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Mr. Dave Cobrain
Hazardous Waste Bureau
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Santa Fe, NM 87505

RE: Evaluation of Regulations for Transportation of High Explosive Waste

Mr. Cobrain:

Los Alamos National Laboratory's (LANL) published a position paper on "Hazardous Waste Decision Could Affect Important National Security Missions," written by Denny Hjeresen, Environmental Protection Division Leader at LANL, in defense of the intent to deny the permitting of the burn units at Technical Area 16 (TA-16). This letter deliverable was drafted in response to this paper and addresses whether explosive waste, and specifically high explosives (HE) or items containing HE residue generated (including RDX, HMX, TNT, and TABN) from research and/or decommissioning activities at LANL, may legally be transported per Federal regulations.

Some background information on each of these four HE compounds is provided below and was derived from the global security webpage on munitions and explosives (www.globalsecurity.org). This information is provided to understand some of the chemical properties of the explosives, including inherent stability.

RDX (cyclotrimethylenetrinitramine) in its pure, synthesized state is a white, crystalline solid. RDX is stable in storage and is considered one of the most powerful and rapidly obtains maximum pressure for effective explosion of the military HE. RDX forms the base for a number of common military explosives; the four most common are:

- Composition A: (wax-coated, granular explosive consisting of RDX and plasticizing wax), composition A5 (mixed with 1.5% stearic acid),
- Composition B: castable mixtures of RDX and TNT,
- Composition C: a plastic demolition explosive consisting of RDX, other explosives, and plasticizers, and
- Composition D,

RDX is very stable at room temperature and it burns rather than explodes and detonates only with a detonator, being unaffected even by small arms fire.

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Waste-water treatment sludges resulting from the manufacture of RDX are classified as hazardous wastes and are subject to Environmental Protection Agency (EPA) regulations. By-products of military explosives such as RDX have also been openly burned in many Army ammunition plants in the past. There are indications that in recent years as much as 80% of waste munitions and propellants have been disposed of by incineration. Wastes containing RDX have been incinerated by grinding the explosive wastes with a flying knife cutter and spraying the ground material with water to form a slurry. The types of incineration used to dispose of waste munitions containing RDX include rotary kiln incineration, fluidized bed incineration, and pyrolitic incineration. The primary disadvantage of open burning or incineration is that explosive contaminants are often released into the air, water, and soils.

HMX (cyclotetramethylene-tetranitramine), also called octogen, is a powerful and relatively insensitive nitroamine high explosive, chemically related to RDX. HMX is the highest-energy solid explosive produced on a large scale in the United States and explodes violently at high temperatures (534 degrees Fahrenheit, °F and above). HMX has a fairly low solubility in water and only a minute amount of HMX will evaporate into the air due to its low volatility; however, HMX can occur in air attached to suspended particles or dust. Studies have shown that sunlight breaks down most of the HMX in surface water into other compounds, usually in a matter of days to weeks. HMX is likely to move from soil into groundwater, particularly in sandy soils.

Trinitrotoluene (2,4,6-trinitrotoluene, TNT) is a yellow-colored solid used primarily as an explosive material and is considered to be the standard measure of strength of bombs and other explosives and is one of the most commonly used explosives for military and industrial applications. TNT is popular due to its insensitivity to shock and friction, which reduces the risk of accidental detonation. TNT melts at 80 degrees Celsius (°C) (176 °F), far below the temperature at which it will spontaneously detonate, allowing TNT to be poured as well as safely combined with other explosives. TNT neither absorbs nor dissolves in water, which allows it to be used effectively in wet environments and is stable compared to other high explosives.

TATB is a very powerful insensitive high explosive (IHE) and is slightly less powerful than RDX, but considerably more powerful than TNT. TATB is extremely insensitive to shock, vibration, fire, or impact. Because TATB is so difficult to detonate by accident, even under severe conditions, it has become preferred for applications where extreme safety is required. The Department of Energy's (DoE) most important IHE for use in modern nuclear warheads is TATB (triamino-trinitrobenzene) because its resistance to heat and physical shock is greater than that of any other known material of comparable energy.

