

Fiscal Year 2004 Secretary of Defense Environmental Awards Nomination

POLLUTION PREVENTION

RADFORD ARMY AMMUNITION PLANT



Sustain the Mission. Secure the Future.



BACKGROUND

Virtually every Soldier fighting the Global War on Terror in Iraq and around the world handles, transports, fires or detonates the propellants and explosives manufactured at Radford Army Ammunition Plant. Nitrocellulose (NC), from Radford, is the primary base material used in virtually all DoD propellants. In fact, this 6,900 acre facility is North America's only military grade NC producer. Land-based weapon systems from 5.56mm for the M16 to 155mm (for artillery) and air-based platforms from attack helicopters to the Air Force A10 use Radford NC or propellants.

Because of the nature of propellant and explosive manufacturing, Radford's operations also produce large quantities of hazardous waste. Given this fact, Team Radford is working to build a successful and innovative closed loop pollution prevention (P2) and hazardous waste recycling program. Backed by the Garrison Commander and reinforced through Army civilian and ATK personnel, Radford's P2 Team diligently works to ensure the proper treatment and most effective handling processes for the elimination of millions of pounds of waste. The installation's core P2 Team, which works to fully integrate environmental quality principals into their jobs each day, includes:

- Mr. Brad Jennings, Radford Army Ammunition Plant, Army Environmental Coordinator;
- Ms. Carolyn Jake, ATK Environmental Chief; and

Soldiers	1 Garrison Commander
Civilians	26
Contractors	1,250 Alliant Ammunition and Powder Company (ATK)

- Dr. Sharon Wetzel, ATK Special Environmental Projects Coordinator.

The Radford Team also works with an extended team that supports specific tasks associated with the installation's successful NC recycling program. These team members include:

- Mr. Bill Lusk, Radford Army Ammunition Plant, Nitrocellulose Manufacturing Area Operations Supervisor;
- Mr. Barry Nichols, Radford Army Ammunition Plant, Nitrocellulose Manufacturing Area Operations Supervisor; and
- Mr. Joe Loveday, ATK Utilities Foreman.

POSITION DESCRIPTION

Radford continues to play a unique role in American history. Since the facility's inception in the closing months of 1940, propellant, explosives and munitions produced at Radford have been a mainstay in every US combat operation to the present day. The Department of Defense (DoD) depends on Radford to efficiently use its resources to provide all Services the firepower needed to be ready and effective on the battlefield. For example, Radford manufactures the NC that is used in 78



▲ Radford manufactures the propellants used by weapons platforms like the M1A1 Abrams tank and the AH-64 Apache attack helicopter to fight the Global War on Terror.



percent of DoD's conventional munitions. Radford produces enough propellants annually to arm 1,100 attack helicopters, and enough propellants monthly so that 660 tanks can train for combat.

Team Radford's role is to further support this readiness mission. The Team's goal is to help make Radford a completely self-sustaining and efficient industrial community despite an aging 1940s infrastructure, lack of resources and impending restrictions on the facility's resident operating explosive waste incinerator.



▲ *This employee is performing a final inspection of the finished 25mm rounds manufactured at Radford. Team Radford continuously works to incorporate P2 in manufacturing processes.*

As good stewards of the environment working towards this goal, Team Radford knows that strong management goes hand-in-hand with well-established programs. Dr. Sharon Wetzel leads the P2 work at Radford with government oversight from Mr. Jennings and from senior ATK Environmental Chief, Ms. Carolyn Jake. Dr. Wetzel's responsibilities involve coordinating the primary efforts of the P2 program to include all biodegradation and optimization efforts. She also coordinates with the extended P2 Team members who take on NC operations supervision, maintenance of the NC production area, utility oversight and the transportation and management of NC waste streams.

AWARDS

Since 1999, Radford has garnered four awards in P2. Recognized for its outstanding efforts in P2 and resourcefulness in innovation, Team Radford has made headway in P2 and waste reduction that virtually no other industrial installations can claim. These awards include a Governor's Environmental Excellence Award for Manufacturers, 2000; DoD Pollution Prevention Award, 1999; and Secretary of the Army Pollution Prevention Award, 1999.

ACCOMPLISHMENTS

Since November 2002, Team Radford saved the installation more than \$1.5 million in hazardous waste incineration, disposal, labor costs and energy consumption. This was achieved despite a one million pound increase in NC production from FY 2002 to FY 2003. Additionally, since 1998, Radford has attracted over \$13 million in research, development, test and evaluation (RDT&E), pilot environmental and environmental security-related pilot projects.

