EL DORADO ENGINEERING, INC.
DESIGNERS/CONSULTANTS

EXPLOSIVE WASTE INCINERATOR

El Dorado Engineering (EDE) is a high technology firm that specializes in the handling, containment, detection, disposal, and treatment of explosives, ordnance, propellants, and explosive contaminated materials. EDE provides engineers, explosive specialists, and support staff for explosive and propellant related engineering operations. EDE is intimately familiar with both environmental and safety requirements regarding ordnance and explosive wastes.

EQUIPMENT SPECIFICATIONS

The Explosive Waste Incinerator (EWI) manufactured by EDE can handle a wide variety of bulk explosive and propellant wastes and small caliber cartridges up to and including most configured 20 mm items. Disassembled components of artillery rounds, military flares, fuzes, primers, boosters, and prepared projectiles can also be processed through the furnace. The EWI can process nitrocellulose; explosives including TNT, RDX, and HMX; propellants including single base, double base, and triple base; and composite propellants. Tables 1 and 2 list some typical feed rates for the EWI. These tables represent only a small sample of materials that can be processed.

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TABLE 1: Nominal Feed Rates for Small Arms Ammunition

Items		Nominal Total Items /hour	Nominal Total lbs/hour	Nominal Total Short tons/day
7.62 mm	Tracer	22,000	1200	6.0
	Ball	22,000	1200	6.0
0.50 cal	Tracer	6,000	1500	7.5
	API-T	6,000	1500	7.5
	Ball	6,000	1500	7.5
	Ball M42	6,000	1500	7.5
.30 cal	Tracer M1	22,000	1300	6.5
	Tracer	22,000	1300	6.5
	Ball	22,000	1300	6.5
	AP M2	22,000	1300	6.5
	Blank	22,000	700	3.5
20mm	TP	1200	675	3.5
	HE	660	375	2.0

Table 2: Nominal Bulk Explosives Feed Rates with Positive Feed System

ITEM/BULK EXPLOSIVE	KG/HOUR
Comp B	50 – 120*
TNT	50 – 120*
Black Powder	50
Octol	50 – 100*
M1 Propellant	50 – 150*
M6 Propellant	50 – 150*
Comp A3	30

* Depends upon physical configuration

PROCESS DESCRIPTION

The EWI, as shown in the General Arrangement drawing below, consists of a rotary kiln incinerator, two different feed systems, a discharge system, an afterburner, an Air Pollution Control System (APCS), and an automatic control system.

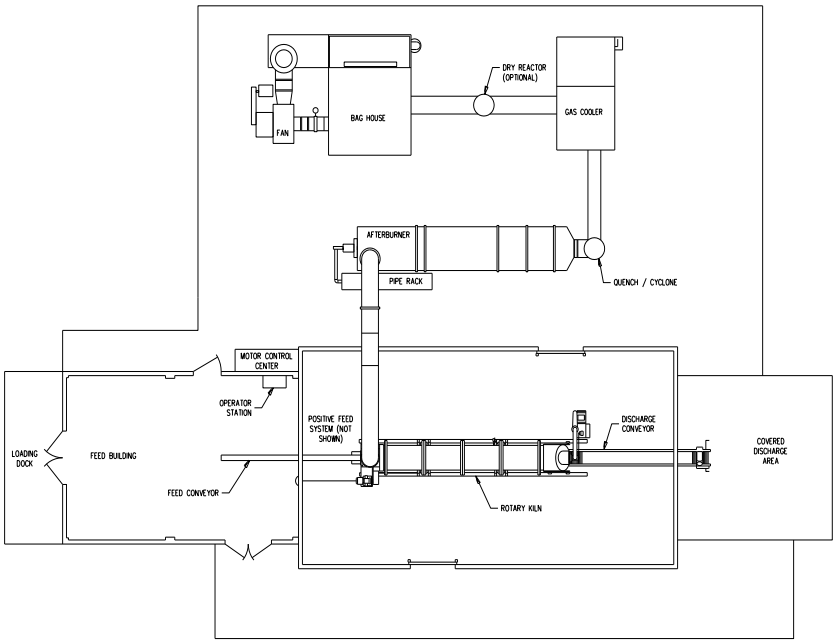

Figure 1: EWI General Arrangement

Rotary Kiln Incinerator for Explosive Materials

The main component of the EWI is a rotary kiln incinerator manufactured by EDE. This rotary kiln incinerator has a long and proven history of treating a wide variety of explosive wastes. The EDE rotary kiln, as shown in Figure 2, consists of four, thick wall, retort sections.

The retort sections each have internal spiral flights that both move the explosive wastes in an auger-like fashion through the retort and provide charge separation for the in-process materials.

