APA Winter Education Conference: PHMSA Regulatory/R&D Update

Candace Casey, Andrea Dunham, Bob Starin, Ian Weissgerber
Pipeline and Hazardous Materials Safety Administration (PHMSA)
Office of Hazardous Materials Safety (OHMS)

February 2023

Standards and Rulemaking Division

Purpose: To provide a brief overview of work performed in the Standards and Rulemaking Division

- Rulemakings
- Letters of Interpretations
- Special Permits
- Petitions
- Policy Papers, RFI's, Safety Advisory Notices

Rulemaking Priorities for 2023 (Con't)

OHMS Rulemakings – 10,000 Foot View

Rule	Description	Rulemaking Status
HM-224I	Revised Lithium Battery Regulations (Final Rule)	COMPLETED (Pub. 12/2022)
HM-260B	Editorial Corrections (Final Rule)	COMPLETED (Pub. 12/2022)
HM-241	ASME Code Section XII (Final Rule)	In Progress
HM-250A	Compatibility with IAEA Regulations (Final Rule)	In Progress
HM-264A	LNG Suspension (Final Rule)	In Progress
HM-208J	Adjust Registration and Fee Program (NPRM)	In Progress
HM-215Q	International Harmonization (NPRM)	In Progress
HM-219D	Reduce Burden & Adopt Petitions (NPRM)	In Progress
HM-219E	Reduce Burden & Adopt Petitions (NPRM)	In Progress
HM-233G	Continued Special Permit Conversion (NPRM)	In Progress
HM-257A	Streamline Energetic Approvals (NPRM)	In Progress
HM-263	Real-Time Train Consist Info (NPRM)	In Progress
HM-264B	Improving the Safety of LNG (NPRM)	In Progress
HM-265	Modal Safety Advancements (NPRM)	In Progress
HM-265A	Reg Reform Initiatives (ANPRM)	In Progress

Rulemaking Priorities for 2023

- HM-257A NPRM to streamline the requirements for the approval of certain energetic materials
- HM-208J NPRM to adjust PHMSA's statutorily mandated registration and fee assessment program (BIL)
- HM-215Q to ensure that, to the extent practicable, the HMR are consistent with standards adopted by international authorities

NPRM expected to publish in Summer 2023

ANPRM published 9/22/2022; Comment period closed 12/21/2022. 7 sets of comments; drafting NPRM

NPRM expected to publish in Spring 2023

Upcoming Rulemaking – HM-257A

- Notice of Proposed Rulemaking
  - HM-257A: Streamlining the Requirements for the Approval of Certain Energetic Materials
  - PHMSA is considering:
    - How to streamline the approval and classification process for energetic materials in future rulemakings
    - PHMSA will solicit comments on any future changes or rulemakings
  - Expected Publication – Summer 2023

Petitions for Rulemakings – Progress

- As of February 2023, PHMSA has 56 "Open" Petitions:
  - 49 have been **accepted** and slotted into open ANPRMs / NPRMs; scheduled to publish in 2023.
  - 7 are currently under PHMSA review.

Policy Papers, RFI's, Safety Advisory Notices

Recently Published or Posted

- FAQs on "Applicability of the HMR"
- Safety Device Classification Policy (10/13/2022; FR Notice)
- Compliance Procedures and Proposed Termination of Certain JPG Approvals (8/12/2022; FR Notice)
- RFI on E-Hazard Communication Alternatives (7/11/2022; C/P Closed 10/24/2022; FR Notice)

Soon to be Published or Posted

- RFI on PHMSA's Recycled Plastics Policy – TBD
- Safety Advisory Notice: Transportation of EV's Containing Lithium Batteries Damaged by Extreme Weather Events – TBD




Thank You!

TC RDIMS #: 18992834 / TC SFDDI #: 19001769

Fine Grain Metal Powder Standards for Consumer Fireworks

Andrea Dunham
Sciences Branch, PHMSA

Overview

- Funded by the US Department of Transportation, Pipeline and Hazardous Materials Administration (PHMSA)
- Research executed by A-P-T Research, Inc. (APT)
  - Testing performed at Oklahoma State University's (OSU) Center for Health Sciences, Explosives Research and Testing Range, Pawnee, Oklahoma
  - Custom Firework devices supplied by Pyrotechnique by Grucci, Inc.

Why Investigate Metal Powders?