Modifying and Improving Processes

Team Radford continuously searches for ways to improve waste treatment operations. They recently began reusing NC Fines (the chief waste stream in NC production) and a sizeable liquid caustic hazardous waste stream generated during process cleaning. A hybrid biodegradation process conceived by Dr. Wetzel reuses these two primary waste streams in a closed loop system; the first of its kind in the nation. As a result, Team Radford has been able to drastically reduce NC Fines by 690,000 pounds to date, and eliminate 500,000 pounds of caustic material (previously considered hazardous waste) from off-site disposal, cutting costs and further protecting the community and environment.

Radford previously incinerated NC Fines at great cost to the installation while expending a large amount of natural gas and electricity¹ to treat the NC Fines waste. Using Dr. Wetzel's approach, Team Radford initiated the biodegradation process utilizing soil microbes harvested at the installation's own landfills. The microbes, having spent decades

¹ *Natural gas and electricity are used to power the installation's incinerator.*

in contact with landfilled propellant wastes, were already acclimated to degrade NC waste. The Team used one of Radford’s existing 100,000-gallon tanks to mix NC Fines with spent caustic material from the installation’s cleaning processes, and added the microbes to break down both waste streams. The slurry is then allowed to settle creating a top layer of decant, rich in chemical oxygen demand (COD). The P2 Team now transports this decant to the installation’s industrial wastewater treatment plant (Bioplant) as a food source for biological treatment microbes. This makes the Bioplant more efficient and is yet another source of cost savings, as additional Bioplant feed stock no longer needs to be purchased.

Radford established specific milestones from pilot scale research to full implementation to ensure this program was a success. These goals are outlined in Figure 2.



▲ Thermal balls are used in the Bioplant to retain heat in the winter, optimizing biological activity and digestion of waste solids.

\$10,000 versus \$400,000 to incinerate that same amount of waste.

Figure 2	
Goal	Milestone Met
Process Safety Study for bench top NC Fines degradation project	November 2001
Concept Engineering Report (CER) submittal for pilot test	October 2002
CER approval	November 2002
Remediation of all NC Fines destined for incineration	March 2004
Remediation of NC Fines in production area*	August 2004
* Marks the beginning of treatment of legacy NC waste treatment.	

The closed loop system is an innovative alternative to incineration that saves Radford valuable dollars. Radford is now reinvesting in scaling up the biodegradation process necessary to expanding NC production. The Team, using only an anaerobic microbe colony as their weapon of choice, has completely diverted NC Fines and spent caustic material from traditional disposal methods.

Additionally, the Team contracts out the use of a large vacuum truck that can move 200,000 pounds of NC Fines in two days to the mixing pit at a cost of

“The biodegradation effort is innovative, environmentally-sustainable and great in reducing the use of incineration of hazardous wastestreams. And by avoiding incineration... it enhances the air quality in Radford and surrounding communities.”

- Juan Lopez, Senior Program Manager at the Office of Federal Environmental Executive

Improving Material Management

Team Radford proactively seeks out methods to reduce the procurement of raw materials. Team members from the manufacturing area help to optimize the waste diversion process by purifying and reclaiming nearly 50 percent of some NC production waste. By reintroducing these NC Fines back into the production cycle, Radford now expends less money on the procurement of raw materials and dramatically reduces time and labor on the transport of this waste stream to transient storage sites throughout the installation.

Furthermore, NC production supervisors are now reusing nine previously out-of-service poacher tubs to remove excess water from NC waste. The poacher tubs allow for more complete de-watering of the NC Fines while still maintaining the fines in a safe-to-handle “water wet” condition. In doing so, they are

conserving valuable space in the 100,000-gallon mixing pit for more solid waste, while preventing excess water from lowering the pH and stressing the microbe colony. By optimizing use of the poacher tubs, production managers are able to move five times more NC Fines for treatment, while reducing labor costs and vacuum truck rental fees. This makes the process even more efficient, saving the installation more than \$10,000 with each load.

Team Radford continually competes for Congressional Research and Development (R&D) funds that could allow them to modify this biodegradation process to treat many other DoD waste streams.

Ensuring Compliance

Executive Order (EO) 13123, "Greening the Government Through Efficient Energy Management," 3 June 1999. Executive Order 13123 demands that installations make strides in energy conservation and energy management. Team Radford realizes that they can make a difference in the overall health of the environment through implementing changes in propellant waste handling. By removing NC Fines from incineration, Team Radford reduced the total hazardous air emissions, resulting in improved air quality around the region. Reductions in specific air emissions are as follows:

- Reduction in particulate matter 10 micrometers in size (PM₁₀) by 1,632 pounds;
- Reduction in carbon monoxide by 3,450 pounds;
- Reduction in nitrogen oxides (NO_x) by 1,235 pounds;
- Reduction in carbon dioxide (CO₂) by 2,415 pounds;
- Reduction in hazardous ash by 1,632 pounds; and
- Reduction in Toxic Release Inventory (TRI)-reportable dioxins by 0.2 grams.

