Continental Research And Engineering's Bullet-n

Vol. 1, May 2002

The Story of the CR&E Logo...

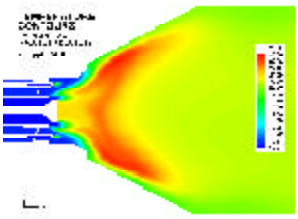
Those of you that have ever been to Colorado know how much the mountains are an integral part of the scenery in the many cities along the Front Range of Colorado. There is also the awesome magnificence of the Continental Divide. Their beauty reminds us daily of the integral part we all play in protecting the environment around us. The peaks in our corporate logo reflects our commitment to protect our natural environment of the Colorado Rockies and the World in which we live, play, and work. The road represents our determination in making our commitment successful!

Washington
Washington Demilitarization Company

JACADS Charcoal Micronization Systems

An important aspect of the closure process at JACADS is the disposal of secondary wastes. One of the most problematic of these wastes is spent charcoal. The selected disposal method is to size-reduce or "micronize" the charcoal followed by combustion in the Deactivation Furnace System (DFS). This has required modifications to the furnace burner system to enable appropriate charcoal injection. Continental Research and Engineering (CR&E) is assisting Washington Demilitarization Company (WDC) in the commissioning, troubleshooting and performance testing of the new installation. CR&E personnel reviewed the burner management system modifications and made minor changes to ensure compliance with the latest applicable NFPA standards. CR&E personnel also assisted WDC with the initial "shakedown" period operation and tuning of the burner and the DFS.

During this "shakedown" period, significant deterioration of the burner and burner tunnel refractory were observed. CR&E assisted WDC in trouble shooting the problem with a Computational Fluid Dynamics (CFD) computer model. In collaboration with ENERCON, CR&E integrated empirical data from JACADS into a CFD model. The model predicted temperatures in excess of 4,000 ^{o}F at the refractory lining. Minor modifications to the burner design were made in the model to reduce the temperature at the refractory face. These variations did not significantly reduce the temperature. It was determined that a major change would be required to the design of the combustion air swirler to reduce the refractory temperature and eliminate the deterioration. This modification would have significantly delayed the JACADS schedule; therefore an alternate solution was developed in which the charcoal feed rate was reduced from 400 lbs/hr to 250 lbs/hr. The reduction in feed rate reduced the refractory temperature (reference pictorial) to within acceptable limits. Because the limiting factor in this process is removal of the charcoal from the trays, this process modification did not affect the overall project schedule.



JACADS is processing the spent charcoal at the lower feed rate without any significant deterioration of the burner and burner tunnel refractory.

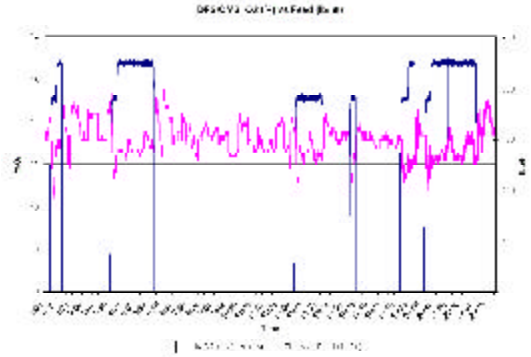
CR&E personnel also assisted WDC in performance of two demonstration trial burns on the CMS system. The latest trial burn was performed in March. Because of the potential applicability at other demil sites, EPA personnel witnessed this trial burn from several regions. To finalize this project CR&E assisted WDC in tuning the DFS system within the operating parameters set by the EPA based on the trial burn operating parameters. The most difficult operating parameter to comply with is the Afterburner O_2 limit of 11%. CR&E personnel with WDC fine-tuned the DFS system to control the O_2 above 11% at 250-lbs/hr charcoal feed rate. The limit of 11% O_2 could not be maintained during charcoal feed ramp

Continued on the next page.

6825 E. Tennessee Avenue Suite 101 Denver, CO 80224 USA Phone: (303) 758-7373 Fax: (303) 758-1072
email: cre@cre-denver.com http://www.cre-denver.com

Scientific Endeavors

up. CR&E and WDC met with the EPA and successfully determined an agreeable ramp up criteria. The chart indicates typical start-up and steady state O_2 operating conditions.