One of the primary positions asserted in this paper is that "burning in LANL's secure, controlled, remote setting is far safer than transporting the material on public roadways to another facility. In fact, the U.S. Department of Transportation prohibits the transport of potentially unstable explosive waste on public roads. Without open burning, this "orphaned" waste would remain dangerous and have no proper disposition path." However, based upon the above descriptions, and available chemical data, the common property of these four different explosives is that they are all relatively stable or can be stabilized.

The regulations outlined in the Code of Federal Regulations (CFR) do not contain any provisions forbidding the transportation of explosive waste if the waste is stabilized properly. In fact, all of the HE components referenced above (RDX, HMX, TNT, and TATB) are allowed for transport by the Department of Transportation (DOT) if the waste is "desensitized" or "wet". Desensitization of waste means that the explosive compounds are combined with a diluting agent and/or other inert material to lower the sensitivity, energy output and flame temperature of the compositions and improve their ability to burn in a controlled manner by increasing the burn time (http://www.freepatentsonline.com/5211777.html). Therefore, some focus needs to be placed on whether the wastes generated at LANL for treatment at TA-16 can be considered stable.

In reviewing figures of TA-16, the locations of the burn units are not located in the immediate vicinity of any building producing waste streams requiring thermal treatment nor are the burn units located at buildings undergoing decommissioning where explosive waste needing treatment may be generated. Therefore, it appears that any waste previously treated at the TA-16 burn units and all proposed waste is transported from the location of generation to the TA-16 burn pans. Because of this assumption that the waste is transported within the LANL facility boundary, there is an assumption that these waste are sufficiently stable to transport to the burn units. If the wastes were unstable, the wastes would require treatment in place, as any movement or relocation of these unstable wastes could potentially result in undue risk.

It is unclear who at LANL makes the declaration of the stability of these wastes. However, if the wastes are stable enough for transport to the burn units, the wastes can most likely be considered stable. If the wastes are stable, DOT regulations do allow for transport of the waste. There are several considerations for transporting these wastes. Bulk containers are not allowed, therefore, to transport the material, the explosive waste would have to be placed into individual containers not to exceed 882 pound (lbs) for solids or 119 gallons (gal) for liquids. Additional research would be required to assess whether mixing all of these together is still considered a "stable" material.

All of the explosive components (RDX, HMX, TNT, and TATB) are classed the same under DOT regulations. RDX, HMX, and TNT are considered as a 1.1D Hazard Class, while TATB, which is actually the least sensitive, is considered Class 1.6. Based upon these regulations, the waste would be shippable as long as it was stabilized properly as a D003 EPA Hazardous Waste. Additional packaging requirements can be found in Title 49 CFR §173.62, while placarding and labeling requirements are also outlined in 49 CFR.

Attached is the DOT Hazardous Material Table showing the "Proper Shipping Name" for RDX, HMX, and TNT. The DOT table does not contain a specific entry for TATB. Based upon the limited data available, it appears that the entry highlighted in yellow would most likely be used to ship these wastes.

In addition to transportation of the compounds listed in the attached spreadsheet, DOT allows for special permits (see attached) authorizing the "transportation of certain unapproved Class 1 explosive materials that have been desensitized by wetting with water, alcohol or other suitable diluent so as to eliminate their explosive properties (removal of the desensitizing agent may restore the material's explosive properties)." The attached Adobe file contains such provisions outlined in an approved permit dated 2009. Therefore, it appears that if LANL were to generate waste containing a HE or other explosive compound other than RDX, HMX, TNT, or TATB, a special permit could be obtained allowing the transport of this waste if stabilized.

The overall conclusion of this review is that if the waste generated at LANL is truly unstable or can not be stabilized, then the position outlined in Denny Hjeresen's paper is probably accurate. However, if the waste is stable or can be stabilized, transportation of the waste under DOT guidelines is allowed.

If you or any of your staff have questions, please contact me at (801) 451-2864 or via email at paigewalton@msn.com.

Thank you,

Paige Walton

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Enclosures

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