	12/04	580	580

El Dorado Engineering, Inc. (EDE) received an ESTCP contract award to demonstrate a technology developed by EDE for decontaminating metal debris produced by military test ranges. A Transportable Flashing Furnace (TFF) is a trailer mounted furnace capable of processing up to 5,000 lbs. per hour of test range debris to assure that the metals are free of explosives and propellants before being sold off-site as scrap metal. EDE's demonstration program utilized actual munition fragments and target debris from the test range at Eglin Air Force Base which were processed in an EDE designed and manufactured TFF. The results of this demonstration program were used to prove technical feasibility and provide the economic analysis for using this technology to assist with clearance of materials at active military test ranges.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-03 Rocket Shear Machine Developmental Testing Salt Lake City, Utah	Develop equipment for cleaning chemical agents from M55 rockets	Ralph M. Parsons Pasadena, CA John Ursillo, 626-440-2628	12/08	1,500,000	500

A team of companies including Ralph M. Parsons received a contract to design, install, and operate the demilitarization plant to treat and dispose of all chemical munitions stored at Blue Grass Arsenal, Kentucky. This process is unique in that it will not use incineration as the primary treatment technology. EDE was tasked to develop equipment and methodology to successfully punch the M55 rocket cavity containing chemical agents and drain the agent from the rocket cavity. The stored rockets are known to have agents that have gelled or crystallized. As part of this demonstration program EDE used simulated gelled agent and simulated crystals. EDE developed a plastic warhead for viewing the high-pressure washout nozzle configuration to successfully determine design pressures, flows and nozzle orientation to completely clean the rocket cavities of all agents. Based on the development tests using the plastic warhead, simulated aluminum rocket warheads contained in fiberglass shipping and firing tubes were punched and washed out again using simulated agents. The demonstration project was very successful with over 98% of the agent being removed, which exceeded the design requirements. Since this project deals with weapons of mass destruction, the tests were performed with exceedingly high levels of quality control and safety analyses.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-04 Explosive Waste Incineration Facility Elbasan, Albania	Build and install an Explosive Waste Incinerator	NAMSA Luxembourg P. Courtney-Green, 352-3063 6449	March 2005	2500	2500

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Elbasan, Albania. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE had the most experience of any company bidding in providing ammunition demilitarization equipment of this nature. EDE was able to exceed NAMSA's requirements and still provide the lowest overall bid for the project. EDE effectively used in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Albania providing employment and training for local Albanians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
05-01 Transportable Flashing Furnace Anniston, Alabama	Design and Manufacture Transportable Flashing Furnace	Anniston Munitions Center Anniston, Alabama Phil Keith, 812-854-6157 Ellen McDaniel, 812-854-5315	12/05	260	260

EDE was asked to design, manufacture, and deliver a Transportable Flashing Furnace (TFF) to the Anniston Munitions Center. The client desired a smaller sized version from EDE's full sized TFF. EDE therefore designed an economy model. This TFF will allow Anniston to flash and decontaminate explosive contaminated metals generated by the missile recycling facility and the detonation chamber. These metals will then be able to be sold directly as scrap metal. EDE assisted Anniston with the environmental permitting and safety siting of this equipment. On-site training and installation assistance was included in the contract.

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				Entire Project	Work For Which Firm Was/Is Responsible
06-01 Magnesium Recovery Pilot Plant Crane Naval Surface Warfare Center	Design and Construction of a Facility for Magnesium Recovery	Crane Naval Surface Warfare Center Crane, Indiana Sara Poehlein, 812-854-3190	12-06	5000	5000

TPL of Albuquerque, New Mexico, had performed an SBIR project at a bench scale level showing the feasibility of recovering magnesium from obsolete illuminating flares for reuse by the Navy in new production applications. EDE was awarded a contract by TPL/NSWC to provide all necessary services to design, procure and fabricate, and install a pilot plant to recover magnesium from obsolete flares. The recovered magnesium must meet the specifications of new material so that it could be used in the Navy's current production. This pilot plant includes a waterjet system to washout materials from obsolete flares. The byproducts are then separated from the magnesium by a series of equipment processes and the magnesium is cleaned, classified, dried, and packaged for reuse. The plant has a state-of-the-art controls system and includes all equipment for preparing and manipulating the flares for washout through all downstream processes to high-grade magnesium recovery. This project was divided into three phases. The first phase was to provide the design of the entire plant and all of the equipment. Phase II was fabrication, procurement, and factory testing. Phase III installation and checkout at Crane is scheduled for completion in 2009. The benefits of this project include a safe and environmentally clean process to dispose of obsolete flares and at the same time recover a highly valuable magnesium material for recycle and reuse.

Reference SOW Task 6 Primary Task 3 and Task 7 Secondary

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
06-02 Explosive Waste Incinerator Shoeburyness, United Kingdom	Turn-Key Explosive Waste Incinerator	QinetiQ Keith Blair 01252 393927	09/06	3000	3000

El Dorado Engineering, Inc. (EDE) was responsible to design and build an Explosive Waste Incinerator to process a wide variety of explosive items. The contract required EDE to meet the very strict EU environmental regulations regarding incineration emissions. The work involved design, fabrication, shipping, installation, testing, and training. EDE provided an Explosive Waste Incinerator with feed systems, lead recovery system, and an air pollution control system including an afterburner, gas cooler, and baghouse.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-01 Design and Fabrication of Waste Incinerator	Design, Fabrication, Startup and Training	Kolon Yeong Dong-gun, Korea S.B. Park	11/07	10,000	1,500

El Dorado Engineering was contracted by Kolon to provide a waste incinerator thermal treatment system for explosive and energetic materials. EDE evaluated the Korean workload and proposed an Explosive Waste Incinerator that included lead removal and recovery of two separate energetic material feed systems. EDE designed, fabricated and shipped the equipment to South Korea. EDE provided installation project managers responsible for both mechanical and electrical/controls installation. EDE also performed startup and training. All work was done on schedule and to the client's full satisfaction.

Primary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-02 Provide Thermal Treatment System for Air Bag Manufacturing Wastes	Design, Fabricate, and Install Thermal Treatment System	Delphi Matamoras, MX Timothy R. Brennaman (937) 356-2754	09/08	350	350

Delphi, in manufacturing airbag and airbag inflators, produces energetic waste materials, reject parts, and contaminated dunnage. EDE was tasked to provide a turn-key thermal treatment system. This system is required to handle all of their various waste streams and provide pollution control that meets Mexico's standards. Besides design, fabrication, and installation, EDE is required to provide on-site training and produce documents in English and Spanish.

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				Entire Project	Work For Which Firm Was/Is Responsible
08-03 Explosive Dieletric Meltout System Hawthorne, Nevada	Turn-key Automated Facility	U.S. Army Brent Ochs/Thomas P. DeAngelis 812-854-3851/908 328-2313	01/10	3,300	3,300

EDE was tasked to provide an explosive dielectric meltout system known as DIHMES. This project is divided into two phases. DIHMES I was to design the system and demonstrate the technology at Crane, Indiana. DIHMES II was to provide a turn-key facility complete with all equipment and material handling systems so that the entire process operates remotely. The process is to recover explosive slugs from obsolete mortars which can be sold directly to the mining industry. The technology consists of a waterjet cutting system that cuts off the fuzes of various size mortars. The mortars are then placed upside down in a dielectric meltout station. When heat is applied, the explosive slug falls in to a collection container much like running hot water over a frozen orange juice can. The system includes a robot to transfer the materials to the waterjet cutting station and a dielectric meltout station. It also has specific equipment to handle the fuzes and any reject mortars. The operation is contained within a reinforced concrete bay with all operations conducted remotely and automatically. The explosive is received in a pure form compared to other technologies and is directly ready for resale.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-04 Flashing Furnace Hill Air Force Base	Refurbish flashing furnace, install, and train operators	Hill Air Force Base Dennis Weder 801-775-6921	May 2008	81	81

El Dorado Engineering (EDE) had previously provided a transportable flashing furnace to Eglin Air Force Base. The Air Force decided to transfer the furnace to Hill Air Force Base to process range scrap. EDE refurbished the flashing furnace, installed the flashing furnace at Hill Air Force Base's Test Range and trained the operators. Hill Air Force Base processed over 240,000 thousand pounds of live and potentially live items up to 20 MM TPT rounds. EDE again refurbished the furnace and shipped it back to Eglin Air Force Base. The project was very successful in that a large quantity of items were processed in a short period of time without incident.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-05 Flashing Furnace for Anniston, Alabama, and Talon, West Virginia	Design, fabrication, and installation of a transportable flashing furnace and training of operators	Crane Naval Weapons Center Phil Keith 812-854-6157	06/08	535	535

El Dorado Engineering, Inc. (EDE) had previously provided a Transportable Flashing Furnace (economy model) to Anniston Army Depot to flash explosive contaminated materials from their rocket recycling facility. EDE was contracted to provide a new larger flashing furnace for this location. EDE designed, fabricated, and installed a new larger flashing furnace capable of flashing up to 5,000 lbs. per hour of explosive contaminated materials. EDE trained the Anniston operators in the use of this equipment.

