

# Annual Summary of Molten Metal Incidents in 2023

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September 2024



# Explosion Rating Force Criteria



<b>Guidelines</b>	<b>Force 1</b>	<b>Force 2</b>	<b>Force 3</b>
<b>Property Damage</b>	None	Minor	Considerable
<b>Light</b>	Minimal	Flash	Intense
<b>Sound</b>	Short cracking	Loud Report	Painful
<b>Vibration</b>	Short and sharp	Brief rolling	Massive structural
<b>Metal Dispersion</b>	<15 feet	>15 to 50 feet	>50 feet

**TABLE 1. Explosion Rating Force Criteria**

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# Incidents by Year

## 1981 – 2023 (Total 4693)

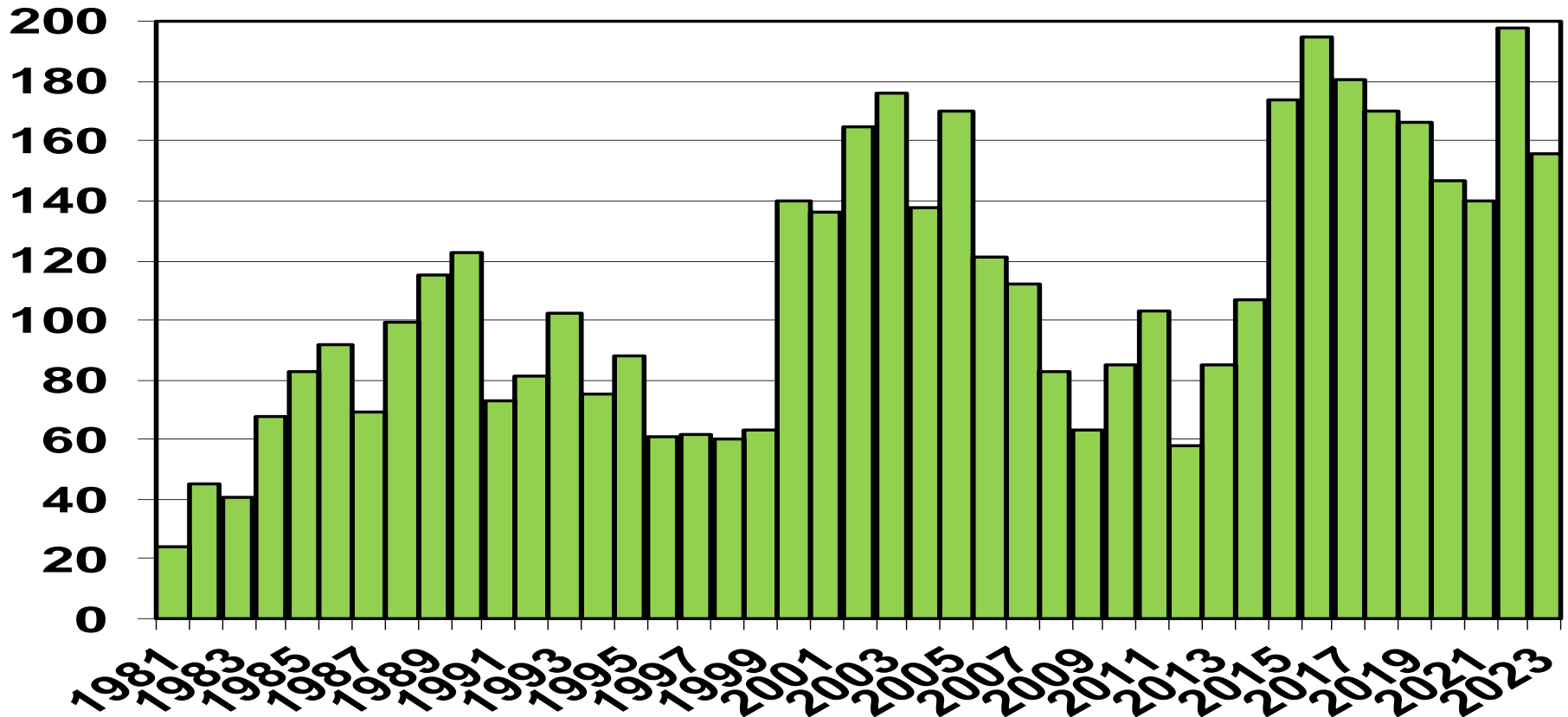


FIGURE 1. Incidents Reported For The Period 1981 – 2023 Sep. 2024



# Incidents by Force Level 1981 – 2023 (Total 4693)

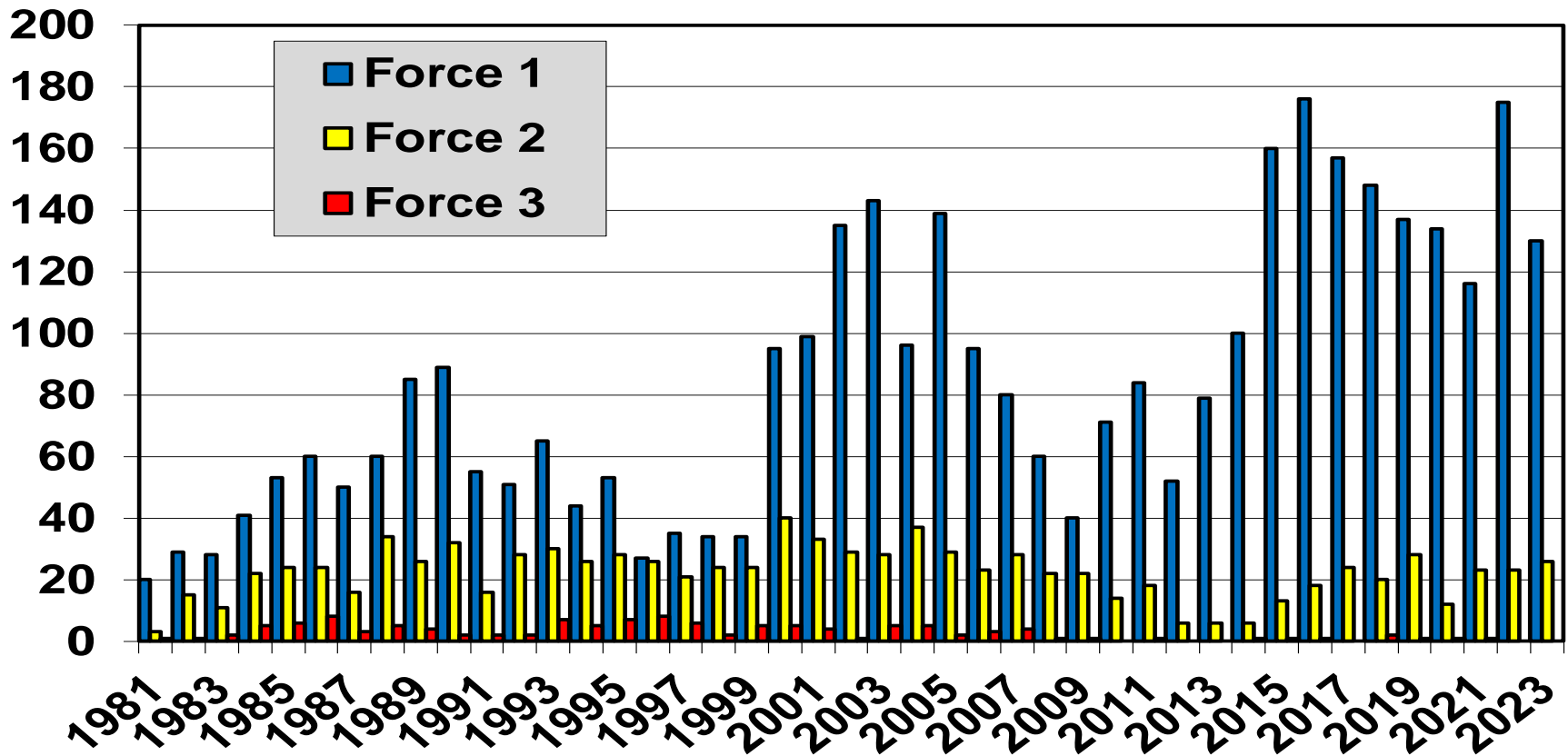


FIGURE 2. Incidents By Force Level 1981 – 2023

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# Incidents by Force Level 1981 – 2023 (Total 4693)

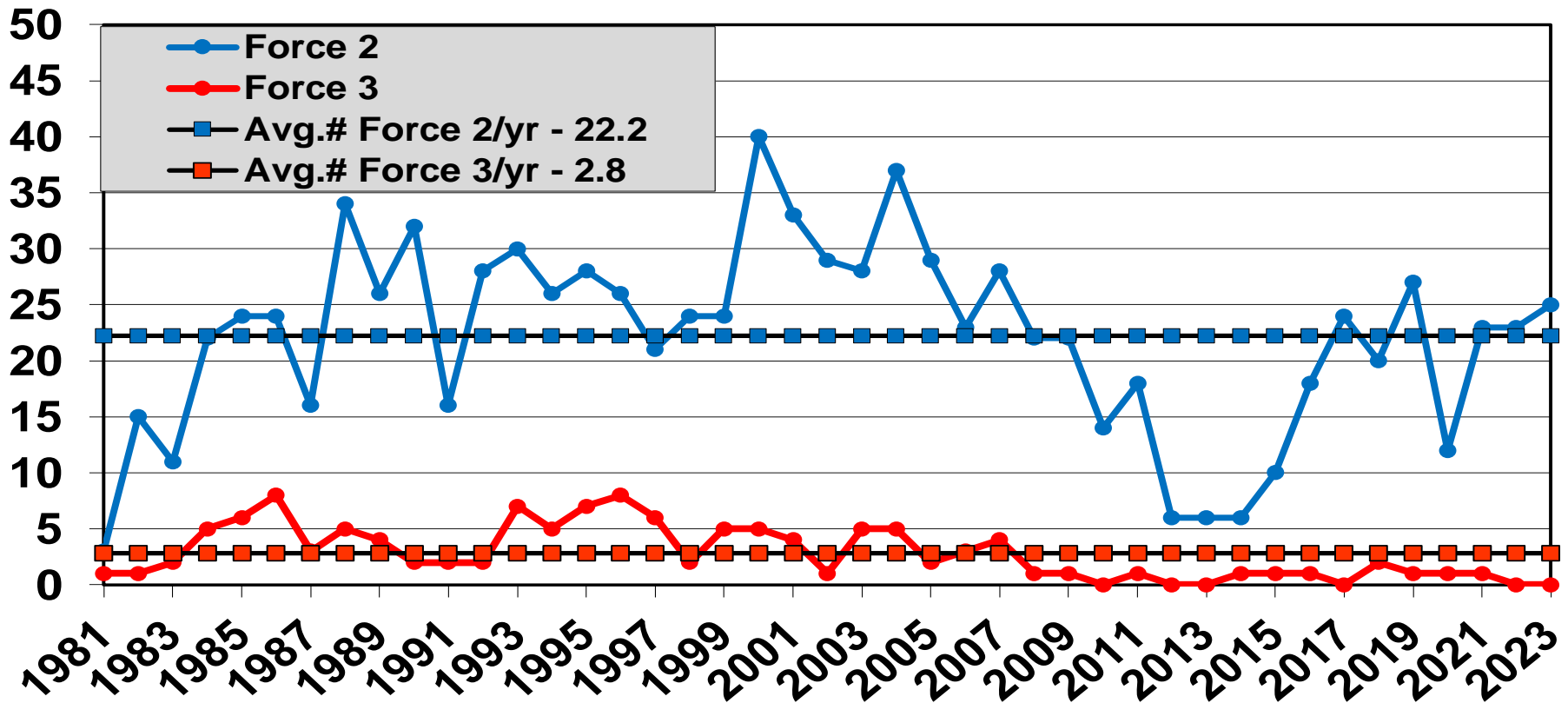


FIGURE 3. Incidents By Force Levels 2 & 3 For 1981 – 2023

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# Force 3 Incidents Only 1981 – 2023

