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FRA's Presentation of Radioactive Rail Car fire in Bedford Park, IL.

How did FRA Find Out?

Most of our transportation leaks or nonaccidental releases, or NARs are discovered in transportation by inspectors, railroad officials, other modal regulators, or through government reporting.

In this case, On June 4, 2020 FRA was forwarded a National Response Center (NRC) Report

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Initial National Response Center (the other NRC!) Report on the incident

NRC#1278842.msg

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The Actual NRC Description of the Incident.

CALLER IS REPORTING A RELEASE OF AN UNKNOWN AMOUNT OF RADIATION INTO THE ATMOSPHERE FROM AN UNKNOWN AMOUNT OF RADIATIVE RODS ON A RAIL CAR THAT CAUGHT FIRE INSIDE THE SRP RAIL YARD. THE FIRE IS ASSUMED TO BE STARTED BY FRICTION OF THE MATERIAL. THE FIRE HAS BEEN PUT OUT AT THIS TIME, AND IS BEING MONITORED INCASE OF REIGNITION

FRA's Immediate Response

- FRA made telephone contact to the Belt Railway Company(BRC) official, a railroad policeman, who submitted the details of the report for additional on-site details.
- He directed us to on-site response from the Bedford Park Fire & Hazmat Team and the BRC's on site emergency contractor

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Initial Response Questions from Emergency Responders

FRA received several questions from on-site responders regarding the appropriate methods to put the fire out.

Based on information they received from the railroad and the shipper, the responders were using water to put out the fire

Unfortunately, it was only temporary, and the fire reignited after a few hours and climbed back up to as much as 700-degrees Fahrenheit.

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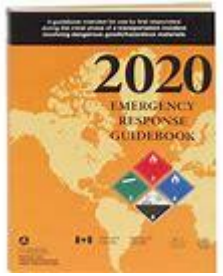

Shipping documents were unclear on the response

Based upon shipping papers provided in the early stages of the response, no one was aware of any obvious flammable materials, so they handled the response based upon the description of the material provided by the railroad and the shipper under ERG # 162, which is the guidance for a Radioactive Material, Low-Specific Activity (LSA). The response advises heavy water as a fire suppressor.

Early conversations with the shipper did not reveal anything of any relevance as to the source of the fire inside the car.

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Puzzling Reactions with the Gondola Railcar's Contents

This cooling and reheating reportedly occurred several times. Something inside the car was still retaining heat and reigniting materials inside the car

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Shipper's Specialized Response Contractor

A response contractor hired by the shipper came in and accessed the situation and made the initial attempt to smother the fire by injected liquid nitrogen into the car to try and displace oxygen and cool the fire.

When that attempt didn't work, the decision to use sand to smother the fire coming from within the car and to reduce the heat. After several truckloads of sand, the cars temperature began to reduce to ambient temperature and stabilize.

Transloading

- The original destination of the material in this car rejected the load after this incident.
- At that point discussions on transloading the material into other packages for removal had begun.
- It was decided that the contents was to be transferred into 20ft roll-off containers for highway transportation.

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Shipping Papers- How did the shipper described the contents of this car?

The specific contents of this car HKRX 50074 was described on the railroad waybill as containing;

UN 2912, Radioactive Materials, Low Specific Activity (LSA-1), 7 Radionuclides; CO-60, CS-134, CS, 137, U-234, Solid Oxide, Fissile Excepted, Exclusive Use.