The smaller economy model was refurbished and sent to West Virginia to be used in the cleanup and restoration of the old Talon site. The furnace was used to process a wide variety of live items including fuzes, detonators, etc. EDE was also tasked to provide assistance with explosive chemistry, combustion, analyses and anticipated air emissions to be used to secure the environmental permits for the operation. EDE also designed and provided strongboxes for the operation at Talon, installed the furnace and trained the operators at Talon. EDE also provided the environmental analyses for use in permitting. This operation at Talon was very successful as the Mobile Ammunition Renovation Inspection Demilitarization (MARID) team was able to process an estimated 15,000 to 20,000 pounds of live ammunition between June and August working two 10-hour shifts per day.

A task to perform contained burn testing of MLRS motor was later added to this contract. This technology was successfully demonstrated by EDE at Arnold Air Force Base to provide complete and safety combustion of the MLRS motors and capture the effluent so it could be cleaned prior to exhaust. The project was on time and on budget.

SOW Reference Primary 3.8 Secondary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-06 Defence Construction Canada Demil Facility Project Study	Demilitarization Planning Study	Defence Construction Canada. Louis Lemay 141 Laurier Avenue West, Suite 301, Ottawa, Ontario K1P 5J3 Phone: (613) 949-6925	02/2009	15	15

EDE reviewed contents of the Canadian stockpile and demilitarization project objectives and prepared a report that recommended a comprehensive demilitarization approach. All viable demil processes from simple incineration to more complex disassembly and resource recovery were considered. EDE recommended a phased approach to allow core demil capability to be acquired to perform significant workload immediately, with later phases adding other capabilities, such as disassembly, to enhance the core capability.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
09-02 Explosive Waste Incinerator Ukraine	Turn-key Explosive Waste Incinerator	NATO (NAMSA) Luxembourg **CLT LAURENT** **352 3063 5988**	12/2009	3000	3000

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Donetsk, Ukraine. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE effectively uses in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Ukraine providing employment and training for local Ukrainians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-01 Air Emissions Modeling & Program for INF Treaty Huntsville, AL & Pueblo, CO	Provide Air Emission Analysis	Missile Command Huntsville, Alabama J. Mangi, 703-534-2484	06/1989	1,300	450

As a subcontractor to Teledyne Brown Engineering, El Dorado Engineering, Inc. (EDE) was asked to provide air emission analysis for the destruction of the Pershing missile motors in accordance with the INF Treaty. This analysis consists of the application of the EDE developed PCAD model which predicts the products of atmospheric dispersion of these products. EDE was also contacted to conduct four tests at Huntsville, AL, and one test at Pueblo Army Depot to collect air emission information for environmental assessments, Part B Permits, and/or changes to interim status. The project was accomplished with a very high level priority requiring rapid mobilization of equipment and personnel and deployment of mobilized sampling teams and equipment. EDE received a rating of 98.0 for delivery and a rating of 100 for quality during contract performance.

This model was used to prepare the environmental assessment at four locations, two in Utah, one in Colorado, and one in Texas. Provided environmental testing to be used to collect data to subsequent Subpart X permits. Provided data for air assessment for Subpart X permitting for the disposal of the Pershing missile motors.

EDE also provided modeling for NEPA requirements.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-02 Model of Open Burning of Explosives	Developed Computer Model to Predict Products of Combustion	Naval Surface Weapons Center Silver Springs, MD G. Young, 202-394-1688	12/1989	294	294

El Dorado Engineering, Inc. (EDE) developed a computer model (Products of Combustion/Atmospheric Dispersion – PCAD) to predict products of combustion, plume rise, and atmospheric dispersion for open burning of ordnance and explosives. The model was validated by test burns and measurements and model iterations at Hercules Bacchus Works.

EDE performed emissions testing on 9 open burns and 9 static firings of rocket motors. Excellent agreement was found between the model and actual emissions tests. EDE developed a method to introduce a tracer gas in the plume to enhance validation.

This effort was used to support both the NEPA requirements and PSD permit application.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
90-02 Air Emissions Support Studies and Testing Thiokol, Utah	Air Emissions Testing	NASA/Sverdrup Stennis Space Center	12/110	45	45

El Dorado Engineering, Inc. (EDE) performed air emissions testing and modeling for the shuttle booster test firings at Thiokol in support of NASA environmental studies. This work also included a study of the tall plume resulting from burning 1.3 million pounds of propellant in two minutes. Investigated plumes that penetrated the mixing layer and the ultimate dispersion of these tall plumes.

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				Entire Project	Work For Which Firm Was/Is Responsible
91-02 Modeling of Surface Deflagrations Involving Air Bag Propellants	Model Downwind Hazards	TRW Safety Systems Mesa, Arizona	06/1991	15	15

El Dorado Engineering, Inc. (EDE) was contracted by TRW to model the downwind hazards in the unlikely event of a surface deflagration involving air bag propellants using the PCAD computer model. Modeling was performed for both nighttime and daytime scenarios to determine expected products from the incident, as well s concentration levels. Sensitive receptors in the area were identified and complete risk assessment performed. EDE served as TRW's advocate during hearings with the city of Mesa, Arizona, involving the risk assessment. Mesa and TRW accepted and agreed with the EDE risk assessment.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
92-01 Consolidation of Phillips Laboratory Kirtland Air Force Base, NM	Risk Assessment Analysis	Kirtland Air Force Base Kirtland Air Force Base, MD	07/1992	200	70

As a subcontractor to the Earth Technology Corporation, EDE was tasked with performing the risk assessment analyses for consolidating the Phillips Laboratory operations from Edwards Air Force Base, California, to Kirtland Air Force Base, New Mexico.

EDE's responsibilities included developing possible scenarios to analyze, including routine operations (static firings of solid and liquid fueled rocket motors), as well as accidental incidents (accidents in transportation and storage, and accidents occurring during firing operations).

EDE performed air emissions dispersion modeling for these scenarios, and compared the results to the regulatory standards in the State of New Mexico. EDE further analyzed the risk to both the population and the environment resulting from both normal operations, and accidental occurrences. This risk analysis was to be used as part of an Environmental Assessment to determine if an Environmental Impact Statement would be required.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
98-03 Shillelagh Motor Contained Burn Nevada Test Site	Design and furnish equipment	Bechtel Nevada Test Site	07/1998	5000	620

El Dorado Engineering, Inc. (EDE) was contracted by Bechtel to design and provide a contained burn system for the demilitarization of Shillelagh rocket motors. This system includes a rocket holder, chamber for containing the combustion gases, a complete pollution control system, and a ventilation control system. EDE provided all electrical controls, hardware, and equipment for the complete system and operation. The system was designed to process 100 rockets per day.