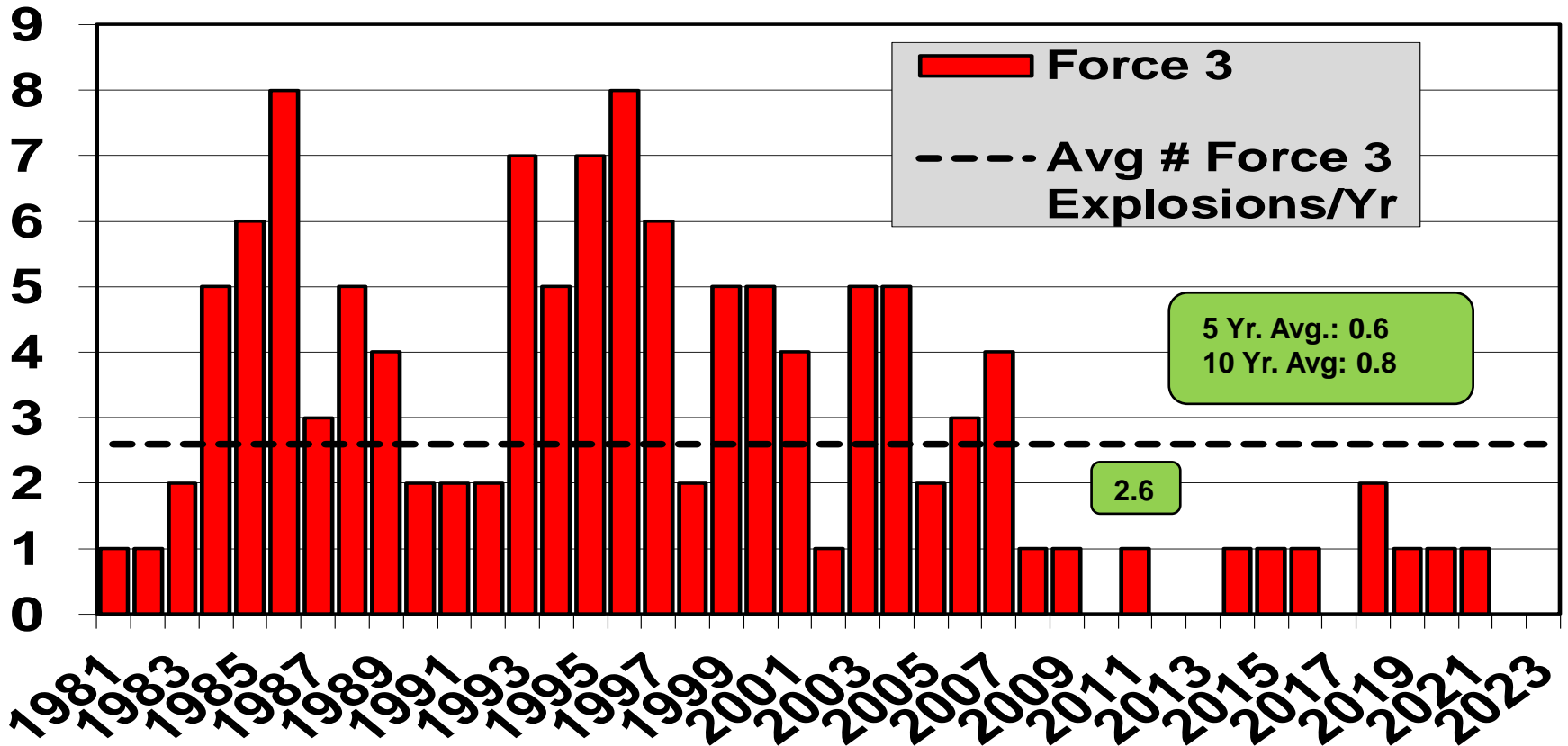


FIGURE 4. Force 3 Incidents For 1981 – 2023

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# Incidents by Force Level 1981 – 2023 (Total 4693)

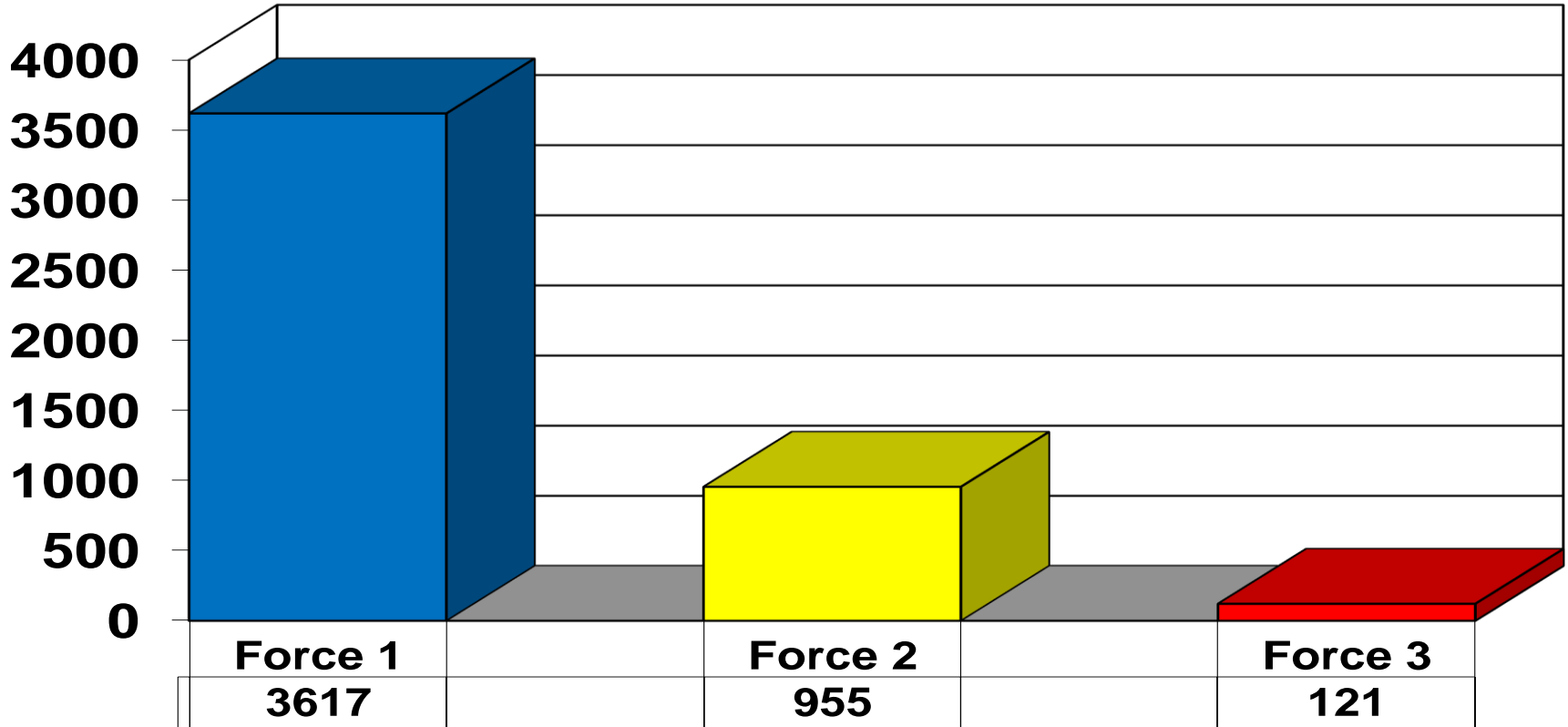


FIGURE 5. Incidents By Force Level 1981 – 2023

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# All Force Levels by Percentage 1981 – 2023