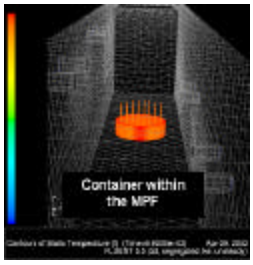
Washington
Washington Demilitarization Company

Things Cast in Concrete

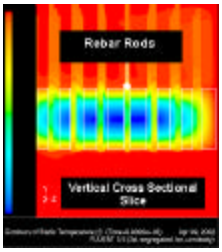
The processing of munitions at Johnston Atoll finished with VX mines, but now the daunting task of decontaminating the remaining building and equipment is underway. In the wake of years of processing thousands of munitions at the Atoll, decontaminating the concrete that resided within the processing buildings is a formidable and costly task. A machine known as a "scabbler" scraps the surface of the concrete. The material is conveyed to a drum. At last estimates, hundreds of thousands of pounds of concrete are going to be processed through the Metal Parts Furnace (MPF). Optimizing the throughput of this material through the MPF is of great interest due to its slow heat-up and required furnace time.

Continental Research and Engineering (CR&E) was recently commissioned to conduct physical testing and modeling of a proposed container design. The design utilizes inexpensive rebar rods to facilitate available furnace heat deep into the concrete container. The physical testing was completed with the cooperation of Hazen Research in Golden, Colorado. There, a smaller version of the proposed JACADS drum was filled with varying concrete configurations, instrumented with thermocouples and placed into a natural gas fired furnace. Temperatures were monitored throughout the experiment.

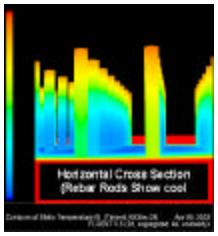
In the next step, the research team at CR&E utilized the Hazen Research data to calibrate a Computational Fluid Dynamics (CFD) model that simulated the Hazen experiments. Once the thermodynamic parameters of the concrete were determined within the model, a Metal Parts Furnace CFD model was constructed. This model allowed the CR&E team to duplicate the proposed JACADS design. With the full-scale, furnace CFD model, the required heat-up times could be studied.



The CFD model indicated where the concrete was the coolest and the effect of the rebar rods within the design. This transient heat conduction problem enables CR&E to make recommendations on design enhancements.



The CFD program allows the engineers and scientist to take "slices" through the concrete as depicted in several illustrations on this page.



With the concrete "dissected" it becomes possible to see the heat transfer trouble areas so that design enhancements can be made. Such enhancements are targeted toward decreased processing times. The model translates heat transfer information into cost savings without having processed one pound of concrete!

6825 E. Tennessee Avenue Suite 101 Denver, CO 80224 USA Phone: (303) 758-7373 Fax: (303) 758-1072
email: cre@cre-denver.com http://www.cre-denver.com

Experience & Technology

In February, Continental Research and Engineering (CR&E) completed a high profile project to assess the processing of frozen mustard HD munitions at the proposed "modified baseline" facility for the Pueblo, Colorado Chemical Depot. As mandated by Public Law, several technologies are being considered for destruction of the chemical munitions at this site. The National Research Council (NRC) Board on Army Science and Technology has been providing a technical evaluation of these technologies. In an August 2001 report, the NRC published findings and recommendations pertinent to each technology.

In response to the report on the modified baseline process, CR&E was asked by Science Applications International Corporation (SAIC) to conduct an in-depth experimental and theoretical evaluation of the process. This assessment specifically focused on understanding the phase behavior within the munitions interior through agent melting, vaporization and combustion.

CR&E designed a series of experiments utilizing simulant munitions to address the NRC topics. A series of high temperature experiments were performed at several commercial laboratories using furnaces designed to simulate the Metal Parts Furnace proposed for the Pueblo facility. This allowed a thorough three-dimensional mapping of the phase changes inside the munitions. A heat transfer model was developed to model agent behavior from freezing through thawing and vaporization. Results of this model were in excellent agreement with the experimental data. Tests and simulations were performed for 4.2 inch, 105 mm and 155 mm HD/HT munitions.

Project results were presented at several meetings with the National Research Council, Program Manager for Chemical Demilitarization, Environmental Protection Agency and State of Colorado Department of Public Health and the Environment. The specific technical issues identified in the NRC report were addressed and successfully resolved.

Black and Veatch Payne Creek Generation Station

Continental Research and Engineering (CR&E) has completed supporting the startup of the Payne Creek Generating Station in Bowling Green, Florida. CR&E's startup experience was instrumental in assisting Black and Veatch and SWPC Consortium in completing the project on time. This 2 over 1 SWPC combined cycle unit was turned over to Seminole Electric Power Company on December 31, 2001 and provides 500 megawatts of electrical power to the local area.