RH/EDE-2

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-01 Contained Burn Facility Iowa Army Ammunition Plant	Turnkey, design, and install	AET Dana Point, California R. Gregg, 949-240-6452	07/2001	1250	200

EDE was contracted to design, fabricate, and install a pilot contained burn facility for treating propellant, explosives, and pyrotechnic (PEP) waste materials and contaminated trash and dunnage. The contained burn facility utilizes a novel approach as an alternative to open burning and open detonation. The facility is constructed without a controlled burner and is not classified as a hazardous waste incinerator. The materials are ignited and burned within a containment vessel and the emissions are passed through with a complete air pollution control system. The design work included upgrading an existing building providing additions and utilities to the building in the design and all equipment required for operations.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-13 Bechtel Nevada Tactical Missile Study Las Vegas, Nevada	Tactical Missile Study	Bechtel Nevada Las Vegas, Nevada Dennis Jeffrey, 702-295-2192	09/2000	8	8

EDE had previously supplied Bechtel Nevada with a contained burn system for processing Shillelagh rocket motors. This system contained the exhaust and processed the exhaust through a pollution control system. It was designed to process one missile motor every 7-½ minutes. EDE evaluated the U.S. stockpile of tactical missiles currently slated for disposal to determine which missiles besides the Shillelagh were also candidates for disposal in this system.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-19 Charted Ammunition Industries Singapore	Demilitarization Study	Chartered Ammunition Industries Singapore	12/2000	15	15

Chartered Ammunition Industries of Singapore retained EDE to examine their existing demilitarization capabilities, compare it with anticipated workload, and prepare a conceptual plan for equipment, process, and facility upgrades.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
01-03 Chemical Munitions Demilitarization Russia	Engineering	Ralph M. Parsons Russia thomas.cc@rcwdp.ru	12/2009	660,000	2000

El Dorado Engineering is part of the Ralph M. Parsons team that was awarded the major contract to accomplish the demilitarization of chemical weapons in Russia. Parsons contracted with Russian companies to accomplish major portions of the work. EDE was tasked to assist with technology transfer from the U.S. experience.

El Dorado Engineering was tasked to provide an evaluation of all of the equipment design and procedures associated with handling the chemical munitions, drilling and draining the agent, technical studies, and all other work associated with bringing this project from a concept design up through a proven completely tested system for chemical munitions. This contract has required several trips per year to on-site Russian facilities since the project inception.

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				Entire Project	Work For Which Firm Was/Is Responsible
01-04 Eglin Burn Kettles Eglin Air Force Base, FL	Design, fabricate, and furnish a Transportable Burn Kettle System and heat source for processing munitions	Eglin Air Force Base, FL D. Freeman	07-2001	468	468

EDE was tasked to evaluate the existing burn kettles at Eglin Air Force Base used for the disposal of munitions. EDE was to design and develop, fabricate and furnish, a new transportable burn kettle system with an external heat source. EDE furnished a trailer mounted transportable burn kettle processor complete with electrical generator, remote control system, fuel and flame safety system for heating specifically designed burn kettles to contain munitions that are thermally treated. Munitions were recovered from the test range and processed in this system. This system is permitted as part of the existing Subpart X environmental permit. EDE was also responsible for modifications to the permit application for this equipment.

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				Entire Project	Work For Which Firm Was/Is Responsible
02-01 Thermal Processor Unit for Kaho'olawe, Hawaii	Design, fabricate, and install transportable thermal processor	Parsons UXB Tom McCabe, 808-471-4303	May 2002	450	450

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a transportable thermal processing unit for processing explosive contaminated ordnance debris as part of the cleanup and restoration of the Island of Kaho'olawe. Kaho'olawe was used as a Naval Test Range for a number of years had an estimated 10 million pounds of potentially explosive contaminated munition parts and target debris. Parsons/UXB was contracted by the Navy to restore the island to deliver it back to Hawaii. EDE's Transportable Flashing Furnace (TFF) allowed all of the metal parts and target debris to be safely treated so that it could be sold as scrap metal as it was removed from the island. The TFF was successfully designed, fabricated, installed and commissioned, and processed over 2 tons of material per hour and complete processing over 8 million pounds of material.

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				Entire Project	Work For Which Firm Was/Is Responsible
02-02 Total Solution Design Blue Grass Army Depot	Equipment system and process Design	Eco Logic Canada B. Morse 281-376-2190	01/02	10,000	1,000

U.S. Army PMACWA determined that there were three viable technologies for accomplishing the demilitarization of the chemical munitions stored at Blue Grass Army Depot using non-incineration technologies. The contract was awarded to each one of the technology providers to provide a total solution design based on their technology. Eco Logic had proposed the technology utilizing chemical neutralization of the agent followed by supercritical water oxidation of waste liquids, and thermal/hydrogen reduction system for processing combustible materials and in treating contaminated metal parts. EDE was contracted to perform all engineering to develop all of the equipment required for disassembly of the munitions to accommodate the various chemical process technologies. EDE also developed and tested a system to grind rocket propellant underwater to accommodate downstream processes. EDE designed all material handling equipment to move energetic materials, slurries, metal parts and chemical agent throughout the entire plant. EDE provided mass and material balances, P&ID diagrams, and equipment layout drawings for the entire process. EDE provided preliminary designs for all of the equipment required to perform the munition disassembly. EDE provided the safety and hazard analysis for the entire plant design. EDE also performed cost estimating for design build construction and operations of this equipment. The entire project was estimated at 1-½ billion dollars.

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				Entire Project	Work For Which Firm Was/Is Responsible
03-01 Rocket Dismantling Machine Component Tests	Design, build, and test Equipment	Eco Logic Canada Doug Gray, 519-856-9591 ext. 214	01/03	1,500	1,300

As part of the non-incineration demilitarization plan for chemical munitions stored at Blue Grass Army Depot, a new M55 rocket dismantling machine needed to be designed for two of the three proposed processes. EDE was tasked to design and test various components that would be required by the dismantling machine. This included:

- Washout of the explosive filled burster using a high pressure washout system
- A low pressure washout system to washout gelled agent from the rocket warhead
- A system to punch and drain the agent and accommodate warhead washout
- A system to extract anti-resonator rods from the rocket propellant
- Develop equipment using sophisticated tube cutters to cut through the fiberglass outer container and the rocket metal parts without leaving an indentation or burr in the metal parts to enable extraction of the rocket motor grain

EDE designed and fabricated each of the equipment components as described and built simulated munitions. EDE utilized the simulated munitions to successfully test each of the components that were developed and write a comprehensive report of the program. All work was completed on schedule despite major changes to the criteria during the project.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-01 Action Manufacturing Contained Burn Construction Atglen, PA	Contained Burn Construction	Action Manufacturing Atglen, PA Tony Taylor, 610-593-6905 ext. 9	03-2004	215	215

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a contained burn thermal treatment system for processing Action Manufacturing's energetic waste materials. The Contained Burn Unit includes air pollution control equipment to meet the Pennsylvania environmental permitting requirements.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-02 Decontamination of Air Force Test Range Metal Debris Using a Transportable Flashing Furnace Eglin Air Force Base	Demonstration Test Program	U.S. Army Corps of Engineers Scott Millhouse, 256-895-1607	12/04	580	580

El Dorado Engineering, Inc. (EDE) received an ESTCP contract award to demonstrate a technology developed by EDE for decontaminating metal debris produced by military test ranges. A Transportable Flashing Furnace (TFF) is a trailer mounted furnace capable of processing up to 5,000 lbs. per hour of test range debris to assure that the metals are free of explosives and propellants before being sold off-site as scrap metal. EDE's demonstration program utilized actual munition fragments and target debris from the test range at Eglin Air Force Base which were processed in an EDE designed and manufactured TFF. The results of this demonstration program were used to prove technical feasibility and provide the economic analysis for using this technology to assist with clearance of materials at active military test ranges.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-03 Rocket Shear Machine Developmental Testing Salt Lake City, Utah	Develop equipment for cleaning chemical agents from M55 rockets	Ralph M. Parsons Pasadena, CA John Ursillo, 626-440-2628	12/08	1,500,000	500

A team of companies including Ralph M. Parsons received a contract to design, install, and operate the demilitarization plant to treat and dispose of all chemical munitions stored at Blue Grass Arsenal, Kentucky. This process is unique in that it will not use incineration as the primary treatment technology. EDE was tasked to develop equipment and methodology to successfully punch the M55 rocket cavity containing chemical agents and drain the agent from the rocket cavity. The stored rockets are known to have agents that have gelled or crystallized. As part of this demonstration program EDE used simulated gelled agent and simulated crystals. EDE developed a plastic warhead for viewing the high-pressure washout nozzle configuration to successfully determine design pressures, flows and nozzle orientation to completely clean the rocket cavities of all agents. Based on the development tests using the plastic warhead, simulated aluminum rocket warheads contained in fiberglass shipping and firing tubes were punched and washed out again using simulated agents. The demonstration project was very successful with over 98% of the agent being removed, which exceeded the design requirements. Since this project deals with weapons of mass destruction, the tests were performed with exceedingly high levels of quality control and safety analyses.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-04 Explosive Waste Incineration Facility Elbasan, Albania	Build and install an Explosive Waste Incinerator	NAMSA Luxembourg P. Courtney-Green, 352-3063 6449	March 2005	2500	2500