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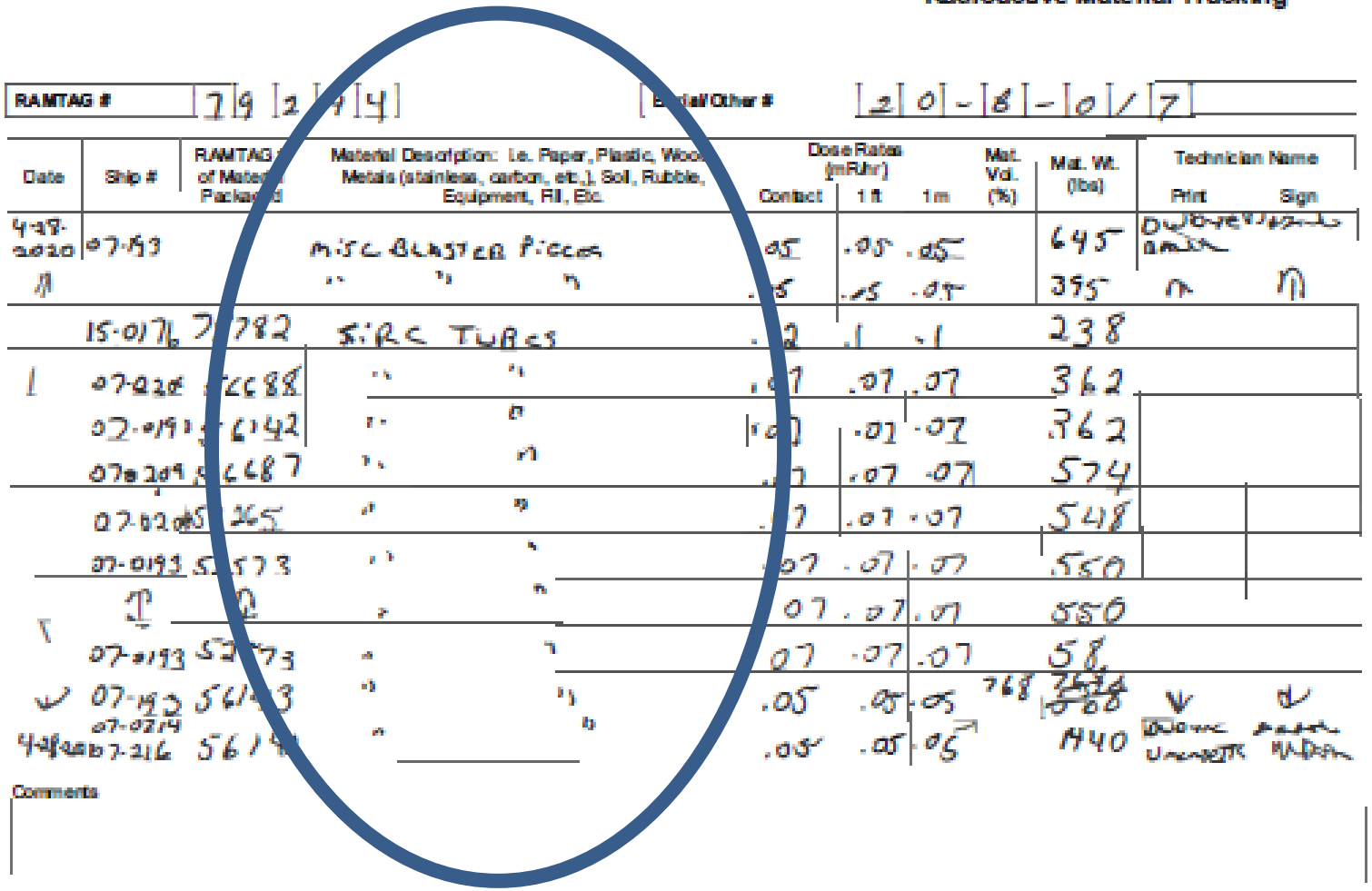
Focused on Non-Hazmat Material in Car

The Nuclear Regulatory Commission 540/541 Low Level Waste Form also described the hazardous contents in the car the car the same, but we had the undeclared, or nonhazardous contents listed;

That included about 20 additional pages listing other nonregulated items by DOT but included in the Waste Disposal sheets attached in the document submitted.

The nonhazardous contents provided by the shipper included a large quantity of Zirc Tubes.



Radioactive Material Tracking

RAMTAG # 79244 Serial/Other # 20-8-017

Date	Ship #	RAMTAG # of Material Packaged	Material Description: i.e. Paper, Plastic, Wood, Metals (stainless, carbon, etc.), Soil, Rubble, Equipment, Fill, Etc.	Dose Rates (mR/hr) Contact	1 ft	1 m	Mat. Vol. (%)	Mat. Wt. (lbs)	Technician Name Print	Sign
4-28-2020	07-193		MISC BLASTER PIECES	.05	.05	.05		645	[illegible]	
			" " "	.05	.05	.05		395		
	15-0176	7[illegible]782	ZIRC TUBES	.02	.1	.1		238		
	07-020[illegible]	[illegible]6688	" "	.07	.07	.07		362		
	07-0191	[illegible]6142	" "	.07	.07	.07		362		
	07-0209	[illegible]6687	" "	.07	.07	.07		574		
	07-020[illegible]	[illegible]265	" "	.07	.07	.07		548		
	07-0193	5[illegible]573	" "	.07	.07	.07		550		
			" "	.07	.07	.07		550		
	07-0193	52[illegible]73	" "	.07	.07	.07		58[illegible]		
	07-193	561[illegible]3	" "	.05	.05	.05	768	[illegible]		
4-28-2020	07-0214 07-216	561[illegible]	" "	.05	.05	.05		1440	[illegible]	[illegible]

Comments

Clarifying the Shipping Paper Entry

- After a few days into the response, FRA had some questions on the Zirc tubes entry and needed more details.

