

Improved Manufacturing Technology for Insensitive Munition Ingredients

PROBLEM / OBJECTIVE

Nitrotriazolone (NTO) is a key ingredient to produce insensitive explosive formulations for insensitive munitions (IM). But the NTO process is not fully optimized thus the high unit cost for NTO. IM has become a high priority to replace or improve legacy end items to be more insensitive to indirect / direct threats but retain or improve lethality.

The RDECOM Armaments Research, Development and Engineering Center (ARDEC) funded a Manufacturing Technology (ManTech) project to optimize the manufacturing process for NTO to increase yield without affecting quality.

ACCOMPLISHMENTS / PAYOFF

Process Improvement: The development toward NTO process optimization occurred in two phases: Analytical Analysis & Process Implementation.

During the analytical analysis, a design of experiments (DOE) was conducted to understand the thermodynamics of NTO recrystallization that would increase process NTO yield without affecting NTO specifications. Process improvement factors included:

- Final re-crystallization temperature
- Cooling Rate
- Initial NTO Concentration
- Agitation
- Hold Temperature

As a result, the DOE demonstrated an increase up to 10% NTO yield from current NTO production by lowering the recrystallization temp with actively controlling the cooling rate. Also verified NTO specifications were met. The NTO crystal structure & morphology remained the same.

In the implementation phase, the results of the analytical analysis fed into the NTO optimization design which determined equipment sizing and controls integration. Once the design was completed, facility was scheduled to shut down to conduct process improvements.

Implementation and Technology Transfer: The manufacturing technology was transitioned to PM Combat Ammunition Systems (CAS) in FY13 and

implemented at Holston Army Ammunition Plant in FY14.



Holston AAP – G10 Agile Manufacturing Facility



155MM M795 HE IM (IMX-101)



120, 81, 60MM HE Mortar Family (IMX-104)

NTO is an essential ingredient for IMX formulations. IMX-101 is qualified and fielded in 155mm M795 Artillery and IMX-104 is qualified in the 120, 81 & 60mm Mortar Family

Expected Benefits and Warfighter Impact:

As a result of ManTech investments that improve NTO production, weapon and munitions systems are safer for the U. S. Warfighter while simultaneously maintaining or improving performance.

The result of this ManTech effort led to an increase in NTO yield up to 10%. The production costs of NTO started at \$15/lb to \$13.5lb. Resulting in a cost avoidance of \$3.2M (Based upon manufacturing 3M pounds of IMX-101). The Army will begin production of NTO using this optimized process in 4QFY14

TIME LINE / MILESTONE

Start Date	April 2010
End Date	March 2013

FUNDING

U.S. Army ManTech	\$1.8M
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PARTICIPANTS

U.S. Army RDECOM Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ
BAE/Holston Army Ammunition Plant, TN