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Elbasan, Albania. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE had the most experience of any company bidding in providing ammunition demilitarization equipment of this nature. EDE was able to exceed NAMSA's requirements and still provide the lowest overall bid for the project. EDE effectively used in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Albania providing employment and training for local Albanians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
05-01 Transportable Flashing Furnace Anniston, Alabama	Design and Manufacture Transportable Flashing Furnace	Anniston Munitions Center Anniston, Alabama Phil Keith, 812-854-6157 Ellen McDaniel, 812-854-5315	12/05	260	260

EDE was asked to design, manufacture, and deliver a Transportable Flashing Furnace (TFF) to the Anniston Munitions Center. The client desired a smaller sized version from EDE's full sized TFF. EDE therefore designed an economy model. This TFF will allow Anniston to flash and decontaminate explosive contaminated metals generated by the missile recycling facility and the detonation chamber. These metals will then be able to be sold directly as scrap metal. EDE assisted Anniston with the environmental permitting and safety siting of this equipment. On-site training and installation assistance was included in the contract.

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				Entire Project	Work For Which Firm Was/Is Responsible
06-01 Magnesium Recovery Pilot Plant Crane Naval Surface Warfare Center	Design and Construction of a Facility for Magnesium Recovery	Crane Naval Surface Warfare Center Crane, Indiana Sara Poehlein, 812-854-3190	12-06	5000	5000

TPL of Albuquerque, New Mexico, had performed an SBIR project at a bench scale level showing the feasibility of recovering magnesium from obsolete illuminating flares for reuse by the Navy in new production applications. EDE was awarded a contract by TPL/NSWC to provide all necessary services to design, procure and fabricate, and install a pilot plant to recover magnesium from obsolete flares. The recovered magnesium must meet the specifications of new material so that it could be used in the Navy's current production. This pilot plant includes a waterjet system to washout materials from obsolete flares. The byproducts are then separated from the magnesium by a series of equipment processes and the magnesium is cleaned, classified, dried, and packaged for reuse. The plant has a state-of-the-art controls system and includes all equipment for preparing and manipulating the flares for washout through all downstream processes to high-grade magnesium recovery. This project was divided into three phases. The first phase was to provide the design of the entire plant and all of the equipment. Phase II was fabrication, procurement, and factory testing. Phase III installation and checkout at Crane is scheduled for completion in 2009. The benefits of this project include a safe and environmentally clean process to dispose of obsolete flares and at the same time recover a highly valuable magnesium material for recycle and reuse.

Reference SOW Task 6 Primary Task 3 and Task 7 Secondary

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
06-02 Explosive Waste Incinerator Shoeburyness, United Kingdom	Turn-Key Explosive Waste Incinerator	QinetiQ Keith Blair 01252 393927	09/06	3000	3000

El Dorado Engineering, Inc. (EDE) was responsible to design and build an Explosive Waste Incinerator to process a wide variety of explosive items. The contract required EDE to meet the very strict EU environmental regulations regarding incineration emissions. The work involved design, fabrication, shipping, installation, testing, and training. EDE provided an Explosive Waste Incinerator with feed systems, lead recovery system, and an air pollution control system including an afterburner, gas cooler, and baghouse.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-01 Design and Fabrication of Waste Incinerator	Design, Fabrication, Startup and Training	Kolon Yeong Dong-gun, Korea S.B. Park	11/07	10,000	1,500

El Dorado Engineering was contracted by Kolon to provide a waste incinerator thermal treatment system for explosive and energetic materials. EDE evaluated the Korean workload and proposed an Explosive Waste Incinerator that included lead removal and recovery of two separate energetic material feed systems. EDE designed, fabricated and shipped the equipment to South Korea. EDE provided installation project managers responsible for both mechanical and electrical/controls installation. EDE also performed startup and training. All work was done on schedule and to the client's full satisfaction.

Primary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-02 Provide Thermal Treatment System for Air Bag Manufacturing Wastes	Design, Fabricate, and Install Thermal Treatment System	Delphi Matamoras, MX Timothy R. Brennaman (937) 356-2754	09/08	350	350

Delphi, in manufacturing airbag and airbag inflators, produces energetic waste materials, reject parts, and contaminated dunnage. EDE was tasked to provide a turn-key thermal treatment system. This system is required to handle all of their various waste streams and provide pollution control that meets Mexico's standards. Besides design, fabrication, and installation, EDE is required to provide on-site training and produce documents in English and Spanish.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-03 Explosive Dieletric Meltout System Hawthorne, Nevada	Turn-key Automated Facility	U.S. Army Brent Ochs/Thomas P. DeAngelis 812-854-3851/908 328-2313	01/10	3,300	3,300

EDE was tasked to provide an explosive dielectric meltout system known as DIHMES. This project is divided into two phases. DIHMES I was to design the system and demonstrate the technology at Crane, Indiana. DIHMES II was to provide a turn-key facility complete with all equipment and material handling systems so that the entire process operates remotely. The process is to recover explosive slugs from obsolete mortars which can be sold directly to the mining industry. The technology consists of a waterjet cutting system that cuts off the fuzes of various size mortars. The mortars are then placed upside down in a dielectric meltout station. When heat is applied, the explosive slug falls in to a collection container much like running hot water over a frozen orange juice can. The system includes a robot to transfer the materials to the waterjet cutting station and a dielectric meltout station. It also has specific equipment to handle the fuzes and any reject mortars. The operation is contained within a reinforced concrete bay with all operations conducted remotely and automatically. The explosive is received in a pure form compared to other technologies and is directly ready for resale.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-04 Flashing Furnace Hill Air Force Base	Refurbish flashing furnace, install, and train operators	Hill Air Force Base Dennis Weder 801-775-6921	May 2008	81	81

El Dorado Engineering (EDE) had previously provided a transportable flashing furnace to Eglin Air Force Base. The Air Force decided to transfer the furnace to Hill Air Force Base to process range scrap. EDE refurbished the flashing furnace, installed the flashing furnace at Hill Air Force Base's Test Range and trained the operators. Hill Air Force Base processed over 240,000 thousand pounds of live and potentially live items up to 20 MM TPT rounds. EDE again refurbished the furnace and shipped it back to Eglin Air Force Base. The project was very successful in that a large quantity of items were processed in a short period of time without incident.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-05 Flashing Furnace for Anniston, Alabama, and Talon, West Virginia	Design, fabrication, and installation of a transportable flashing furnace and training of operators	Crane Naval Weapons Center Phil Keith 812-854-6157	06/08	535	535

El Dorado Engineering, Inc. (EDE) had previously provided a Transportable Flashing Furnace (economy model) to Anniston Army Depot to flash explosive contaminated materials from their rocket recycling facility. EDE was contracted to provide a new larger flashing furnace for this location. EDE designed, fabricated, and installed a new larger flashing furnace capable of flashing up to 5,000 lbs. per hour of explosive contaminated materials. EDE trained the Anniston operators in the use of this equipment.

The smaller economy model was refurbished and sent to West Virginia to be used in the cleanup and restoration of the old Talon site. The furnace was used to process a wide variety of live items including fuzes, detonators, etc. EDE was also tasked to provide assistance with explosive chemistry, combustion, analyses and anticipated air emissions to be used to secure the environmental permits for the operation. EDE also designed and provided strongboxes for the operation at Talon, installed the furnace and trained the operators at Talon. EDE also provided the environmental analyses for use in permitting. This operation at Talon was very successful as the Mobile Ammunition Renovation Inspection Demilitarization (MARID) team was able to process an estimated 15,000 to 20,000 pounds of live ammunition between June and August working two 10-hour shifts per day.

A task to perform contained burn testing of MLRS motor was later added to this contract. This technology was successfully demonstrated by EDE at Arnold Air Force Base to provide complete and safety combustion of the MLRS motors and capture the effluent so it could be cleaned prior to exhaust. The project was on time and on budget.

