El Dorado Comments to Dialogue Technical Subcommittee

It is important for the committee to recognize that there are two parts to most technologies:

1. Primary Treatment System
2. Pollution Control System (Effluent Treatment System)

Primary Treatment

Both the Rotary Kiln EWI and Contained Burn Technology are primary thermal treatment systems.

EDE has extensive experience with both oxidation and pyrolysis thermal treatment technologies. It is our design philosophy that for Minden complete oxidation is far superior because for both M6 and CBI materials, oxidation results in much more benign (safe) products than pyrolysis type methods which result in large quantities of vaporized products which are hazardous from a toxic and also an explosive atmosphere standpoint. M6 contains some oxygen, but not enough for complete oxidation. If M6 materials are heated in an oxygen starved environment, pyrolysis products are created as well as partially oxidized species. These compounds pose a very real risk of an extremely undesirable environmental release or a major safety incident.

Therefore, both the rotary kiln EWI and Contained Burn Technology provide sufficient oxygen so that very complete combustion occurs in the primary thermal treatment unit, with only trace species remaining for scrubbing downstream.

Pollution Controls

Both the Rotary Kiln EWI and Contained Burn systems are designed to utilize an advanced pollution control system for treatment of all off gases.

The pollution control technology we propose to implement has the same options for either thermal treatment technology, which can range from the minimum to meet applicable standards to the maximum control possible. We successfully demonstrated our most advanced pollution control system during treatment of M6 at our thermal treatment facility in Belgium, which resulted in emissions well below the most stringent EU standards. The technology employed and proven on M6 in Belgium is the best available for pollution control from thermal treatment of M6; this technology and performance is unmatched.

Rotary Kiln EWI

Additional Information:

This technology is very well proven for the safe destruction of M6 and similar materials.

However, the committee is correct that the throughput rate of a single unit is limited, so that multiple units would be required to meet throughput requirements for Camp Minden. The proposal for this technology would include the correct number of units to meet throughput requirements.

The throughput rate is not limited by the length of the kiln, i.e., a longer kiln would not provide a higher throughput rate. Because M6 burns so quickly when ignited, a longer kiln with more residence time is not needed to improve throughput. The throughput rate is actually only limited due to feed and temperature limitations of the standardized system design, which was designed for treating a wide variety of bulk propellants, explosives, and configured ammunition, including limitations on the amount of high explosive materials which can be fed at one time for safety purposes. It is viable to make a minor modification to the design to reduce these thermal constraints and increase throughput, while maintaining the well proven safety features of the design.

This technology typically falls under the hazardous waste incinerator environmental permit requirements, which are typically more costly and time consuming than RCRA subpart X. This is the same as all other thermal treatment systems which utilize a controlled secondary heat source (burner) in the primary thermal treatment system.

Contained Burn

Additional Information:

This technology is also well proven for destruction of bulk propellants safely, including nitrocellulose based propellants similar to M6. It is especially very well suited for bulk propellants which burn readily and relatively completely following simple ignition. This is true of M6 which is designed to burn very well following ignition.

A thoughtful question by the committee is regarding the ability to control the combustion process for contained burn versus control afforded by furnace or incinerator technologies.

The control of all combustion processes are a function primarily of the amount of oxygen provided (stoichiometric ratios), mixing, temperature, and time.

Pressure is also a factor for some materials, especially for energetic materials in a highly confined state (detonation). Pressure is not a factor for most thermal treatment processes being considered since the material will burn in an unconfined state at relatively low localized pressures.

M6 contains oxidizer as part of its composition, but it does not contain sufficient oxygen for complete oxidation during combustion. Additional oxygen is required, and available oxygen is a key parameter for control of the initial combustion reaction. M6 ignites readily at relatively low temperatures and quickly reaches a very high flame temperature (localized temperature in the flame zone). When sufficient oxygen is provided this results in further oxidation reactions which are exothermic, which promotes very complete combustion in the local flame zone. This is why when M6 is burned in the open air combustion is relatively complete.

After gases exit the high temperature flame zone the main parameters of interest are then temperature, time, and oxygen conditions to which these gases are exposed, which may promote further oxidation reactions.

The contained burn system is designed to supply sufficient oxygen to promote complete combustion.

The contained burn system is also designed and sized to provide additional residence time at elevated temperature of the gases inside the unit following combustion, which promotes complete oxidation.

EDE designs burners, furnaces, incinerators, and contained burn systems so we are very familiar with all aspects of how combustion processes are controlled in practice. Furnace or incinerator “temperature control” can utilize a controlled variable auxiliary heat source (e.g. burner) or a controlled variable air source (e.g. fan) to maintain a temperature setpoint at a certain measurement location in the furnace through PID loop control. This, however, does not actually provide control of the M6 “flame zone” temperature from a practical standpoint. In any thermal treatment system M6 will rapidly combust as soon as it reaches its autoignition temperature. From a practical standpoint, provision of an additional burner only provides the means of ignition and keeps the furnace sufficiently hot when M6 is not being fed into the system.

This is much different than when considering traditional incineration to oxidize materials that don’t burn nearly as easily as M6. For example if you were incinerating materials that require a substantial amount of heat input to promote combustion, such as old tires, you could achieve much more complete combustion by feeding them into a high temperature incinerator than if you simply ignite them surrounded in air because you can create better combustion conditions. However M6 does not require any additional auxiliary heat input to promote combustion after it is ignited, so a controlled auxiliary heat source is not needed. This is why contained burn technology is ideally suited and proven for treatment of propellant, while it is not well suited for thermal treatment of materials that require an external heat source such as old tires.

This technology is not theoretical it has been proven at full scale and commercial facilities have completed thermal destruction of millions of pounds of propellant using a contained burn approach. One of the key drivers of this approach in the U.S. is that permits for this technology fall under RCRA, Subpart X, which is typically a faster and lower cost permit approval pathway.

The time for implementation of this technology is 5-6 months, which is only 2-3 months longer than the mobilization time allowed under the open burn procurement.