El Dorado Engineering, Inc.
Applications of Contained Burn Technology

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El Dorado Engineering, Inc.
Designers - Consultants

• Over 34 yrs. Specializing in the Demilitarization Industry, HQ in Salt Lake City, UT

• Capabilities Include:
  – Design
  – Consulting
  – Fabrication
  – Installation
  – Commissioning
  – Training
  – Permitting

• Specialize in demilitarization of conventional munitions, chemical munitions, bulk propellants, explosives, and pyrotechnics (PEP), and rocket motors
  – Thermal Treatment
  – Pollution Control Systems
  – Recycling/Conversion of energetic materials and munition related waste
  – Disassembly Machines
  – Environmental consulting, permitting and restoration, related to PEP

Take pride in record of safety, project cooperation, and client satisfaction
RECENT PROJECTS INCLUDE:

- Developed and constructed small-scale semi-continuous feed contained burn facilities for disposal of commercial energetic wastes for many private commercial clients
- Design/build contained burn systems to dispose of small tactical rocket motors (<50 lbs NEW)
- Design/Build turnkey facility for contained burn of large tactical rocket motors (e.g. MLRS) for U.S. Army at Letterkenny Army Depot, Pennsylvania*
- Design/Build turnkey contained burn system for Bulk Single Base Propellant for emergency response removal action at Camp Minden, Louisiana*
- Design & install turnkey induction heating meltout system for explosives recycling from mortars*
- Turnkey Rotary Kiln Explosive Waste Incinerators Worldwide, including international facilities in: Taiwan, Germany, Albania, U.K., South Korea, Ukraine, & Belgium.
- Turnkey Flashing Furnace Systems and Contaminated Waste Processors (Ravenna AAP, Eglin AFB, Hill AFB, Anniston AD, China Lake NWS, Puerto Rico, Hawaii, Talon, WV, Letterkenny AD, Albania, Belgium, Mexico)
- Design & Construct a facility to demilitarize flares, reclaiming and recycling magnesium
- Design, Build, and Demonstrated water jet washout system for chemical munitions
- Used our understanding of combustion processes & atmospheric dispersion to consult for NASA on go/no-go launch criteria for Space Shuttle Launches, and permitting of Demil & test facilities

* Ongoing
Demilitarization Technology Considerations

- Safe
- Environmentally Responsible
- Effective
- Robust
- Simple
- Proven
- Inexpensive
- Versatile
Non-Open Burning Thermal Treatment Alternatives

- Contained Burn
- Rotary Kiln
- Static Kiln
- Tunnel Furnace
- Contained Detonation
- Car-bottom Furnace
- Transportable Furnace
- Co-firing Boilers
Contained Burn Systems

- Bulk Propellant, Explosives
- Tactical Rocket Motors
- Air Bag Propellants
- Igniters, Detonators
- PEP Contaminated Waste
Contained Burn Technology System Elements

- **Feed System:**
  - Minimize Handling
  - Batch or Semi-Continuous

- **Containment Vessel:**
  - Promote Proper Combustion
  - Contain Products

- **Ignition Source:** Reliable, Safe

- **Pollution Abatement System**
  - Meter and Scrub Exhaust
  - Prevent Fugitive Emissions

- **Controls**
Commercial Clients
Various Turnkey Systems

- Semi-Continuous Feed
- Multiple Stations
- Different Feed Types
- Continuous Exhaust
- Efficient Pollution Control
- Simple Permitting
Contained Burn
Batch Cycle Process

• Feed System Interlocked with Ignition Controls
• Ignition Source
  – Electric Match
  – Hot Wire
• Containment Vessel
• Metering Valve
• Pollution Control System
• Controls/Data Acquisition
Contained Burn Technology Scaling

10 pounds per burn cycle

50,000 pounds per burn cycle
Contained Burn
Recent Applications

Small Tactical Rocket Motors (2 Projects)
- Small Tactical Rocket Motors (<20 lbs propellant)
- Design Throughput: >40 motors per day
- Multi Stage (dual grain) double based propellant
- Dry scrubber PAS (OGT) for particulate

Ammonium Perchlorate Rocket Motor Demil (ARMD)
- Flexibility for Wide Variety of Tactical Rocket Motor Types
- 60 – 1605 lbs propellant per RM
- Design throughput: up to 3 cycles per hour
- Off Gas Treatment for HCl, particulate, and dioxin/furan
- Full-Scale demonstration performed for: MLRS (216 lbs NEW) and PHX (365 lbs NEW)
- Production Facility Under Construction, Startup Spring 2016

Camp Minden M6 Bulk Propellant
- Throughput >15 million lbs of M6 propellant in One Year
- Off Gas Treatment similar to Belgium EWI
- Emergency Response: Design/Build < 8 months
- Production Facility Under Construction, Startup 1Q 2016
ARMD

- **Large Workload**
  - 60 – 1605 lbs Propellant/Motor
  - Challenging Chemistry

- **Thorough Technology Evaluation**
  - Non Open Burning
  - Numerous Stakeholders

- **Contained Burn Selected**

- **Construction Ongoing**
  - Letterkenny, PA
  - RCRA and Air Permits Approved
  - DDESB
PROCESS DESIGN
• RM’s are placed on firing stand
• RM’s are remotely loaded into system
• Remote automated chamber sealing with ignition interlock
• RM’s are static fired intact
• Propellant burns as designed
• Gases are contained in chamber
• Gases cool and are metered through economical pollution abatement system
Camp Minden
Contained Burn System

- Intense Public Scrutiny
- Advanced Pollution Control
- Throughput (>15 million lbs/yr)
- Highly Versatile
- Expedited Schedule (Design/Build <8 months)

- Up to 880 lbs per Cycle
- Up to 3 cycles per Hour
Key Advantages of Contained Burn

• Safety
• Versatile
• Inexpensive
• Proven
• Efficient Pollution Control
• Relatively Simple Permitting