SOW Reference Primary 3.8 Secondary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-06 Defence Construction Canada Demil Facility Project Study	Demilitarization Planning Study	Defence Construction Canada. Louis Lemay 141 Laurier Avenue West, Suite 301, Ottawa, Ontario K1P 5J3 Phone: (613) 949-6925	02/2009	15	15

EDE reviewed contents of the Canadian stockpile and demilitarization project objectives and prepared a report that recommended a comprehensive demilitarization approach. All viable demil processes from simple incineration to more complex disassembly and resource recovery were considered. EDE recommended a phased approach to allow core demil capability to be acquired to perform significant workload immediately, with later phases adding other capabilities, such as disassembly, to enhance the core capability.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (housands)	
				Entire Project	Work For Which Firm Was/Is Responsible
09-02 Explosive Waste Incinerator Ukraine	Turn-key Explosive Waste Incinerator	NATO (NAMSA) Luxembourg **CLT LAURENT** **352 3063 5988**	12/2009	3000	3000

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Donetsk, Ukraine. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE effectively uses in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Ukraine providing employment and training for local Ukrainians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-01 Air Emissions Modeling & Program for INF Treaty Huntsville, AL & Pueblo, CO	Provide Air Emission Analysis	Missile Command Huntsville, Alabama J. Mangi, 703-534-2484	06/1989	1,300	450

As a subcontractor to Teledyne Brown Engineering, El Dorado Engineering, Inc. (EDE) was asked to provide air emission analysis for the destruction of the Pershing missile motors in accordance with the INF Treaty. This analysis consists of the application of the EDE developed PCAD model which predicts the products of atmospheric dispersion of these products. EDE was also contacted to conduct four tests at Huntsville, AL, and one test at Pueblo Army Depot to collect air emission information for environmental assessments, Part B Permits, and/or changes to interim status. The project was accomplished with a very high level priority requiring rapid mobilization of equipment and personnel and deployment of mobilized sampling teams and equipment. EDE received a rating of 98.0 for delivery and a rating of 100 for quality during contract performance.

This model was used to prepare the environmental assessment at four locations, two in Utah, one in Colorado, and one in Texas. Provided environmental testing to be used to collect data to subsequent Subpart X permits. Provided data for air assessment for Subpart X permitting for the disposal of the Pershing missile motors.

EDE also provided modeling for NEPA requirements.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-02 Model of Open Burning of Explosives	Developed Computer Model to Predict Products of Combustion	Naval Surface Weapons Center Silver Springs, MD G. Young, 202-394-1688	12/1989	294	294

El Dorado Engineering, Inc. (EDE) developed a computer model (Products of Combustion/Atmospheric Dispersion – PCAD) to predict products of combustion, plume rise, and atmospheric dispersion for open burning of ordnance and explosives. The model was validated by test burns and measurements and model iterations at Hercules Bacchus Works.

EDE performed emissions testing on 9 open burns and 9 static firings of rocket motors. Excellent agreement was found between the model and actual emissions tests. EDE developed a method to introduce a tracer gas in the plume to enhance validation.

This effort was used to support both the NEPA requirements and PSD permit application.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
90-02 Air Emissions Support Studies and Testing Thiokol, Utah	Air Emissions Testing	NASA/Sverdrup Stennis Space Center	12/110	45	45

El Dorado Engineering, Inc. (EDE) performed air emissions testing and modeling for the shuttle booster test firings at Thiokol in support of NASA environmental studies. This work also included a study of the tall plume resulting from burning 1.3 million pounds of propellant in two minutes. Investigated plumes that penetrated the mixing layer and the ultimate dispersion of these tall plumes.

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				Entire Project	Work For Which Firm Was/Is Responsible
91-02 Modeling of Surface Deflagrations Involving Air Bag Propellants	Model Downwind Hazards	TRW Safety Systems Mesa, Arizona	06/1991	15	15

El Dorado Engineering, Inc. (EDE) was contracted by TRW to model the downwind hazards in the unlikely event of a surface deflagration involving air bag propellants using the PCAD computer model. Modeling was performed for both nighttime and daytime scenarios to determine expected products from the incident, as well s concentration levels. Sensitive receptors in the area were identified and complete risk assessment performed. EDE served as TRW's advocate during hearings with the city of Mesa, Arizona, involving the risk assessment. Mesa and TRW accepted and agreed with the EDE risk assessment.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
92-01 Consolidation of Phillips Laboratory Kirtland Air Force Base, NM	Risk Assessment Analysis	Kirtland Air Force Base Kirtland Air Force Base, MD	07/1992	200	70

As a subcontractor to the Earth Technology Corporation, EDE was tasked with performing the risk assessment analyses for consolidating the Phillips Laboratory operations from Edwards Air Force Base, California, to Kirtland Air Force Base, New Mexico.

EDE's responsibilities included developing possible scenarios to analyze, including routine operations (static firings of solid and liquid fueled rocket motors), as well as accidental incidents (accidents in transportation and storage, and accidents occurring during firing operations).

EDE performed air emissions dispersion modeling for these scenarios, and compared the results to the regulatory standards in the State of New Mexico. EDE further analyzed the risk to both the population and the environment resulting from both normal operations, and accidental occurrences. This risk analysis was to be used as part of an Environmental Assessment to determine if an Environmental Impact Statement would be required.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
98-03 Shillelagh Motor Contained Burn Nevada Test Site	Design and furnish equipment	Bechtel Nevada Test Site	07/1998	5000	620

El Dorado Engineering, Inc. (EDE) was contracted by Bechtel to design and provide a contained burn system for the demilitarization of Shillelagh rocket motors. This system includes a rocket holder, chamber for containing the combustion gases, a complete pollution control system, and a ventilation control system. EDE provided all electrical controls, hardware, and equipment for the complete system and operation. The system was designed to process 100 rockets per day.

RH/EDE - 2

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-01 Contained Burn Facility Iowa Army Ammunition Plant	Turnkey, design, and install	AET Dana Point, California R. Gregg, 949-240-6452	07/2001	1250	200

EDE was contracted to design, fabricate, and install a pilot contained burn facility for treating propellant, explosives, and pyrotechnic (PEP) waste materials and contaminated trash and dunnage. The contained burn facility utilizes a novel approach as an alternative to open burning and open detonation. The facility is constructed without a controlled burner and is not classified as a hazardous waste incinerator. The materials are ignited and burned within a containment vessel and the emissions are passed through with a complete air pollution control system. The design work included upgrading an existing building providing additions and utilities to the building in the design and all equipment required for operations.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-13 Bechtel Nevada Tactical Missile Study Las Vegas, Nevada	Tactical Missile Study	Bechtel Nevada Las Vegas, Nevada Dennis Jeffrey, 702-295-2192	09/2000	8	8

EDE had previously supplied Bechtel Nevada with a contained burn system for processing Shillelagh rocket motors. This system contained the exhaust and processed the exhaust through a pollution control system. It was designed to process one missile motor every 7-½ minutes. EDE evaluated the U.S. stockpile of tactical missiles currently slated for disposal to determine which missiles besides the Shillelagh were also candidates for disposal in this system.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
00-19 Charted Ammunition Industries Singapore	Demilitarization Study	Chartered Ammunition Industries Singapore	12/2000	15	15

Chartered Ammunition Industries of Singapore retained EDE to examine their existing demilitarization capabilities, compare it with anticipated workload, and prepare a conceptual plan for equipment, process, and facility upgrades.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
01-03 Chemical Munitions Demilitarization Russia	Engineering	Ralph M. Parsons Russia thomas.cc@rcwdp.ru	12/2009	660,000	2000

El Dorado Engineering is part of the Ralph M. Parsons team that was awarded the major contract to accomplish the demilitarization of chemical weapons in Russia. Parsons contracted with Russian companies to accomplish major portions of the work. EDE was tasked to assist with technology transfer from the U.S. experience.

El Dorado Engineering was tasked to provide an evaluation of all of the equipment design and procedures associated with handling the chemical munitions, drilling and draining the agent, technical studies, and all other work associated with bringing this project from a concept design up through a proven completely tested system for chemical munitions. This contract has required several trips per year to on-site Russian facilities since the project inception.