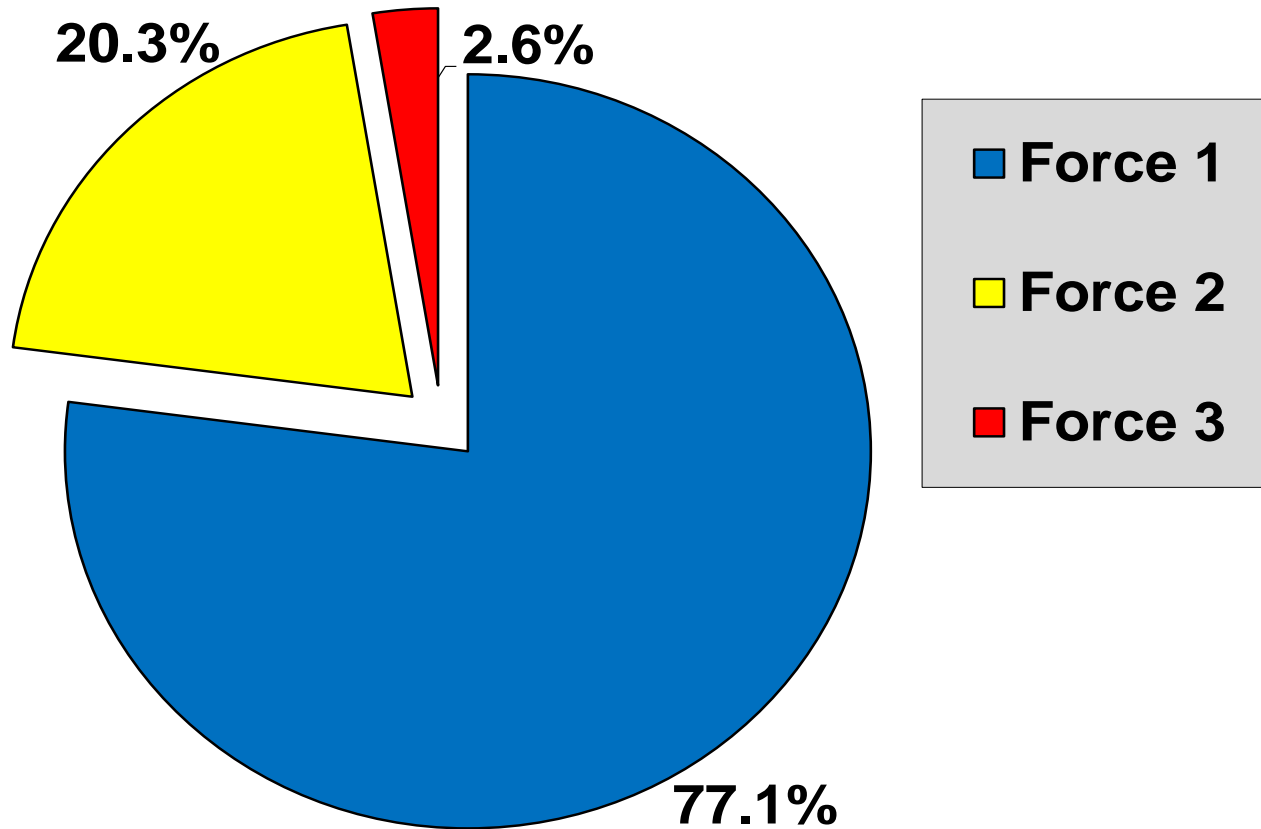


FIGURE 6. All Force Levels By Percentage 1981 – 2023

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# Injuries from Incidents 1981 – 2023

## (Total 1645)

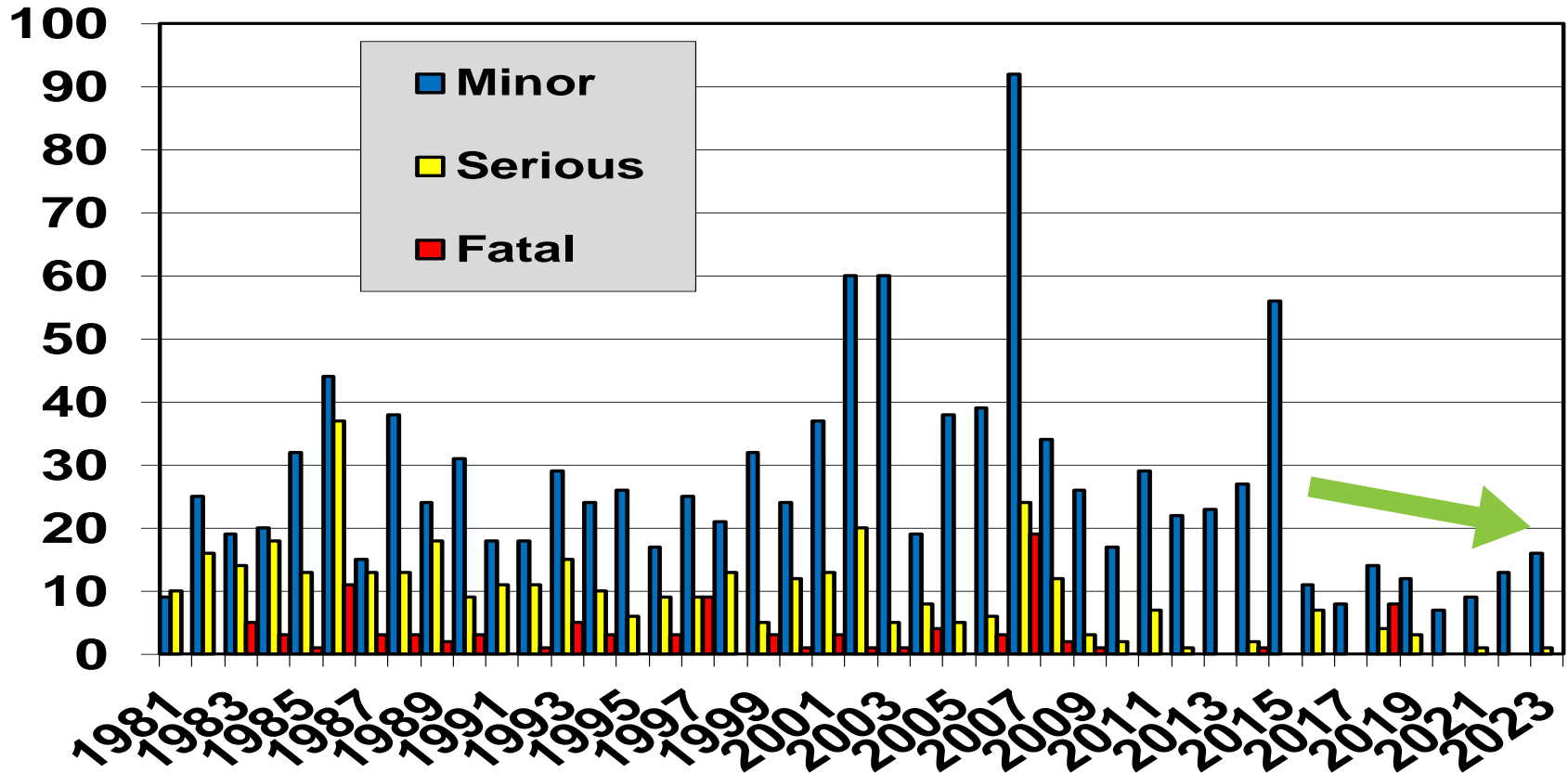


FIGURE 7. Injuries From Incidents For 1981 – 2023

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# % Injuries per Total Annual Incidents 2001 – 2023 (Total 836 Injuries)