- Fine grain metal powders (FGMP)
  - Particles size >53 to ≤ 149 microns
  - Aluminum (Al), Magnalium (Mg/Al), Titanium (Ti)
- FGMP benefits
  - Produces a sharp, clear audible effect
  - Produces a desired visual effect
- FGMP concerns
  - Are more energetic than black powder formulations
  - May increase the hazard of firework devices

Metal Powders in APA 87-A Standard

- Burst Charge in APA Standard 87-1A
  - used to break open a fireworks device after it has been propelled into the air, producing a secondary effect such as a shower of stars

Permitted and Restricted Chemicals for Consumer Fireworks and Novelties (APA 87-1A)

Chemical	Formula	Typical Use	Restrictions
Alloprene (Chlorinated Rubber)	Not Required	Color Intensifier	
Aluminum > 149 microns	Al	Fuel	Not to exceed 10 percent by weight in a burst charge formulation or a propellant formulation
Aluminum > 53 to ≤ 149 microns	Al	Fuel	Not permitted in burst charge
Aluminum ≤ 53 microns	Al	Fuel	Permitted only in reports
Ammonium Dichromate	$(NH_4)_2Cr_2O_7$	Oxygen Donor / Colored Ash	1) Not to exceed 5 percent of formulation; 2) Prohibited if mixed with a chlorate.
Ammonium Perchlorate	NH_4ClO_4	Oxygen Donor	1) Prohibited if mixed with a chlorate; 2) In sparkler or dipped stick the total composition is limited to 5 grams

Research Objectives

- To provide data to assist users and PHMSA in the hazard classification of consumer fireworks containing FGMP in burst charges
- To inform future APA Standard and regulatory changes

Testing

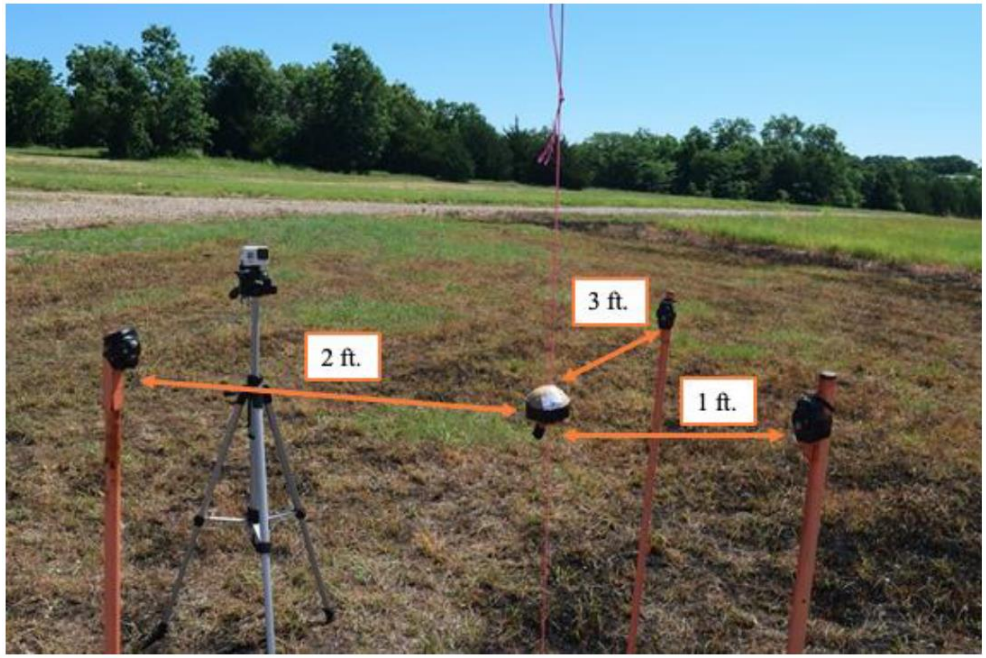
- 17 commercially available reloadable shells from 4 different manufacturers
- Custom made reloadable shells - Pyrotechnique by Grucci, Inc.
  - same consumer pyrotechnic article configurations
  - burst charges containing varying percentages and mesh sizes of fine grain metal powders
  - 12%, 9%, 6%, and 3% of FGMP in the burst charges.
  - A total of 200 custom shells were manufactured