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				Entire Project	Work For Which Firm Was/Is Responsible
01-04 Eglin Burn Kettles Eglin Air Force Base, FL	Design, fabricate, and furnish a Transportable Burn Kettle System and heat source for processing munitions	Eglin Air Force Base, FL D. Freeman	07-2001	468	468

EDE was tasked to evaluate the existing burn kettles at Eglin Air Force Base used for the disposal of munitions. EDE was to design and develop, fabricate and furnish, a new transportable burn kettle system with an external heat source. EDE furnished a trailer mounted transportable burn kettle processor complete with electrical generator, remote control system, fuel and flame safety system for heating specifically designed burn kettles to contain munitions that are thermally treated. Munitions were recovered from the test range and processed in this system. This system is permitted as part of the existing Subpart X environmental permit. EDE was also responsible for modifications to the permit application for this equipment.

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				Entire Project	Work For Which Firm Was/Is Responsible
02-01 Thermal Processor Unit for Kaho'olawe, Hawaii	Design, fabricate, and install transportable thermal processor	Parsons UXB Tom McCabe, 808-471-4303	May 2002	450	450

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a transportable thermal processing unit for processing explosive contaminated ordnance debris as part of the cleanup and restoration of the Island of Kaho'olawe. Kaho'olawe was used as a Naval Test Range for a number of years had an estimated 10 million pounds of potentially explosive contaminated munition parts and target debris. Parsons/UXB was contracted by the Navy to restore the island to deliver it back to Hawaii. EDE's Transportable Flashing Furnace (TFF) allowed all of the metal parts and target debris to be safely treated so that it could be sold as scrap metal as it was removed from the island. The TFF was successfully designed, fabricated, installed and commissioned, and processed over 2 tons of material per hour and complete processing over 8 million pounds of material.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
02-02 Total Solution Design Blue Grass Army Depot	Equipment system and process Design	Eco Logic Canada B. Morse 281-376-2190	01/02	10,000	1,000

U.S. Army PMACWA determined that there were three viable technologies for accomplishing the demilitarization of the chemical munitions stored at Blue Grass Army Depot using non-incineration technologies. The contract was awarded to each one of the technology providers to provide a total solution design based on their technology. Eco Logic had proposed the technology utilizing chemical neutralization of the agent followed by supercritical water oxidation of waste liquids, and thermal/hydrogen reduction system for processing combustible materials and in treating contaminated metal parts. EDE was contracted to perform all engineering to develop all of the equipment required for disassembly of the munitions to accommodate the various chemical process technologies. EDE also developed and tested a system to grind rocket propellant underwater to accommodate downstream processes. EDE designed all material handling equipment to move energetic materials, slurries, metal parts and chemical agent throughout the entire plant. EDE provided mass and material balances, P&ID diagrams, and equipment layout drawings for the entire process. EDE provided preliminary designs for all of the equipment required to perform the munition disassembly. EDE provided the safety and hazard analysis for the entire plant design. EDE also performed cost estimating for design build construction and operations of this equipment. The entire project was estimated at 1-½ billion dollars.

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				Entire Project	Work For Which Firm Was/Is Responsible
03-01 Rocket Dismantling Machine Component Tests	Design, build, and test Equipment	Eco Logic Canada Doug Gray, 519-856-9591 ext. 214	01/03	1,500	1,300

As part of the non-incineration demilitarization plan for chemical munitions stored at Blue Grass Army Depot, a new M55 rocket dismantling machine needed to be designed for two of the three proposed processes. EDE was tasked to design and test various components that would be required by the dismantling machine. This included:

- Washout of the explosive filled burster using a high pressure washout system
- A low pressure washout system to washout gelled agent from the rocket warhead
- A system to punch and drain the agent and accommodate warhead washout
- A system to extract anti-resonator rods from the rocket propellant
- Develop equipment using sophisticated tube cutters to cut through the fiberglass outer container and the rocket metal parts without leaving an indentation or burr in the metal parts to enable extraction of the rocket motor grain

EDE designed and fabricated each of the equipment components as described and built simulated munitions. EDE utilized the simulated munitions to successfully test each of the components that were developed and write a comprehensive report of the program. All work was completed on schedule despite major changes to the criteria during the project.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-01 Action Manufacturing Contained Burn Construction Atglen, PA	Contained Burn Construction	Action Manufacturing Atglen, PA Tony Taylor, 610-593-6905 ext. 9	03-2004	215	215

El Dorado Engineering, Inc. (EDE) was contracted to design, fabricate, and install a contained burn thermal treatment system for processing Action Manufacturing's energetic waste materials. The Contained Burn Unit includes air pollution control equipment to meet the Pennsylvania environmental permitting requirements.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-02 Decontamination of Air Force Test Range Metal Debris Using a Transportable Flashing Furnace Eglin Air Force Base	Demonstration Test Program	U.S. Army Corps of Engineers Scott Millhouse, 256-895-1607	12/04	580	580

El Dorado Engineering, Inc. (EDE) received an ESTCP contract award to demonstrate a technology developed by EDE for decontaminating metal debris produced by military test ranges. A Transportable Flashing Furnace (TFF) is a trailer mounted furnace capable of processing up to 5,000 lbs. per hour of test range debris to assure that the metals are free of explosives and propellants before being sold off-site as scrap metal. EDE's demonstration program utilized actual munition fragments and target debris from the test range at Eglin Air Force Base which were processed in an EDE designed and manufactured TFF. The results of this demonstration program were used to prove technical feasibility and provide the economic analysis for using this technology to assist with clearance of materials at active military test ranges.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-03 Rocket Shear Machine Developmental Testing Salt Lake City, Utah	Develop equipment for cleaning chemical agents from M55 rockets	Ralph M. Parsons Pasadena, CA John Ursillo, 626-440-2628	12/08	1,500,000	500

A team of companies including Ralph M. Parsons received a contract to design, install, and operate the demilitarization plant to treat and dispose of all chemical munitions stored at Blue Grass Arsenal, Kentucky. This process is unique in that it will not use incineration as the primary treatment technology. EDE was tasked to develop equipment and methodology to successfully punch the M55 rocket cavity containing chemical agents and drain the agent from the rocket cavity. The stored rockets are known to have agents that have gelled or crystallized. As part of this demonstration program EDE used simulated gelled agent and simulated crystals. EDE developed a plastic warhead for viewing the high-pressure washout nozzle configuration to successfully determine design pressures, flows and nozzle orientation to completely clean the rocket cavities of all agents. Based on the development tests using the plastic warhead, simulated aluminum rocket warheads contained in fiberglass shipping and firing tubes were punched and washed out again using simulated agents. The demonstration project was very successful with over 98% of the agent being removed, which exceeded the design requirements. Since this project deals with weapons of mass destruction, the tests were performed with exceedingly high levels of quality control and safety analyses.

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				Entire Project	Work For Which Firm Was/Is Responsible
04-04 Explosive Waste Incineration Facility Elbasan, Albania	Build and install an Explosive Waste Incinerator	NAMSA Luxembourg P. Courtney-Green, 352-3063 6449	March 2005	2500	2500

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Elbasan, Albania. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE had the most experience of any company bidding in providing ammunition demilitarization equipment of this nature. EDE was able to exceed NAMSA's requirements and still provide the lowest overall bid for the project. EDE effectively used in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Albania providing employment and training for local Albanians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
05-01 Transportable Flashing Furnace Anniston, Alabama	Design and Manufacture Transportable Flashing Furnace	Anniston Munitions Center Anniston, Alabama Phil Keith, 812-854-6157 Ellen McDaniel, 812-854-5315	12/05	260	260

EDE was asked to design, manufacture, and deliver a Transportable Flashing Furnace (TFF) to the Anniston Munitions Center. The client desired a smaller sized version from EDE's full sized TFF. EDE therefore designed an economy model. This TFF will allow Anniston to flash and decontaminate explosive contaminated metals generated by the missile recycling facility and the detonation chamber. These metals will then be able to be sold directly as scrap metal. EDE assisted Anniston with the environmental permitting and safety siting of this equipment. On-site training and installation assistance was included in the contract.