Executive Order (EO) 13148, "Greening the Government Through Leadership in Environmental Management," 26 April 2000. DoD and the US Environmental Protection Agency (USEPA) developed the Environmental Planning and Community Right-to-Know Act (EPCRA) TRI to minimize the overall use of EPCRA-listed chemicals. As responsible staff on the installation, and dually concerned citizens

of the surrounding community, Team Radford integrates environmental accountability not only into their day-to-day decision-making, but also into its long-term planning processes. Radford generates 90 percent of DoD's total reportable nitrates, and EO 13148 requires a 10 percent reduction annually or an overall 40 percent reduction in TRI releases by 31 December 2006. Radford acted proactively through a Six Sigma process to identify, measure and reduce nitrate losses. By installing new filtration screens in their nitration building and throughout the production process, Team Radford successfully reduced their reportable nitrates by 16 percent in 2003, saving the installation over two million pounds of acid loss annually. This was accomplished even as propellant production increased, moving Radford closer to TRI reduction goals.

Upon receipt of Army guidance, Radford staff immediately began planning and executing an aggressive schedule towards implementation of an Environmental Management System (EMS). A primary component driving Radford's already successful P2 program is the coming implementation of its EMS. The Team understands that an installation-wide EMS will allow for flexibility in addressing different operational readiness requirements while continuing to expand their already robust P2 and waste diversion programs. Team Radford expects to have a management review completed before the 31 December 2005 deadline, and to be fully compliant with ISO 14001 and DoD EMS standards by mid-2006.

Reducing Wastes

Throughout the nation, military installations increasingly face reductions in funding and resources. Through innovative thinking, Team Radford uses their available resources to optimize production and recycling processes on a daily basis. They achieve results that enable the installation to preserve valuable installation dollars while protecting the health and safety of employees and the surrounding community. Figure 3 clearly

"Radford has distinguished itself as a leader with its clever twist on an existing, environmentally sound technology."
 -T. J. Granito, Environmental Management System/
 Pollution Prevention Program Manager, US Coast Guard

Figure 3. Waste Reductions			
Waste	Treatment Method	Date Implemented	Achievement
NC Fines	<ul style="list-style-type: none"> · 50% reclaimed · 50% biodegraded 	November 2002	<ul style="list-style-type: none"> · 100% removed from incineration · 690,000 lbs. treated · \$900,000 cost avoidance · 30 million cubic feet natural gas saved from use in incineration
Spent caustic material	Biodegraded/ beneficial reuse	November 2002	<ul style="list-style-type: none"> · 500,000 lbs. recycled to date · 100% removed from off-site disposal · \$75,000 cost avoidance
Decant liquid rich in COD (by product of mixing NC Fines and spent caustic material)	Liquid removed from the mixture and taken to Bioplant as food source for microbes	November 2002	<ul style="list-style-type: none"> · 160,000 gallons recycled · \$35,000 cost savings

presents the outstanding results Team Radford has attained throughout the achievement period.

Partnering and Educating for Success

Long-established partnerships with state and local environmental regulators are crucial to mission success at Radford Army Ammunition Plant. For example, Mr. Jennings and the rest of the Team have continued to foster this relationship by encouraging and including regulator participation during all phases of planning. They know that a positive public image for this project will help the installation to preserve its mission.

Educating Radford’s propellant and munitions manufacturing community about P2 is not only critical to creating an increased P2 awareness to ensure efficiency, but it also helps to protect its valuable workforce. The Team ensures that installation staff are fully trained in the handling of hazardous material and educated in responsible hazardous material management. Team Radford works closely with installation staff to provide training for process optimization on-the-job. Awareness training is also required through computer-based training programs. In addition, Radford provides public access to its P2 technologies and programs by presenting at technical forums around the country, including the 2004 USEPA Environmental Colloquium held in Williamsburg, Va.

CONCLUSION

Radford undoubtedly benefits from the hard work and waste management techniques this team oversees daily. The installation can now efficiently and economically treat their chief waste streams and begin to successfully eliminate the installation’s legacy NC Fines. Through this Team’s efforts and the help of every installation employee, Radford will continue to meet the increasing demands of an Army at war. The important role Radford plays in our nation’s defense is evident; and yet like its sister production facilities, its mission is almost unknown to those outside of DoD. Radford’s mission fulfillment contributes not only to the safety of the nation, but the work of this Team also helps to ensure the continued protection of the pristine wilderness areas that surround the installation. Radford continues to meet its mission requirements in a sustainable, environmentally responsible, safe and innovative manner.