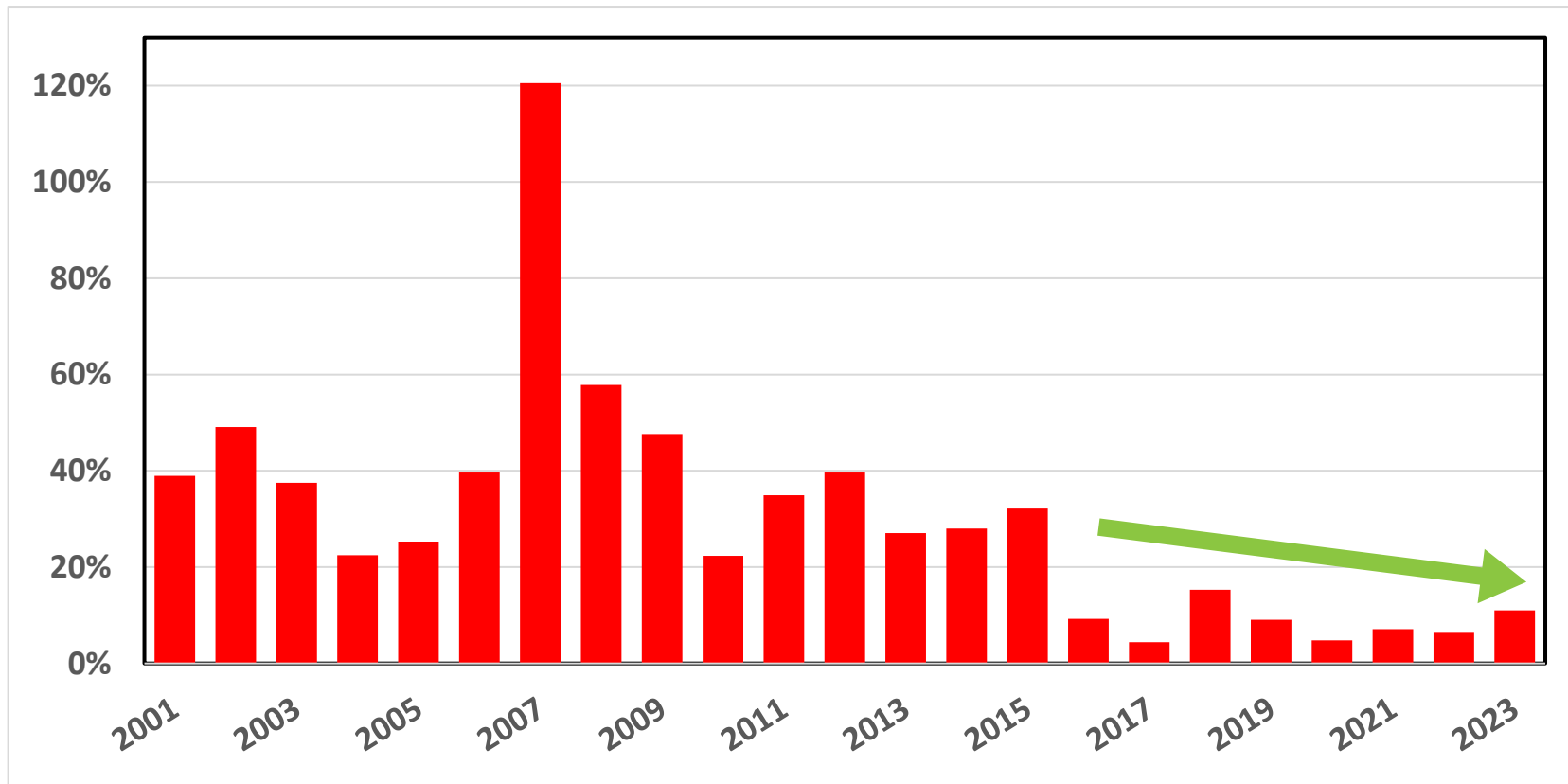
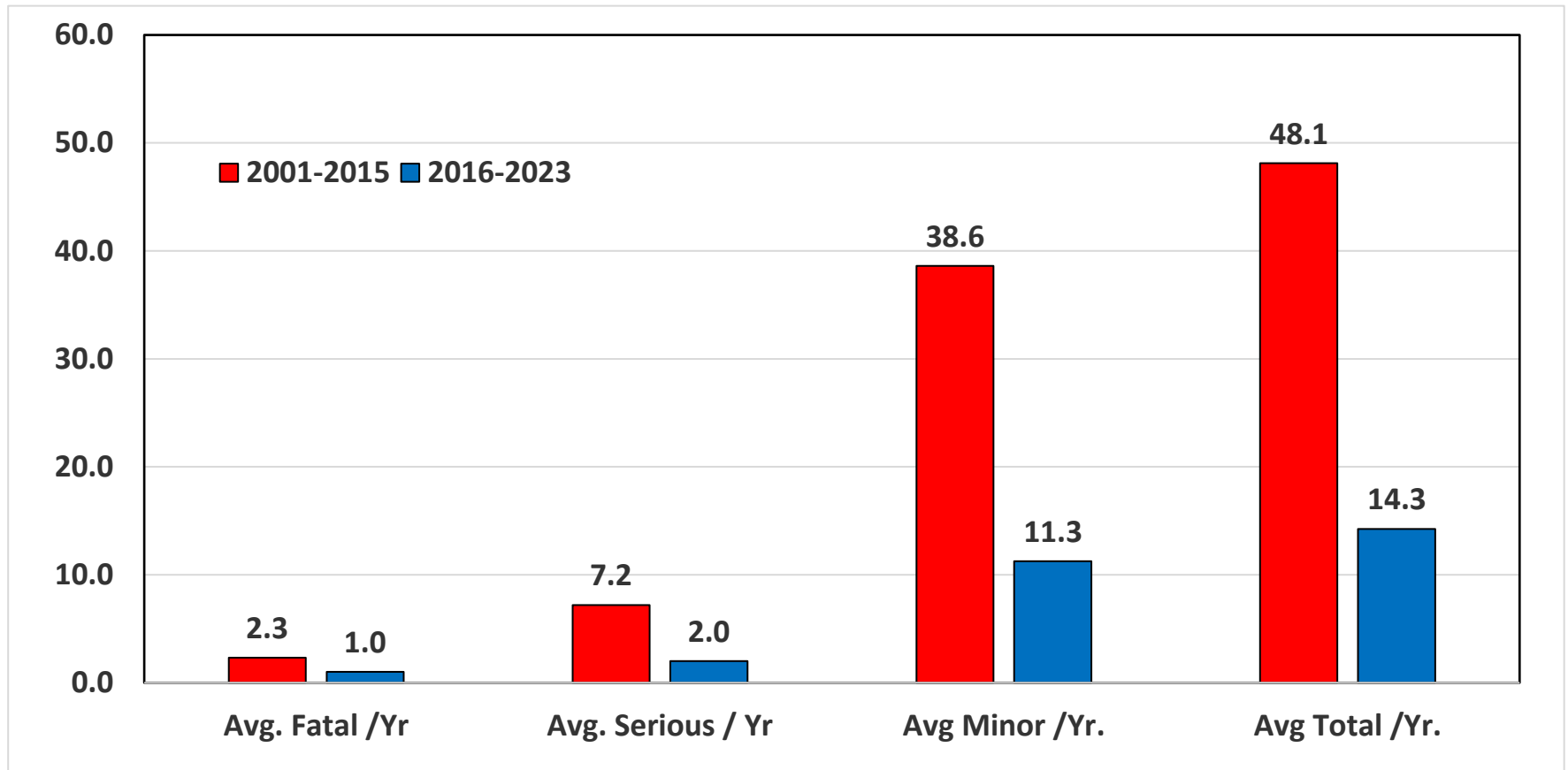