- We had a telephone conversation with the shipper who insisted that the Zirc tubes entry was in fact, Zircalloy and not Zirconium. They were very adamant that the rods were not Zirconium, especially not Zirconium Scrap and it no way hazardous, but they did convey that some of the rods were unused. We had several reasons to ask about Zirc Scrap.

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Hazardous Materials Table in 49 CFR 172.101

Zirconium scrap	4.2	UN1932	III	4.2	B135, IB8, IP21, N34, T1, TP33, W31	None	213	240	Forbidden	Forbidden	D	13, 148

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Hazardous Class 4.2 Spontaneously Combustible

Spontaneously Combustible-Spontaneous combustion or spontaneous ignition, as it is often called, is the **occurrence of fire without the application of an external heat source**.

Due to chemical, biological, or physical processes, combustible materials self-heat to a temperature high enough for ignition to occur.

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FRA Observations during the Transloading Operations

During the transloading, FRA reported and photographed large metal machinery parts, including metal shop tables, drill presses and other objects as they were removed from the car. Large pieces of wood and the remains of other combustible debris were also removed along with the Zirc Rods.

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Additional FRA Observations during the Transloading Operations

The Zirc Rods were dispersed throughout the gondola in no certain arrangement and were observed and photographed of various lengths. Some of the Zirc Rods were banded tighter and other looked to be used, flattened raggedly cut and ready for disposal. Because of the various degrees of the conditions of these rods, the "Zirc Rod," entry on the shipping paper became a bigger, more intriguing question.

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Federal and State Agency Assistance in this Investigation

Thanks to our friends at the Nuclear Regulatory Commission, The Pipeline & Hazardous Safety Administration, Illinois Commerce Commission, and the IEMA Division of Nuclear Safety for their assistance in this investigation.

Photo Identifying the Other Materials, Metal Machine Parts, in the car. Also see the Fire Suppression Hoses.

Photos from the Response/Transload

Shipper Interview

- On Sept 2, 2020, at approximately 10:00 am, FRA met with the shipper face-to-face, at their home office in Wampum PA. Our intent of the meeting was to compare our findings as to the cause of the fire in the gondola car at the BRC in Bedford Park (Chicago), IL.

- FRA were there to specifically discuss the contents of the car as presented on the 540/541 shipping documents and ask specific detailed questions as to the non-hazardous contents within the car to help determine the cause of the fire by reviewing both the hazardous and nonhazardous materials inside the car.

Shipper Responses to our Interview

Based on the **reactions from the car's contents**, we, FRA pressed the shipper in person about clarifying the Zirc Rod entry.

The shipper continued to state that the rods inside the car were not Zirconium but Zircalloy Rods and not hazardous. They further stated that the rods had been cleaned of all shaving and loose debris. The shipper did admit that some of the rods had been cut and smashed in an earlier process for disposal, but no records were offered.

Shipper Responses to our Interview- OK, Prove IT!

- At that point FRA asked for any specific documents, shipping papers, invoices and any documents to indicate how the shipper classified the Zirc Rods listed as Zircalloy and not Zirc Scrap.

- The shipper indicated that they had no documents to identify the rods as Zircalloy rods and used nothing to classify the material as Zircalloy.

Regulatory Responsibility to classify the Materials

Under the regulations, specifically, 49 CFR 173.22- (a) Except as otherwise provided in this part, a person may offer a hazardous material for transportation in a packaging or container required by this part only in accordance with the following:
(1) The person shall class and describe the hazardous material in accordance with parts 172 and 173 of this subchapter,

NRC Import License dated 2010

FRA shared an NRC document dated August 31, 2010, with the shipper at this meeting. The document was an import license to move metals and other radiological materials from Mississauga Metals and Alloys (MM&A) in Canada to Energy Solutions in Clive, UT for final disposal with a mid-point stop at the shipper's location in Wampum, PA. Several entries in the document included various metals including Zirconium and Zirconium Scrap. The shipper claimed they had never seen the document.

Explaining the NRC Import License Document

- The materials were radiological waste and other metals and materials from US sites to Canada. The company Mississauga Metals in Canada had a fire in 2009 and was forced by the Canadian government to remove the materials from their site.
- This import application document, the NRC Form 7, docket #11005875 the " Application for NRC Export/Import License, Amendment, or Renewal", dated August 31, 2010, details by site specific waste code and material list where the materials originated from in the US by Waste Code and an inventory list by description and total weight coming from each location back to the US.