Testing

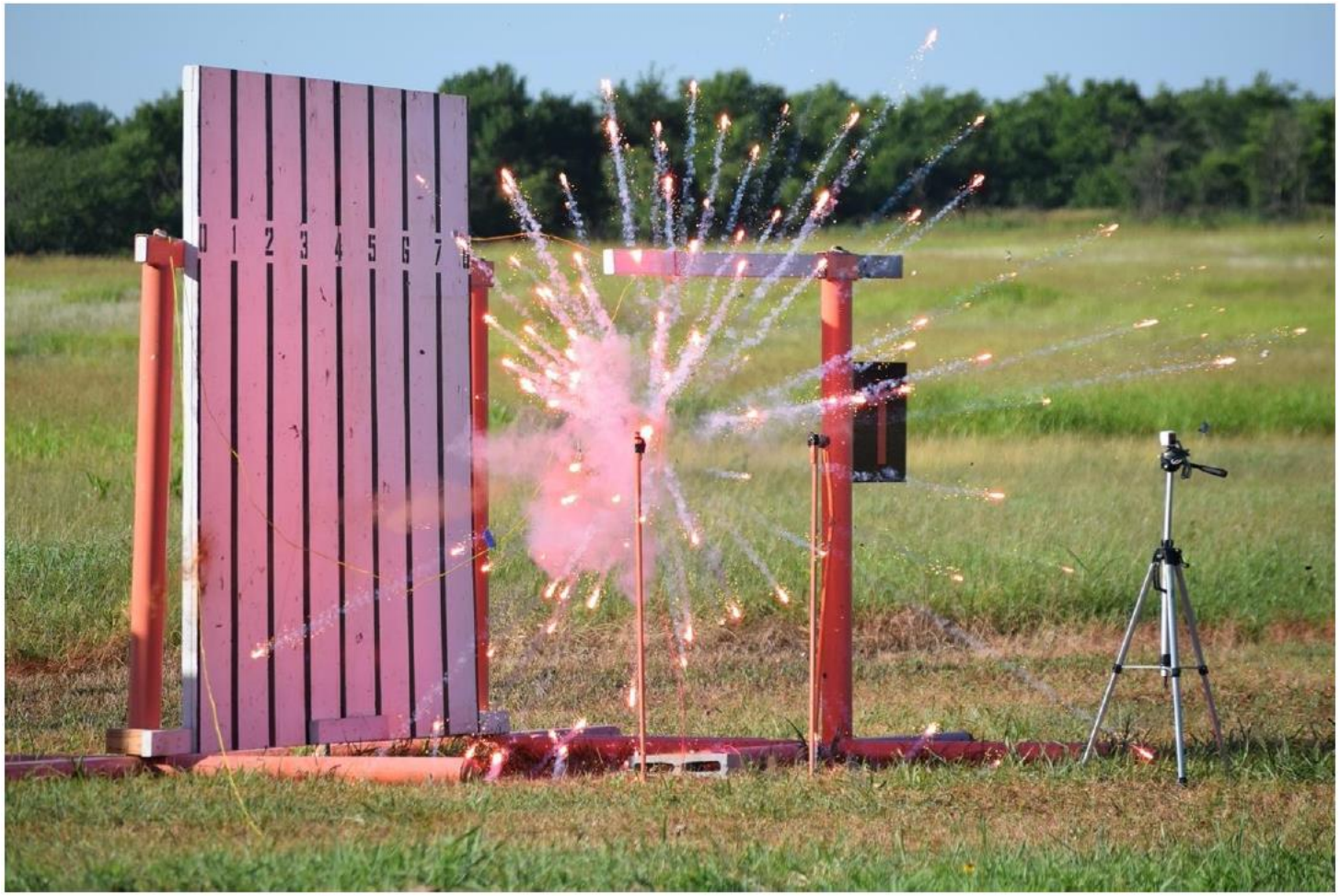
- Blast effect pressure
- Sensitivity
- Impact

Blast Effect

- Measures the blast overpressure with air blast gauges
- Articles and gauges were 4 feet from the ground