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				Entire Project	Work For Which Firm Was/Is Responsible
06-01 Magnesium Recovery Pilot Plant Crane Naval Surface Warfare Center	Design and Construction of a Facility for Magnesium Recovery	Crane Naval Surface Warfare Center Crane, Indiana Sara Poehlein, 812-854-3190	12-06	5000	5000

TPL of Albuquerque, New Mexico, had performed an SBIR project at a bench scale level showing the feasibility of recovering magnesium from obsolete illuminating flares for reuse by the Navy in new production applications. EDE was awarded a contract by TPL/NSWC to provide all necessary services to design, procure and fabricate, and install a pilot plant to recover magnesium from obsolete flares. The recovered magnesium must meet the specifications of new material so that it could be used in the Navy's current production. This pilot plant includes a waterjet system to washout materials from obsolete flares. The byproducts are then separated from the magnesium by a series of equipment processes and the magnesium is cleaned, classified, dried, and packaged for reuse. The plant has a state-of-the-art controls system and includes all equipment for preparing and manipulating the flares for washout through all downstream processes to high-grade magnesium recovery. This project was divided into three phases. The first phase was to provide the design of the entire plant and all of the equipment. Phase II was fabrication, procurement, and factory testing. Phase III installation and checkout at Crane is scheduled for completion in 2009. The benefits of this project include a safe and environmentally clean process to dispose of obsolete flares and at the same time recover a highly valuable magnesium material for recycle and reuse.

Reference SOW Task 6 Primary Task 3 and Task 7 Secondary

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
06-02 Explosive Waste Incinerator Shoeburyness, United Kingdom	Turn-Key Explosive Waste Incinerator	QinetiQ Keith Blair 01252 393927	09/06	3000	3000

El Dorado Engineering, Inc. (EDE) was responsible to design and build an Explosive Waste Incinerator to process a wide variety of explosive items. The contract required EDE to meet the very strict EU environmental regulations regarding incineration emissions. The work involved design, fabrication, shipping, installation, testing, and training. EDE provided an Explosive Waste Incinerator with feed systems, lead recovery system, and an air pollution control system including an afterburner, gas cooler, and baghouse.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (000 thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-01 Design and Fabrication of Waste Incinerator	Design, Fabrication, Startup and Training	Kolon Yeong Dong-gun, Korea S.B. Park	11/07	10,000	1,500

El Dorado Engineering was contracted by Kolon to provide a waste incinerator thermal treatment system for explosive and energetic materials. EDE evaluated the Korean workload and proposed an Explosive Waste Incinerator that included lead removal and recovery of two separate energetic material feed systems. EDE designed, fabricated and shipped the equipment to South Korea. EDE provided installation project managers responsible for both mechanical and electrical/controls installation. EDE also performed startup and training. All work was done on schedule and to the client's full satisfaction.

Primary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-02 Provide Thermal Treatment System for Air Bag Manufacturing Wastes	Design, Fabricate, and Install Thermal Treatment System	Delphi Matamoras, MX Timothy R. Brennaman (937) 356-2754	09/08	350	350

Delphi, in manufacturing airbag and airbag inflators, produces energetic waste materials, reject parts, and contaminated dunnage. EDE was tasked to provide a turn-key thermal treatment system. This system is required to handle all of their various waste streams and provide pollution control that meets Mexico's standards. Besides design, fabrication, and installation, EDE is required to provide on-site training and produce documents in English and Spanish.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-03 Explosive Dieletric Meltout System Hawthorne, Nevada	Turn-key Automated Facility	U.S. Army Brent Ochs/Thomas P. DeAngelis 812-854-3851/908 328-2313	01/10	3,300	3,300

EDE was tasked to provide an explosive dielectric meltout system known as DIHMES. This project is divided into two phases. DIHMES I was to design the system and demonstrate the technology at Crane, Indiana. DIHMES II was to provide a turn-key facility complete with all equipment and material handling systems so that the entire process operates remotely. The process is to recover explosive slugs from obsolete mortars which can be sold directly to the mining industry. The technology consists of a waterjet cutting system that cuts off the fuzes of various size mortars. The mortars are then placed upside down in a dielectric meltout station. When heat is applied, the explosive slug falls in to a collection container much like running hot water over a frozen orange juice can. The system includes a robot to transfer the materials to the waterjet cutting station and a dielectric meltout station. It also has specific equipment to handle the fuzes and any reject mortars. The operation is contained within a reinforced concrete bay with all operations conducted remotely and automatically. The explosive is received in a pure form compared to other technologies and is directly ready for resale.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-04 Flashing Furnace Hill Air Force Base	Refurbish flashing furnace, install, and train operators	Hill Air Force Base Dennis Weder 801-775-6921	May 2008	81	81

El Dorado Engineering (EDE) had previously provided a transportable flashing furnace to Eglin Air Force Base. The Air Force decided to transfer the furnace to Hill Air Force Base to process range scrap. EDE refurbished the flashing furnace, installed the flashing furnace at Hill Air Force Base's Test Range and trained the operators. Hill Air Force Base processed over 240,000 thousand pounds of live and potentially live items up to 20 MM TPT rounds. EDE again refurbished the furnace and shipped it back to Eglin Air Force Base. The project was very successful in that a large quantity of items were processed in a short period of time without incident.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-05 Flashing Furnace for Anniston, Alabama, and Talon, West Virginia	Design, fabrication, and installation of a transportable flashing furnace and training of operators	Crane Naval Weapons Center Phil Keith 812-854-6157	06/08	535	535

El Dorado Engineering, Inc. (EDE) had previously provided a Transportable Flashing Furnace (economy model) to Anniston Army Depot to flash explosive contaminated materials from their rocket recycling facility. EDE was contracted to provide a new larger flashing furnace for this location. EDE designed, fabricated, and installed a new larger flashing furnace capable of flashing up to 5,000 lbs. per hour of explosive contaminated materials. EDE trained the Anniston operators in the use of this equipment.

The smaller economy model was refurbished and sent to West Virginia to be used in the cleanup and restoration of the old Talon site. The furnace was used to process a wide variety of live items including fuzes, detonators, etc. EDE was also tasked to provide assistance with explosive chemistry, combustion, analyses and anticipated air emissions to be used to secure the environmental permits for the operation. EDE also designed and provided strongboxes for the operation at Talon, installed the furnace and trained the operators at Talon. EDE also provided the environmental analyses for use in permitting. This operation at Talon was very successful as the Mobile Ammunition Renovation Inspection Demilitarization (MARID) team was able to process an estimated 15,000 to 20,000 pounds of live ammunition between June and August working two 10-hour shifts per day.

A task to perform contained burn testing of MLRS motor was later added to this contract. This technology was successfully demonstrated by EDE at Arnold Air Force Base to provide complete and safety combustion of the MLRS motors and capture the effluent so it could be cleaned prior to exhaust. The project was on time and on budget.

SOW Reference Primary 3.8 Secondary 3.7

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
08-06 Defence Construction Canada Demil Facility Project Study	Demilitarization Planning Study	Defence Construction Canada. Louis Lemay 141 Laurier Avenue West, Suite 301, Ottawa, Ontario K1P 5J3 Phone: (613) 949-6925	02/2009	15	15

EDE reviewed contents of the Canadian stockpile and demilitarization project objectives and prepared a report that recommended a comprehensive demilitarization approach. All viable demil processes from simple incineration to more complex disassembly and resource recovery were considered. EDE recommended a phased approach to allow core demil capability to be acquired to perform significant workload immediately, with later phases adding other capabilities, such as disassembly, to enhance the core capability.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
09-02 Explosive Waste Incinerator Ukraine	Turn-key Explosive Waste Incinerator	NATO (NAMSA) Luxembourg **CLT LAURENT** **352 3063 5988**	12/2009	3000	3000

EDE was contracted by NAMSA to design, build, and install an Explosive Waste Incinerator (EWI) for demilitarization and destroying conventional munitions in Donetsk, Ukraine. The project included total responsibility to prepare the design, procure and fabricate all equipment, ship the equipment, install the equipment, and train the operators. The EWI is used to dispose of munitions at a very high feed rate with complete pollution control and absolute safety. EDE was awarded this contract based on a competitive bid of international companies to NAMSA. EDE effectively uses in-country personnel to assist with the program. This was regarded by NAMSA as an excellent benefit to the country of Ukraine providing employment and training for local Ukrainians on a project of this nature.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-01 Air Emissions Modeling & Program for INF Treaty Huntsville, AL & Pueblo, CO	Provide Air Emission Analysis	Missile Command Huntsville, Alabama J. Mangi, 703-534-2484	06/1989	1,300	450

As a subcontractor to Teledyne Brown Engineering, El Dorado Engineering, Inc. (EDE) was asked to provide air emission analysis for the destruction of the Pershing missile motors in accordance with the INF Treaty. This analysis consists of the application of the EDE developed PCAD model which predicts the products of atmospheric dispersion of these products. EDE was also contacted to conduct four tests at Huntsville, AL, and one test at Pueblo Army Depot to collect air emission information for environmental assessments, Part B Permits, and/or changes to interim status. The project was accomplished with a very high level priority requiring rapid mobilization of equipment and personnel and deployment of mobilized sampling teams and equipment. EDE received a rating of 98.0 for delivery and a rating of 100 for quality during contract performance.