Shipper Responsibility to Classify the Materials in a DOT Shipment

Since the shipper was so adamant that the Zirc Rods were nonhazardous, we did ask the shipper to search their archives to on any paperwork, Safety Data Sheets (SDS), shipping papers or other documentable testing or justification for their Zircalloy classification on this shipping paper.

The shipper did state the they have an off site storage facility and would look for any documentation that would relate to the 2010 shipment date of the MM&A import license document that we presented to them.

20 days later- the shipper found a bill of lading for a truck delivery dated 2010 from MM&A to their facility- The load was Zirconium Scrap and other metals.

NRC Document Research

- FRA discovered an additional document, specifically a letter, dated November 15, 2010, from the NRC addressed to the State of Pennsylvania. The letter was written specifically to ask Pennsylvania to grant an application for an import license to Oregon Specialty Metals (IWO28) to allow materials from Canada to come into Pennsylvania, specifically Oregon Metals in Wampum, PA (***same physical address for shipper*)** for waste processing before being sent to Energy Solutions in Clive, UT.

NRC Historical Documents

A separate and third document dated January 13, 2011, was obtained from the NRC by FRA on December 19, 2020. This document was a written response from Oregon Specialty Metals that described the relationship between Oregon Specialty Metals and the shipper.

Who was Oregon Specialist Metals?

Oregon Specialty Metals is the business unit of MM&A and was created because the NRC regulations required a US registered entity for processing waste.

The document further describes that all processes will occur under the shippers Pennsylvania License with the NRC and that all the wasted processes for the incoming materials will occur on the shipper's property. These processes included cutting, splitting and smashing the remaining Zirconium Scrap rods.

The relationship between Oregon Metals and the Shipper

- This document clarifies that the shipper had access to all records of incoming materials, the processes conducted and the final analysis of those materials before shipments to Energy Solutions in Clive, UT.

Remembering the cut Zirconium Rods

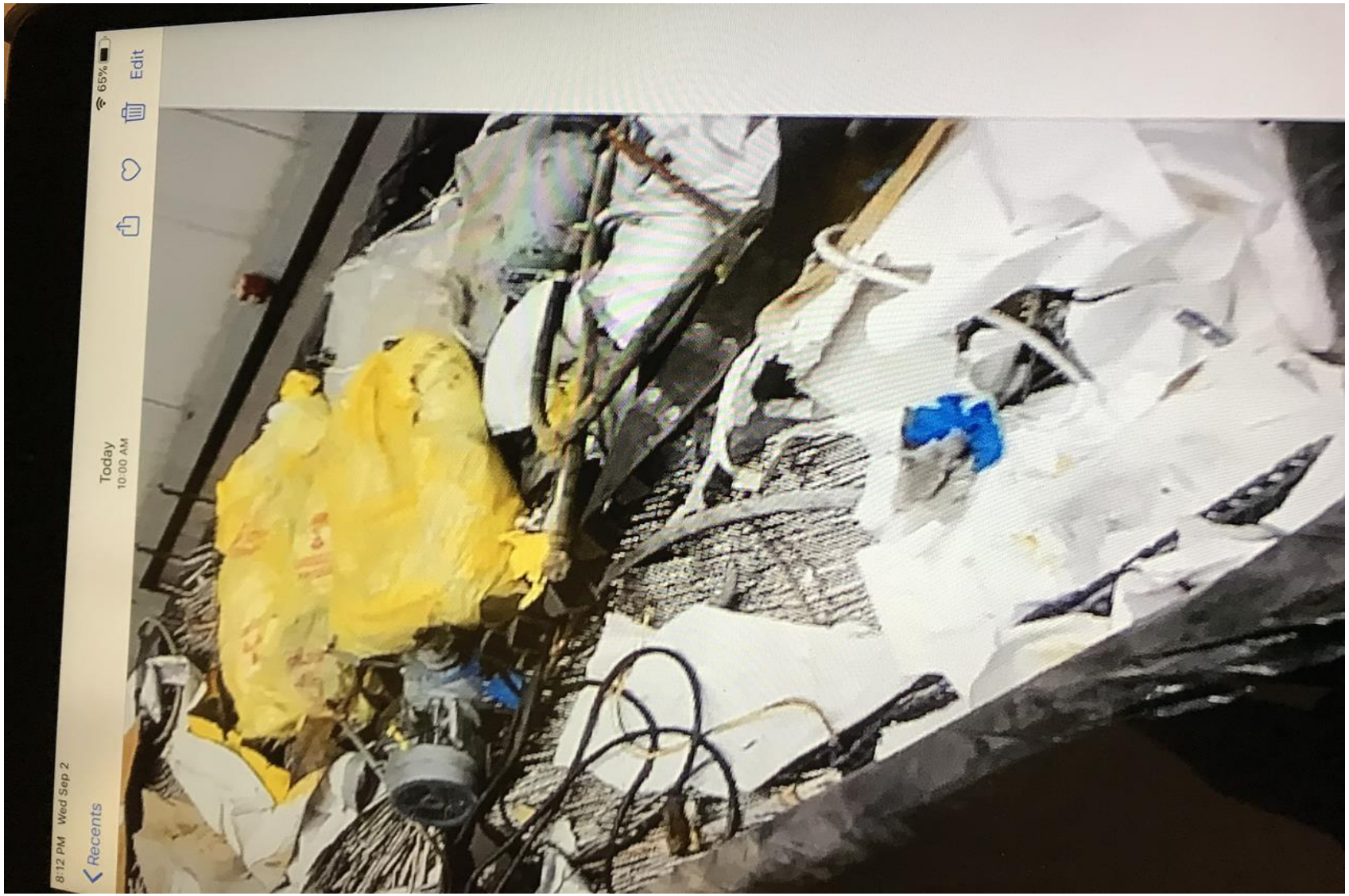
Based upon the Safety Data Sheets for Zirconium Rods, and/or (Zircalloy Rods), there is a "Special Precautions Section" that indicates this material, especially "cut" sections, can be pyrophoric and can be ignited. There was no special handling instructions provided from the shipper with the loading of these Zirconium rods.