The retort is equipped with an adjustable speed drive and sprocket kit, which allows the retort to rotate at different speeds based on different wastes to better control where the burning or detonations occur. The burner is located at the end of the rotary kiln making this a counter current incinerator. This design minimizes pre-mature detonations at the feed end and ensures that all wastes are processed prior to discharge. The burner is equipped with a flame detector. Upon flame failure, the flame detector will cause a flame-safeguard unit to shut off fuel flow to the burner. It also activates visible and

audible alarms at the control panel and signals the local controller of the fault.

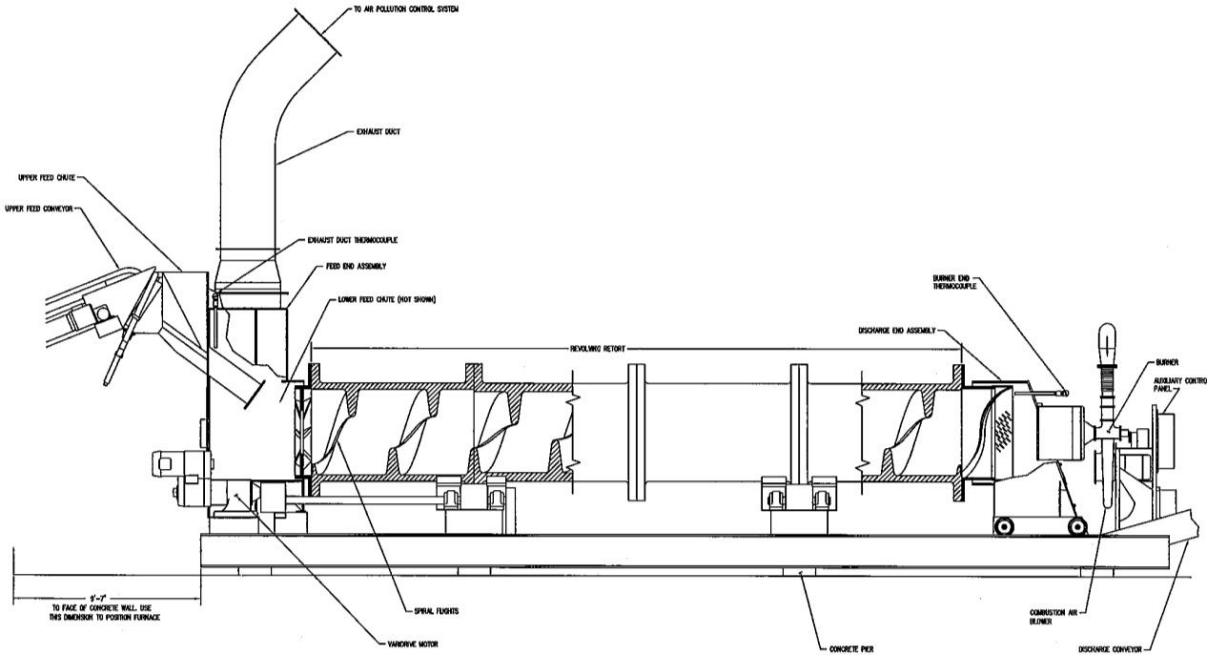

Figure 2: EDE's Rotary Kiln Incinerator for Explosive Wastes

Feed Systems

EDE has two different feed systems available. The Feed Conveyor System (FCS) is used primarily for configured items or munitions and the Positive Feed System (PFS) for bulk powders. The FCS is an 8 inch (0.2 m) wide, inclined pan conveyor, which moves items from the feed room through a barricade wall, to an elevated location above the feed chute. Items drop off the conveyor end, and slide by gravity down a feed chute and into the first section of the furnace retort. This system is a proven performer. It is rugged, safe, simple, and rarely causes downtime.

The PFS is designed to push the bulk explosives and combustible containers into the retort by using a combination of ram feeders. The explosive wastes are put in a combustible container, which can carry up to 5 lbs (2.3 Kg) of TNT. The PFS is designed to avoid explosive propagation back to the loading point by eliminating direct line of sight from the point the containers are pushed into the furnace to the point behind the concrete barricade where the combustible containers are manually placed into the mechanism. The PFS is automatically controlled by the main control system.

Discharging System

Metal components from configured items are discharged from the Rotary Kiln onto the discharge conveyor. The discharge conveyor transports this material through a hole in

the reinforced concrete barricade wall to a discharge point outside the wall. The scrap metal drops into a collection container.

Automated Lead Recovery System

The furnace is equipped with a lead screen, which allows for the continuous removal of molten lead from the discharge stream. The lead is collected onto a lead conveyor, which cools the molten lead into ingots, which are conveyed outside the barricade and automatically dumped into a collection container

Air Pollution Control System (APCS)

The APCS is designed for removal of particulate and hazardous waste constituents from the exhaust gases resulting from the incineration process. The APCS consists of an afterburner, cyclone particle separator, gas cooling system, a high efficiency fabric baghouse, and an Induced-Draft (ID) fan with exhaust stack.