FIGURE 8. % Injuries/Total Annual Incidents 2001 – 2023

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# Average # of Injuries / Year from Explosions



**FIGURE 9. Avg. # Injuries / Yr. For 2001-2015 & 2016-2023**

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# Injuries by Severity – Total 1645 1981 – 2023

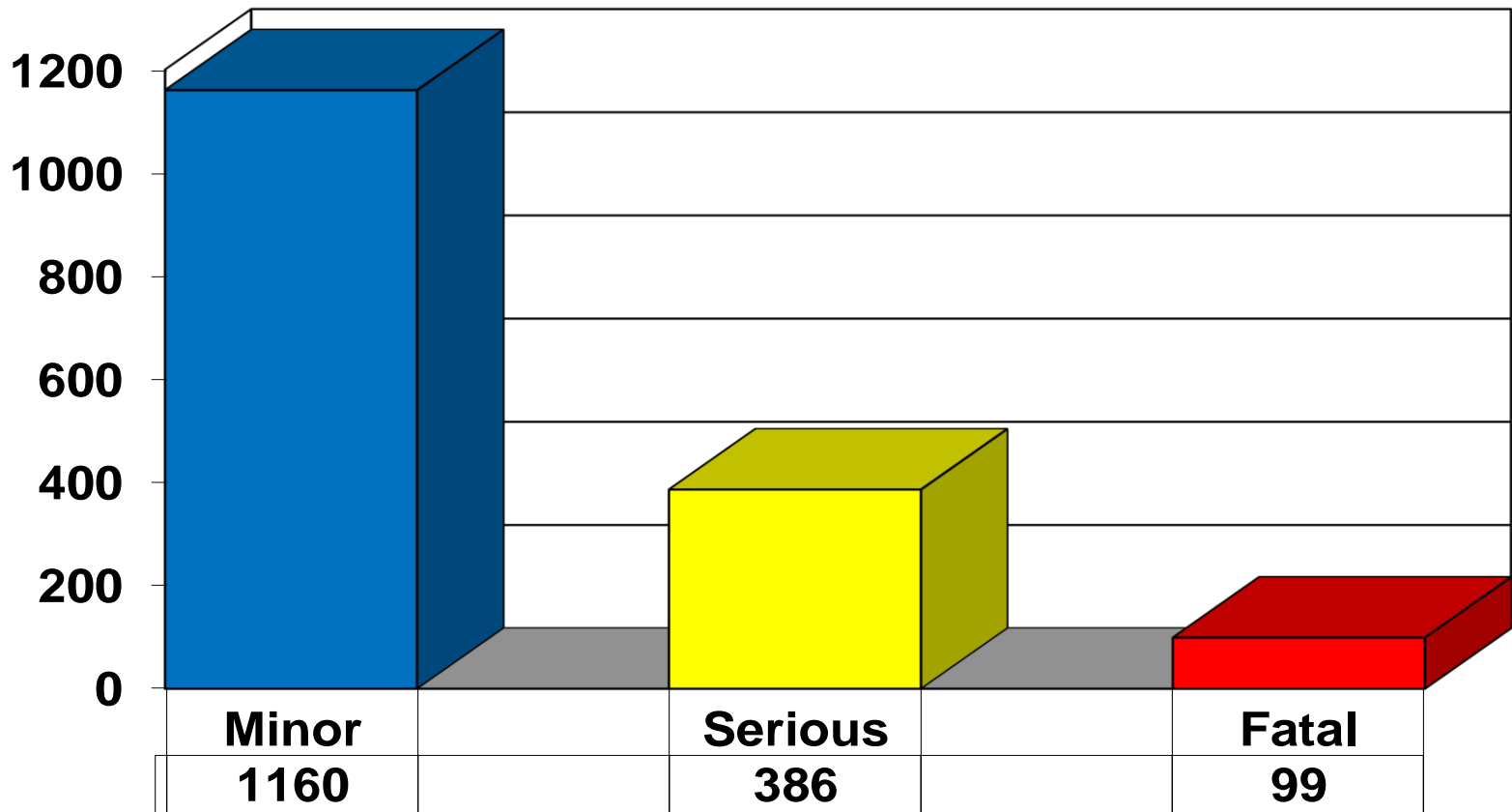