Safety Data Sheet Information

- That section also indicates not to use water. Water was utilized to extinguish the fire created when the contents of the rail car was unloaded that created an oxygen rich environment.

- There were no special handling instructions provided from the shipper or conveyed on the shipping documents with the shipping of these Zircalloy rods. The Zirc Rods were found piled on top of each other in the car when the transloading/remediation began.

Photograph of the loaded car provided by the shipper before the fiberglass lid was applied



Zirconium Properties

- Dust clouds of larger particle size can be readily ignited if an ignition source is present, and such explosions can occur in atmospheres of carbon dioxide or nitrogen as well as in air. Spontaneous heating and ignition are also possibilities with **scrap chips, borings, and turnings if fine dust is present.**

Investigation Conclusions

- Although zirconium rods pose no danger of reaction if properly packaged and the rods themselves, when they have not been altered, but sufficient evidence was found that many of the zirconium rods were altered by an internal process at the shipper's location and loaded into this car.
- Based upon the information collected during this investigation by FRA, the shipper had the information to properly know that Zirconium Rods, Zirc Scrap, Molybdenum and other metals were being loaded into this car.

Investigation Conclusions

- This investigation also proved that the shipper improperly loaded this car by allowing the Zirconium Rods to interact with other Zirconium Rods and other metal objects, despite information of the SDS for this material.
- This metal-to-metal contact created friction through movement in transportation that caused the rods to create filings. Those filings are the most volatile and they created the sparks that ignited the combustible dunnage that was loaded in the void spaces between the rods and other metal objects in the car.

FRA Regulatory Findings 49 CFR

As a result of this investigation, FRA wrote 2 recommendations for civil penalties against the shipper for not properly classifying the material in the car per;

49 CFR 173.24(e)4(i).

Mixed contents. Hazardous materials may not be packed or mixed in the same outer packaging with other hazardous or nonhazardous materials if such materials are capable of reacting dangerously with each other and causing – (i) Combustion or dangerous evolution of heat; **AND**

FRA Regulatory Findings 49 CFR

FRA's also concluded that the shipper did not properly classify, or properly identify and describe the contents of this car based upon the information collected during this investigation per this regulation.

49 CFR 173.22(a)(1)

Except as otherwise provided in this part, a person may offer a hazardous material for transportation in a packaging or container required by this part only in accordance with the following:

The person shall class and describe the hazardous material in accordance with parts 172 and 173 of this subchapter,

FRA Recommendations for Regulatory Changes

- We are recommending that packaging standards be developed for Zirconium, Zircalloy and all other derivatives of Zirconium that demonstrates pyrophoric properties be required to be separated and/or blocked and braced by regulation so they cannot interact themselves or other potential metals loaded in the same package while in transportation.

- By creating packaging standards for such metals, it would eliminate the possibility of the metals interacting with each other, and the pyrophoric event that created the non-accidental release associated with this package.

Federal Railroad Administration

If you have any Questions, Please do not hesitate to call or email me using the contact information below;

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