Blast Effect

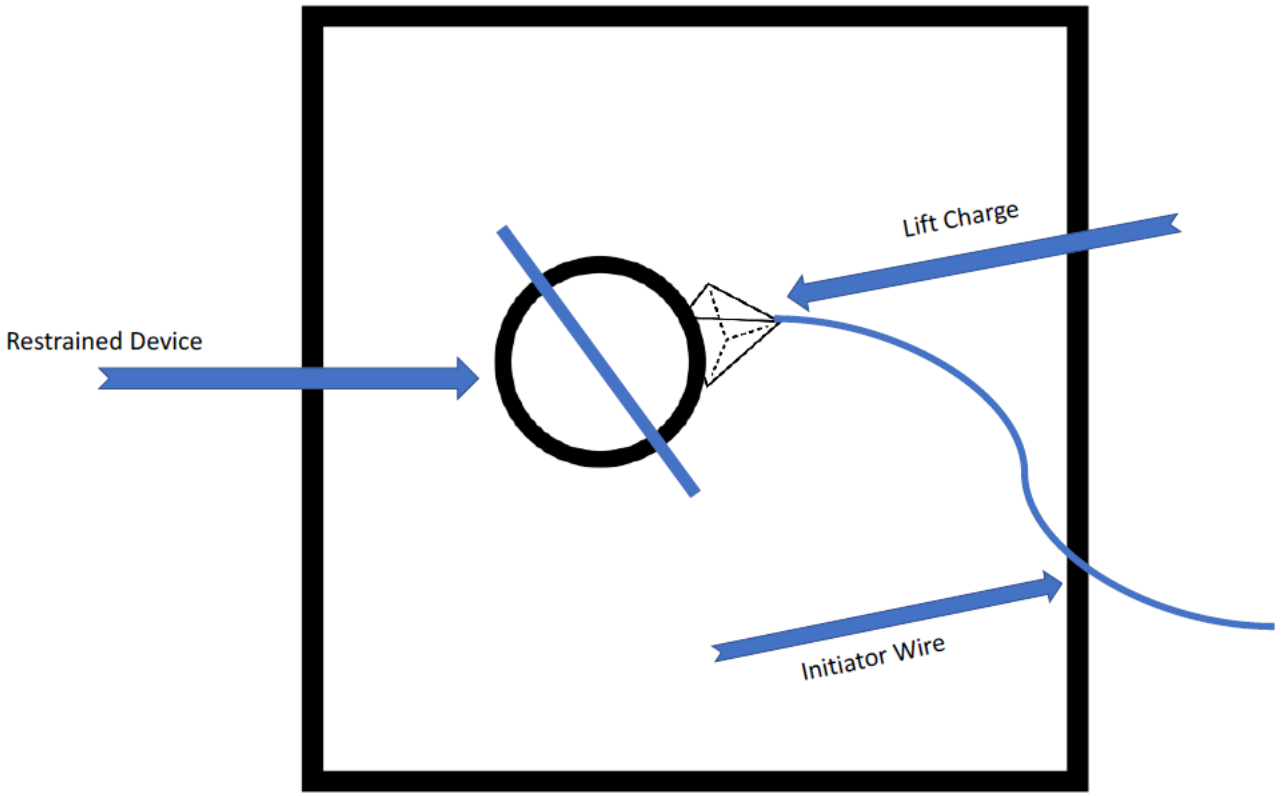


Blast Effect

- Cylindrical shells overwhelmed pressure gauges
- Only spherical shells containing FGMP were tested
- Commercial shells produced higher pressures than FGMP shells
- Shells containing higher percentages of FGMP produced higher pressures than shells containing less FGMP

Sensitivity

- Assesses the sensitivity of a burst charge when a lift charge has been initiated next to the burst charge