FIGURE 10. Injuries By Severity For 1981 – 2023 Sep. 2024



# Injury Levels by Percentage 1981 - 2023

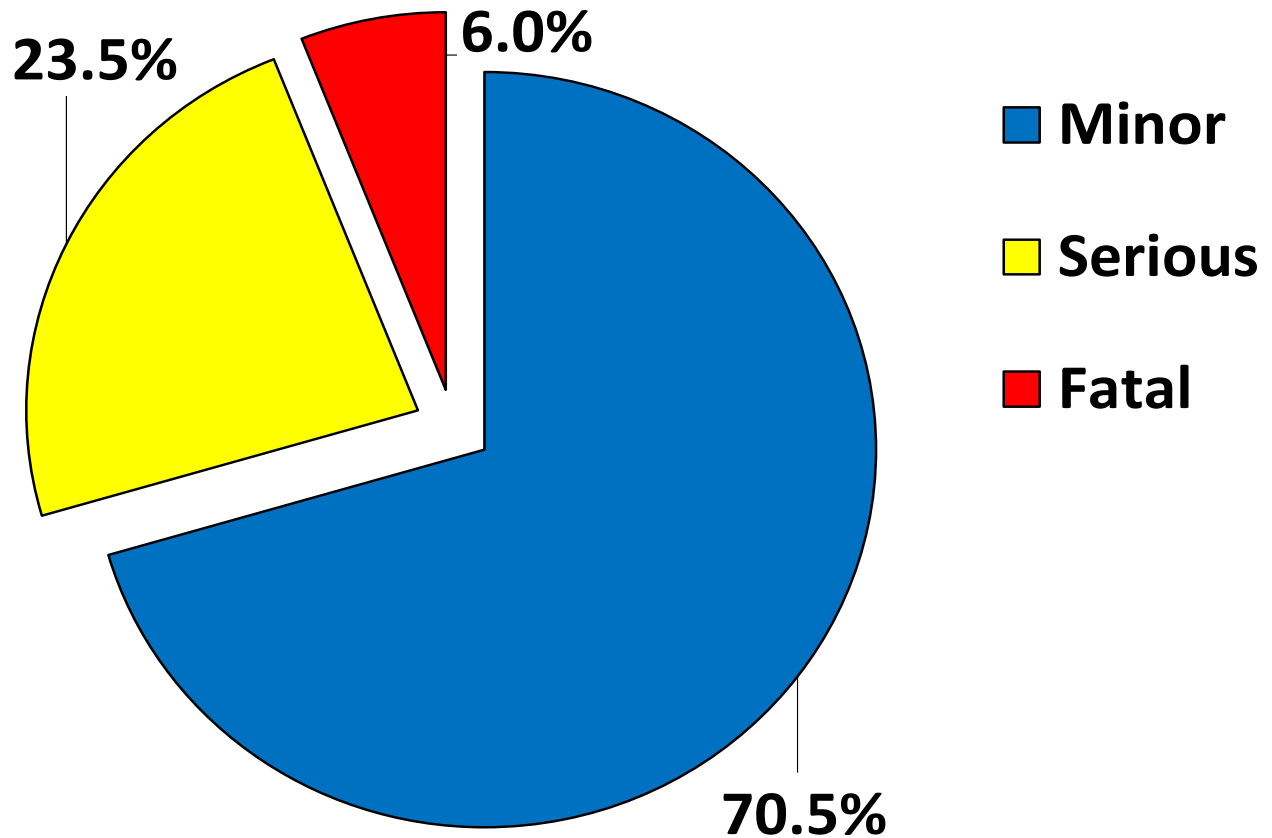
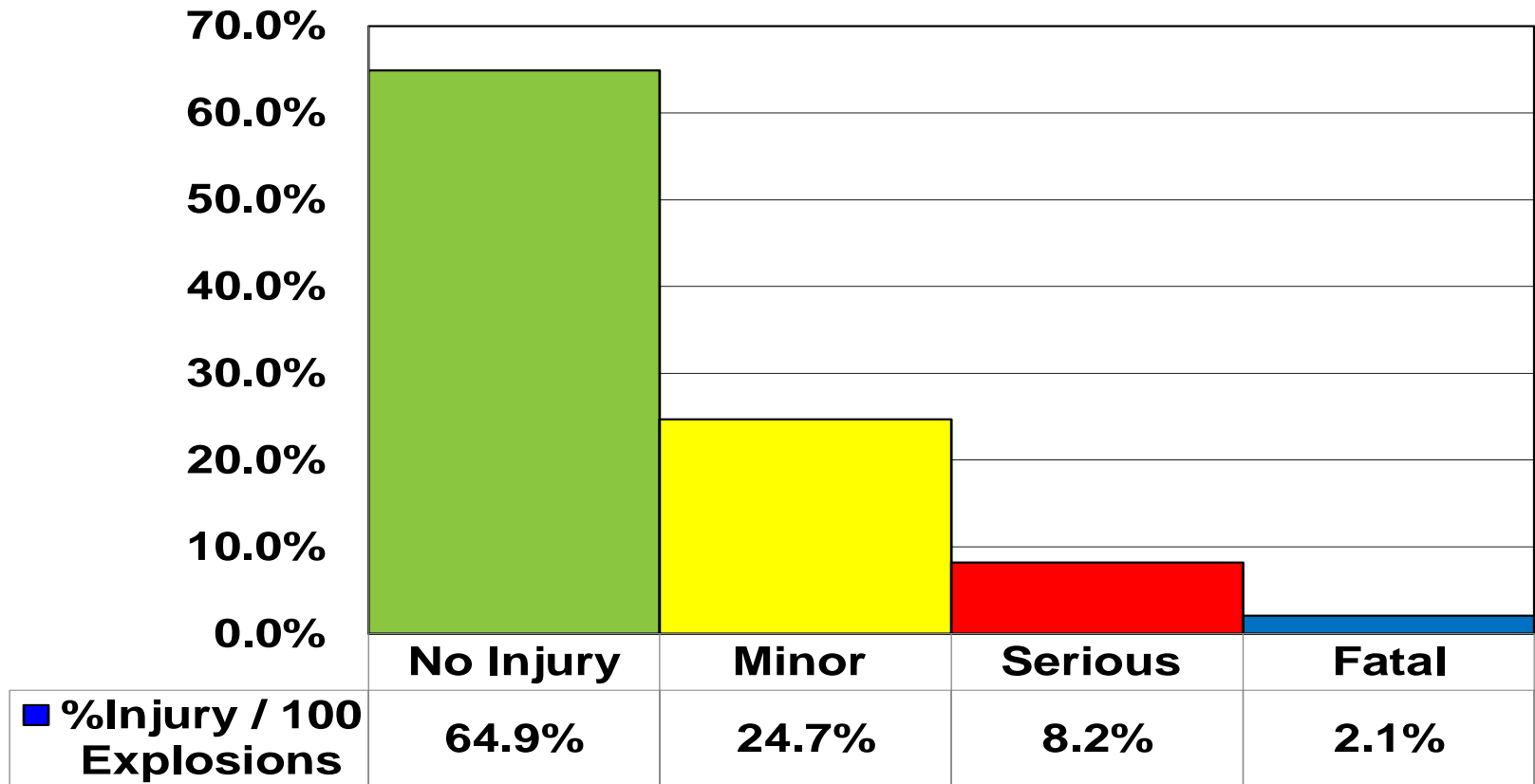


FIGURE 11. Injuries Levels By Percentage For 1981 – 2023

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# Injury Risk per 100 Explosions 1981 - 2023