This model was used to prepare the environmental assessment at four locations, two in Utah, one in Colorado, and one in Texas. Provided environmental testing to be used to collect data to subsequent Subpart X permits. Provided data for air assessment for Subpart X permitting for the disposal of the Pershing missile motors.

EDE also provided modeling for NEPA requirements.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
89-02 Model of Open Burning of Explosives	Developed Computer Model to Predict Products of Combustion	Naval Surface Weapons Center Silver Springs, MD G. Young, 202-394-1688	12/1989	294	294

El Dorado Engineering, Inc. (EDE) developed a computer model (Products of Combustion/Atmospheric Dispersion – PCAD) to predict products of combustion, plume rise, and atmospheric dispersion for open burning of ordnance and explosives. The model was validated by test burns and measurements and model iterations at Hercules Bacchus Works.

EDE performed emissions testing on 9 open burns and 9 static firings of rocket motors. Excellent agreement was found between the model and actual emissions tests. EDE developed a method to introduce a tracer gas in the plume to enhance validation.

This effort was used to support both the NEPA requirements and PSD permit application.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
90-02 Air Emissions Support Studies and Testing Thiokol, Utah	Air Emissions Testing	NASA/Sverdrup Stennis Space Center	12/110	45	45

El Dorado Engineering, Inc. (EDE) performed air emissions testing and modeling for the shuttle booster test firings at Thiokol in support of NASA environmental studies. This work also included a study of the tall plume resulting from burning 1.3 million pounds of propellant in two minutes. Investigated plumes that penetrated the mixing layer and the ultimate dispersion of these tall plumes.

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				Entire Project	Work For Which Firm Was/Is Responsible
91-02 Modeling of Surface Deflagrations Involving Air Bag Propellants	Model Downwind Hazards	TRW Safety Systems Mesa, Arizona	06/1991	15	15

El Dorado Engineering, Inc. (EDE) was contracted by TRW to model the downwind hazards in the unlikely event of a surface deflagration involving air bag propellants using the PCAD computer model. Modeling was performed for both nighttime and daytime scenarios to determine expected products from the incident, as well s concentration levels. Sensitive receptors in the area were identified and complete risk assessment performed. EDE served as TRW's advocate during hearings with the city of Mesa, Arizona, involving the risk assessment. Mesa and TRW accepted and agreed with the EDE risk assessment.

a. Project Name & Location	b. Nature of Firm's Responsibility	c. Project Owner's Name & Address and Project Manager's Name & Phone Number	d. Completion Date (actual or estimated)	e. Estimated Cost (in Thousands)	
				Entire Project	Work For Which Firm Was/Is Responsible
92-01 Consolidation of Phillips Laboratory Kirtland Air Force Base, NM	Risk Assessment Analysis	Kirtland Air Force Base Kirtland Air Force Base, MD	07/1992	200	70

As a subcontractor to the Earth Technology Corporation, EDE was tasked with performing the risk assessment analyses for consolidating the Phillips Laboratory operations from Edwards Air Force Base, California, to Kirtland Air Force Base, New Mexico.

EDE's responsibilities included developing possible scenarios to analyze, including routine operations (static firings of solid and liquid fueled rocket motors), as well as accidental incidents (accidents in transportation and storage, and accidents occurring during firing operations).

EDE performed air emissions dispersion modeling for these scenarios, and compared the results to the regulatory standards in the State of New Mexico. EDE further analyzed the risk to both the population and the environment resulting from both normal operations, and accidental occurrences. This risk analysis was to be used as part of an Environmental Assessment to determine if an Environmental Impact Statement would be required.

http://www.epa.gov/apti/bces/module6/dioxins/formation/formation.htm
Last updated on January 29, 2010

BCES: Module 6: Air Pollutants/Control Techniques

Module 6: Air Pollutants and Control Techniques - Dioxins and Furans - Formation Mechanisms

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Objective

1. Describe the basic formation mechanism for dioxin and furan compounds.

Lesson Material

The formation mechanisms for dioxin-furan compounds have not been fully identified. It is believed that there are at least three different types of formation mechanisms that are possible. All of these depend on the availability of chlorinated precursor compounds in the fuel and/or waste being burned and the appropriate gas temperature conditions. One of the proposed formation mechanisms for dioxin-furan compounds involves reactions on the surfaces of particles entrained in the gas stream.

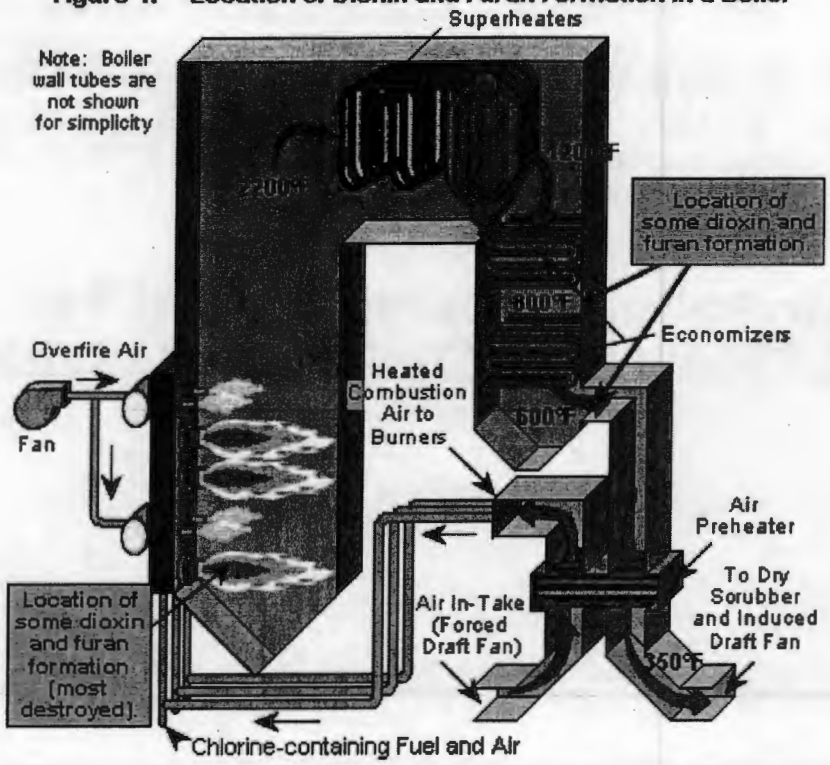
Dioxin-furan concentrations appear to increase over the temperature range from 400 to 1,000°F. However, at temperatures well above 1,000°F, dioxin-furan compounds are readily oxidized.

As Figure 1 illustrates, some dioxins and furans form and are destroyed (i.e. oxidized) in the burner flames of combustion chambers. Most of the chlorinated precursor compounds, which originated in the fuel and/or waste, volatilize and move with the gas stream through the combustion process until they reach the temperature range favorable for dioxin and furan formation (400 to 1,000°F). A small percentage of dioxins and furans can form in boilers where the economizers and heat exchange equipment are located. Since most dioxins and furans tend to form in control devices, gas streams leaving combustion processes should be cooled to temperatures below 400°F.

EXHIBIT
RH/EDE-3

-LANL EEE

Figure 1. Location of Dioxin and Furan Formation in a Boiler



Practice Problems
Dioxins and Furans - Formation Mechanisms

Instructions:

Complete the Practice Problems before proceeding to the next section. Click on the button below.

Practice Problems

Previous Section Dioxins and Furans: Characteristics

Next Section Dioxins and Furans: Control Techniques