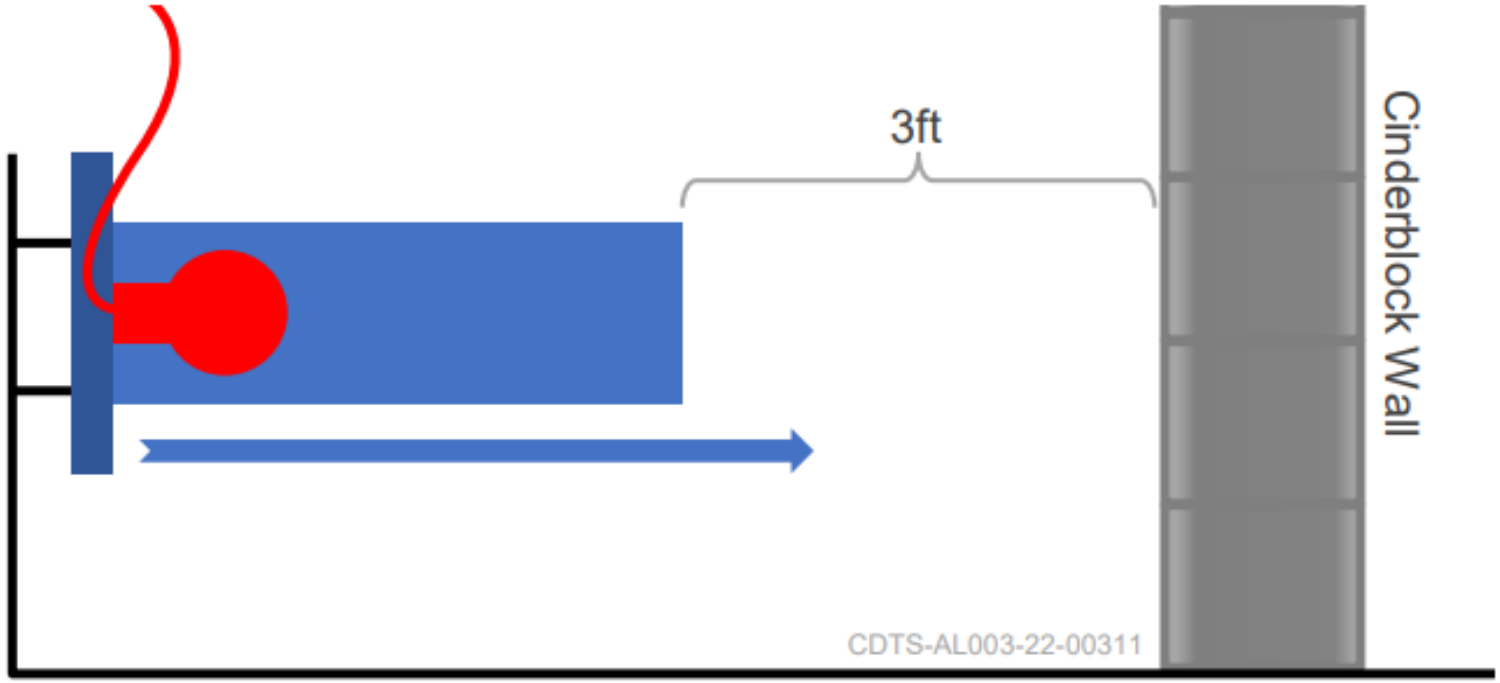


Sensitivity

- Setup
  - lift charges removed and burst charge fuses covered
  - shells were restrained and the lift charge was placed in direct contact with the side of the shell
  - Lift charge was ignited results were observed
- Results
  - No shells ignited due to lift charge ignition
  - 4.8 % of commercial shells and 48.8% of custom shells had delayed ignition

Impact Testing

- Measures the susceptibility of the burst charge to initiation via impact



Impact Testing

- 10 commercial shells ignited, 4 did not
- No FGMP shells ignited

Results and Conclusions

- Comparison of commercial devices to custom devices
- No increase in sensitivity, impact, or blast pressure with FGMP
- Direct comparison to commercial products not possible – proprietary formulations
- Devices were tested, but burst charge formulations were not studied on their own

Next Steps

- Determine if other factors impact safety when including FGMP in burst charges
  - different chemical compositions of burst charges
  - overall net explosive weight of the device
  - different shell constructions
- Test commercial products with known formulations
- Perform UN classification tests
- High-speed cameras in performance tests
- Test higher percentages of FGMPs

Report

- Final report on PHMSA's website:

https://www.phmsa.dot.gov/research-and-development/hazmat/reports/fine-grain-metal-powder-final-report

Questions?

Thank you!

Contact:
Andrea Dunham
US DOT/PHMSA
Sciences Branch
Andrea.dunham@dot.gov

Pipeline and Hazardous Materials Safety Administration

Office of Hazardous Materials Safety

Research, Development and Technology

February 23, 2023

Introduction

- The RD&T program seeks to:
- Identify methods to incorporate automation into the safe transportation of hazardous materials.
- Research innovative technologies such as sensors, leak detectors, and monitoring tools.
- Seek out innovation and emerging technology from small businesses and industries.
- Provide useful and available research results.

FY2023 Program Highlight

De Minimis Quantities of Explosives

- Establish a technical basis for De Minimis Quantity exceptions for explosives-related hazard classes (Classes 1, 3, 4, 5 and 9, PG I - PG II), and reconcile 49 CFR §173.4 Small quantities for highway and rail, 49 CFR §173.4a Excepted quantities, and 49 CFR §173.4b De minimis exceptions.

Developed From: Broad Agency Announcement

OHMS RD+T Focus Area: Risk Management and Mitigation

DOT Strategic Goals Supported: Safety & Transformation

Estimated Completion: September 2025

OHMS
RESEARCH, DEVELOPMENT, & TECHNOLOGY FORUM

- Lithium-Ion Batteries
- Distributed Carbon Nanomaterial Sensing Networks
- Leak Detectors for Autonomous Vehicle
- Battery Logistics Integrated Safety System

Prior: 12-1-2022
Next: Fall 2023

For more information, please email the OHMS RD&T team.

HazMatResearch@dot.gov

U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

SEND YOUR RESEARCH IDEAS, PROBLEM STATEMENTS, AND WHITEPAPERS TO

HazMatResearch@dot.gov

THINK OF THE POSSIBILITIES FOR RESEARCH QUESTIONS!

All without the base, no trouble?
(as performed by Meghan Trainor)

Nitrocellulose Fountains of Use?
(as performed by Lady Gaga)

* Pop-song parody not required when actually sending your research question

Contact Information

- **Robert Starin**

Risk, Data, and Analysis; Chief

Email: Robert.starin@dot.gov