Washington Demilitarization Company

Umatilla Systemization

Washington Demilitarization Company (WDC) is the operator of UMCDF which is located near Hermiston, Oregon. WDC is preparing to perform surrogate trial burns as a predecessor to destroying the stockpile of chemical weapons stored at Umatilla Army Depot.

Continental Research and Engineering (CR&E) is assisting, in the commissioning, troubleshooting and systemization testing of UMCDF. WDC is utilizing CR&E's experience in chemical demil and startup to assist WDC personnel in the startup of systems at UMCDF. WDC has assigned CR&E personnel to support Liquid Incinerator startup, Laboratory Certification, Fire Detection, and Brine Reduction Area systemization.

6825 E. Tennessee Avenue Suite 101 Denver, CO 80224 USA Phone: (303) 758-7373 Fax: (303) 758-1072
email: cre@cre-denver.com http://www.cre-denver.com

CR&E Expands Technology

Non-Thermal Plasma Research

Continental Research and Engineering (CR&E) has devised a technology for mercury removal from flue gas streams utilizing a non-thermal plasma device. In collaboration with Western Research Institute (WRI), a jointly sponsored research and development program has been approved by the U.S. Department of Energy National Energy Technology Laboratory to further this technology. This project will begin in May 2002 and will include both scientific research to verify the process concepts and engineering design and analysis for development of the commercialization strategy.

In this application, the technology is being developed to remove trace metals such as mercury from flue gas streams. The device may be easily incorporated into existing off-gas ducts at demilitarization incineration facilities, is economical, easily maintained, uses common gases and chemicals for reactants. In addition, it will provide a secondary destruction method for chemical agents such as sulfur mustard, VX, GB and others.

A parallel development effort is underway to provide a solution to chemical demilitarization facilities for rapid equipment and surface decontamination. For example, at stockpile sites, large-scale facility decontamination procedures are utilized during campaign or agent change-overs. Decontamination and facility re-certification procedures can take several months, requiring numerous Decontamination Protective Ensemble (DPE) suit entries and large quantities of water based solutions for decontamination. The process is tedious, time-consuming and requires repeated spraying and scrubbing procedures. Agents HD and VX are known to be persistent, hindering successful decontamination. In addition, room air monitoring must be done repeatedly over extended periods to ensure that these persistent agents do not "re-appear" following evaporation of a covering surface layer of water.

In addition to decontamination during campaign and agent changeover, routine decontamination operations are also necessary. For example, decontamination is required during maintenance activities in the TOX cubical, buffer storage areas, munitions process bay, explosive containment rooms (ECR), and the explosive containment vestibule (ECV). If a piece of equipment is to be removed from a contaminated area, decontamination is required. If leaking munitions are being processed, immediate decontamination may also be required.

CR&E and WRI are jointly developing a non-thermal plasma device that is expected to address these difficult decontamination problems. The available data from CAMDS and JACADS has been analyzed for DPE entry time and surface scrubbing rates. For example, it is estimated that one person wearing a DPE suit can scrub 300 ft^2 of surface area during a single entry (average, 1 hour, 3.5 minute). A simple analysis for the proposed non-thermal plasma decontamination device indicates that decontamination rates substantially higher are readily achievable. The rate increases will also directly translates into fewer DPE entries, decreased use of decontamination solution, less time to process spent decontamination solution and decreased overall time for campaign change-over.

A concurrent effort is underway to develop methods to effectively decontaminate surfaces and air containing biological warfare agents such as *Anthrax bacillus*. The hazardous gas ClO_2 was used in the Hart Senate Office Building with mixed success. In addition, strains of antibiotic resistant bacterium, viruses, prions, spores and fungi pose new threats to the health care system. Current health care practices utilizing autoclaves, ethylene oxide, or other liquid chemical sterilants can be time consuming, dangerous and material dependent in their effectiveness. Non-thermal plasma systems have been shown by various research groups to destroy biological systems. However, large scale, rapid decontamination devices are not readily available. In addition, the destruction mechanisms are poorly understood, hindering scale-up and commercial deployment. CR&E has teamed with WRI and a bioengineering expert to study the mechanisms of plasma induced cellular death. This research will focus on the elucidation of the specific mechanisms, including an emphasis on the kinetics of destruction.

The Bullet-in is designed to keep CR&E's customers informed of developments, projects and of CR&E's involvement in the National effort to destroy chemical warfare munitions.
For more information on our operations, please contact our office at (303) 758-7373 or email: cre@cre-denver.com

6825 E. Tennessee Avenue Suite 101 Denver, CO 80224 USA Phone: (303) 758-7373 Fax: (303) 758-1072
email: cre@cre-denver.com http://www.cre-denver.com