The purpose of the afterburner is to raise the temperature of the exhaust gases exiting the kiln in order to ensure the complete combustion of all explosives and any generated carbon monoxide. EDE is now offering a modified Contaminated Waste Processor (CWP) for the afterburner. This modified CWP can be used as an afterburner to heat the exhaust from the Rotary Kiln or as a stand alone unit to flash large, explosive contaminated metal parts, as well as burn bulk quantities of explosive contaminated/combustible wastes and trash.

The cyclone particulate separator removes large particles and acts as a spark arrestor. The gas cooler is designed to cool the heated exhaust from the afterburner down to the operating temperature of the fabric baghouse. The gas cooling system is self-cleaning to mitigate plugging. The baghouse is a fabric-filtration collector, used for final particulate cleansing of the gas stream. The baghouse uses reverse pulsing for self-cleaning of the filters.

The Induced Draft Fan maintains a negative pressure throughout the system and controls to the setpoint draft at the kiln. The nominal exhaust stack height is 30 feet (9.1 m), with four sampling ports provided.

The APCS system can be tailored according to local environmental requirements. EDE is able to meet and exceed even the stringent EU standards for air pollution control.

Available APCS options include subsystems for NOx reduction (SNCR or SCR), acid gas removal (dry or wet scrubbing), ultra-high efficiency particulate removal (HEPA filter), and Mercury (Hg) removal, which can be added depending on local requirements and expected feed.

EDE's EXPERIENCE IN EXPLOSIVE WASTE INCINERATION

EDE is the leading firm in the world for the design of EWIs. EDE personnel have been the designers for the majority of the EWIs that have been built worldwide.

EDE's project personnel are highly experienced in the design, startup, and construction oversight of these systems with an overriding emphasis on safety for all our equipment and facility designs. EDE employs specialists in all areas of the EWI design from retorts, to feed systems, to pollution controls, to combustion, to instrumentation. EDE has provided environmental permitting and incinerator design and installation services throughout the U.S. and overseas. EDE has provided several turnkey EWI systems internationally, with a reputation for reliability, flexibility, and performance.

EDE's incineration experience includes all phases of design, fabrication, start-up and construction. EDE personnel's incineration experience spans the entire era of military explosives incineration, from the original design of the deactivation furnace in 1954, through the current state of the art EWI.

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ABOUT EL DORADO ENGINEERING, INC.

El Dorado Engineering is a 33-year old, employee-owned, small business headquartered in Salt Lake City, Utah. As designers and consultants, EDE works on projects worldwide in the specialties of demilitarization of conventional munitions, chemical munitions, and rocket motors; environmental consulting, permitting and restoration; and hazardous/explosive waste treatment and disposal.

In the past several years, EDE has:

- Designed and provided transportable flashing furnace (TFF) systems for decontaminating bomb cases, warhead parts, rocket motor bodies, range scrap, etc. and thermal treatment of small arms and initiating devices. EDE TFF systems have been deployed at Ravenna, Ohio; Anniston Missile Recycling Center, AL; Kaho'olawe HA; Vieques, Puerto Rico; Hill AFB, UT; Talon, WV; Letterkenny Army Depot, PA.
- Provided design and construction of a plant to use induction melt out technology to directly recover explosives from obsolete munitions for resale, this plant is fully automated and uses no steam or fossil fuels.
- Provided design and construction of a plant to remove and recycle magnesium from obsolete military flares.
- Provided the air modeling and risk assessment for static firing rocket motors for disposal as part of the U.S. INF Treaty.
- Installed six Contaminated Waste Processors (El Dorado Corp.) and 24 Explosive Waste Incinerators and/or pollution control systems within the U.S.
- Designed, installed and started rotary kiln Explosive Waste Incinerators in Taiwan, Germany, Albania, United Kingdom, Korea, Ukraine, and Belgium.
- Assisted the Ralph M. Parsons and Russian Federation in the design of a Chemical Munitions Demilitarization System, with a significant amount of work in Moscow.
- Used understanding of combustion processes and atmospheric dispersion to consult with NASA on go/no-go launch criteria for Space Shuttle launches, and environmental permitting of test facilities.
- Designed and built a contained burn system to dispose of tactical rocket motors.
- Designed and built a contained burn system to dispose of commercial energetic wastes.
- Designed, built and installed a system to remove melt-cast explosives from bombs and warheads using microwaves.
- Prepared RCRA and air permits across the U.S. and supported environmental restoration projects across the U.S.
- Assisted Demil International in demonstrating contained detonation systems and procedures for demil and UXO remediation.