**FIGURE 12. Injury Risk Per 100 Explosions For 1981 – 2023      Sep. 2024**



# Fatalities from Explosions 1981 - 2023

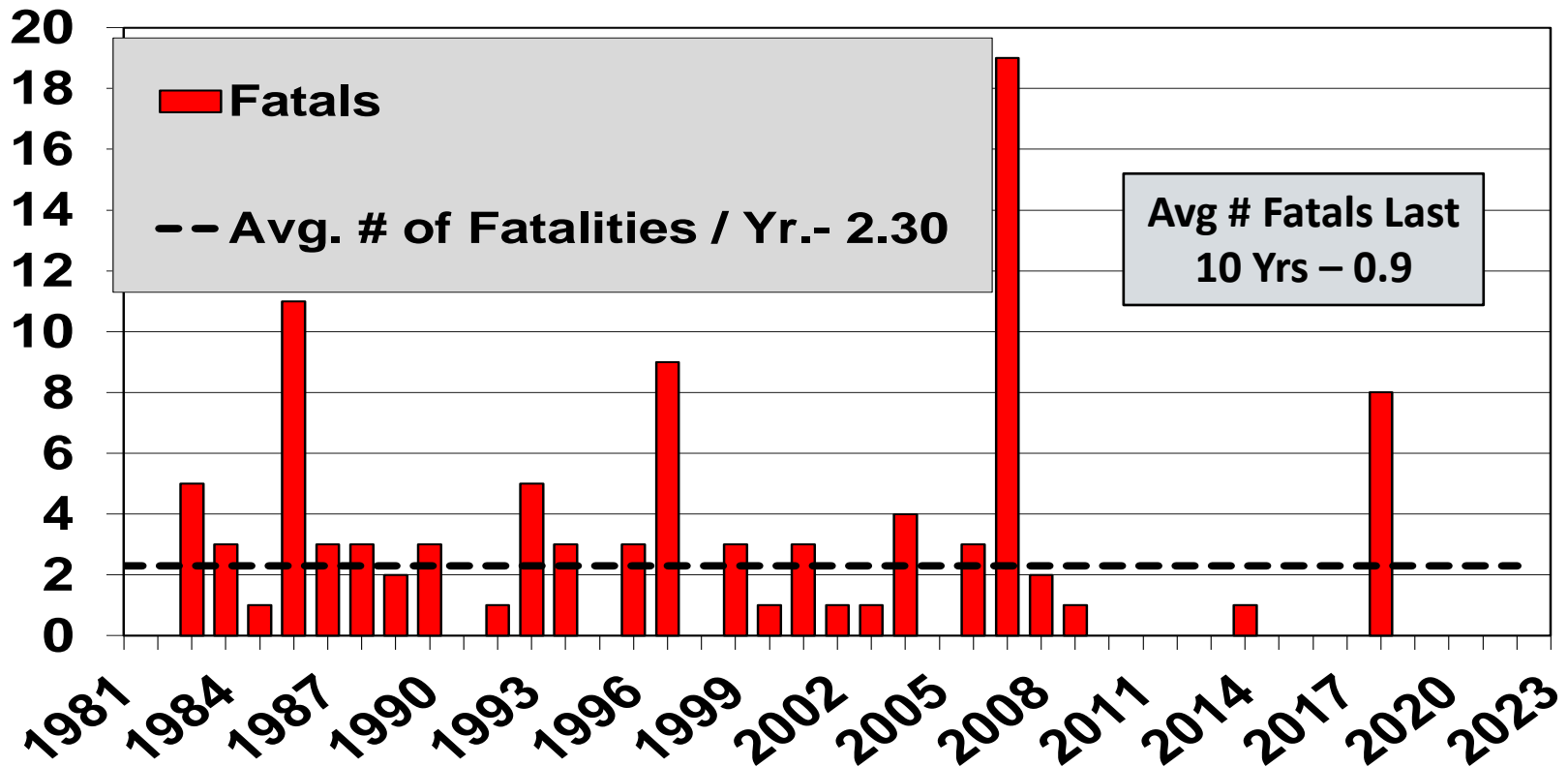


FIGURE 13. Fatalities From Explosions For 1981 – 2023 Sep. 2024

# Force Level Incidents by Operation – 2023

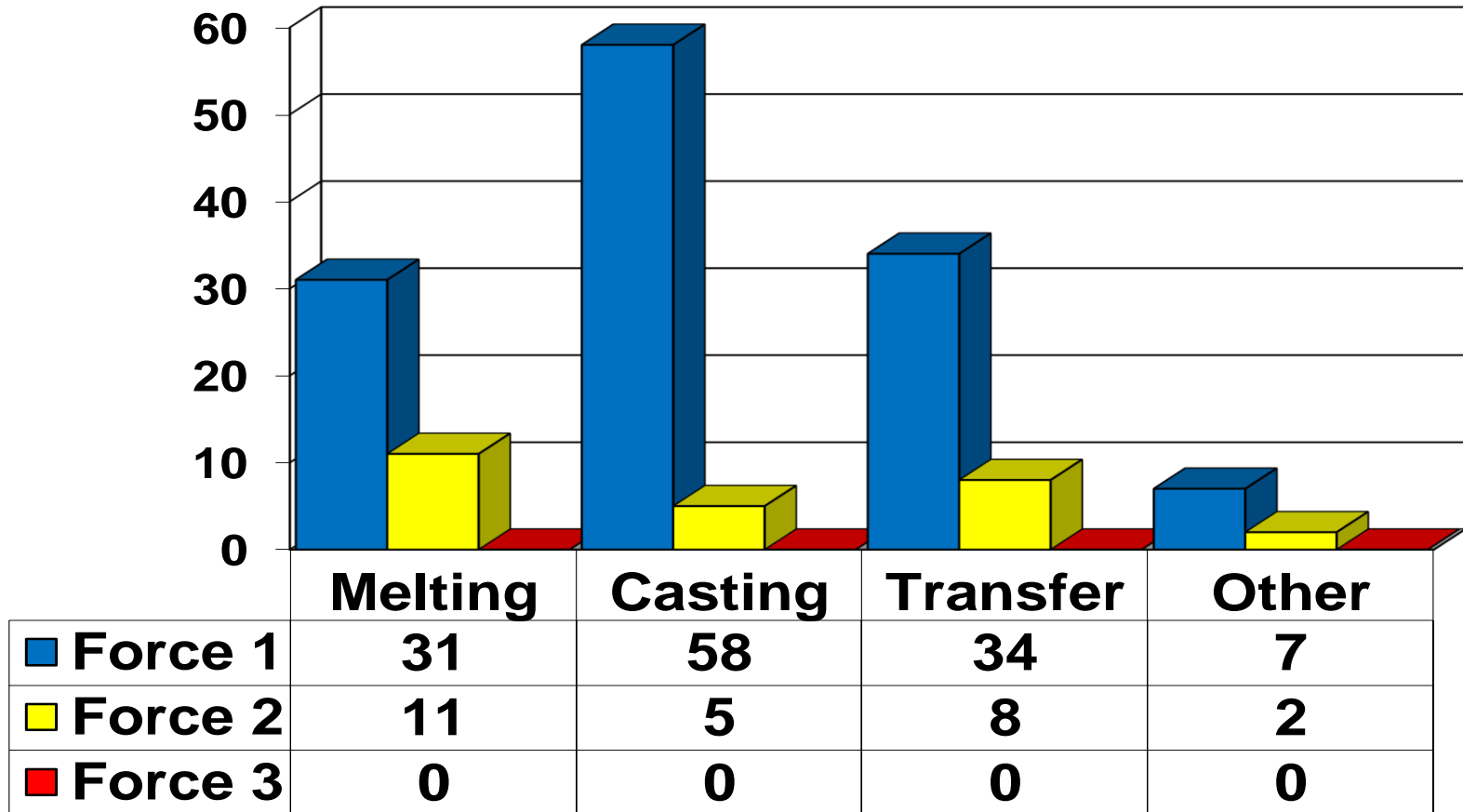


FIGURE 14. Force Level Incidents By Operation For 2023

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# Force Level & % Incidents by Operation

## 1980 – 2023

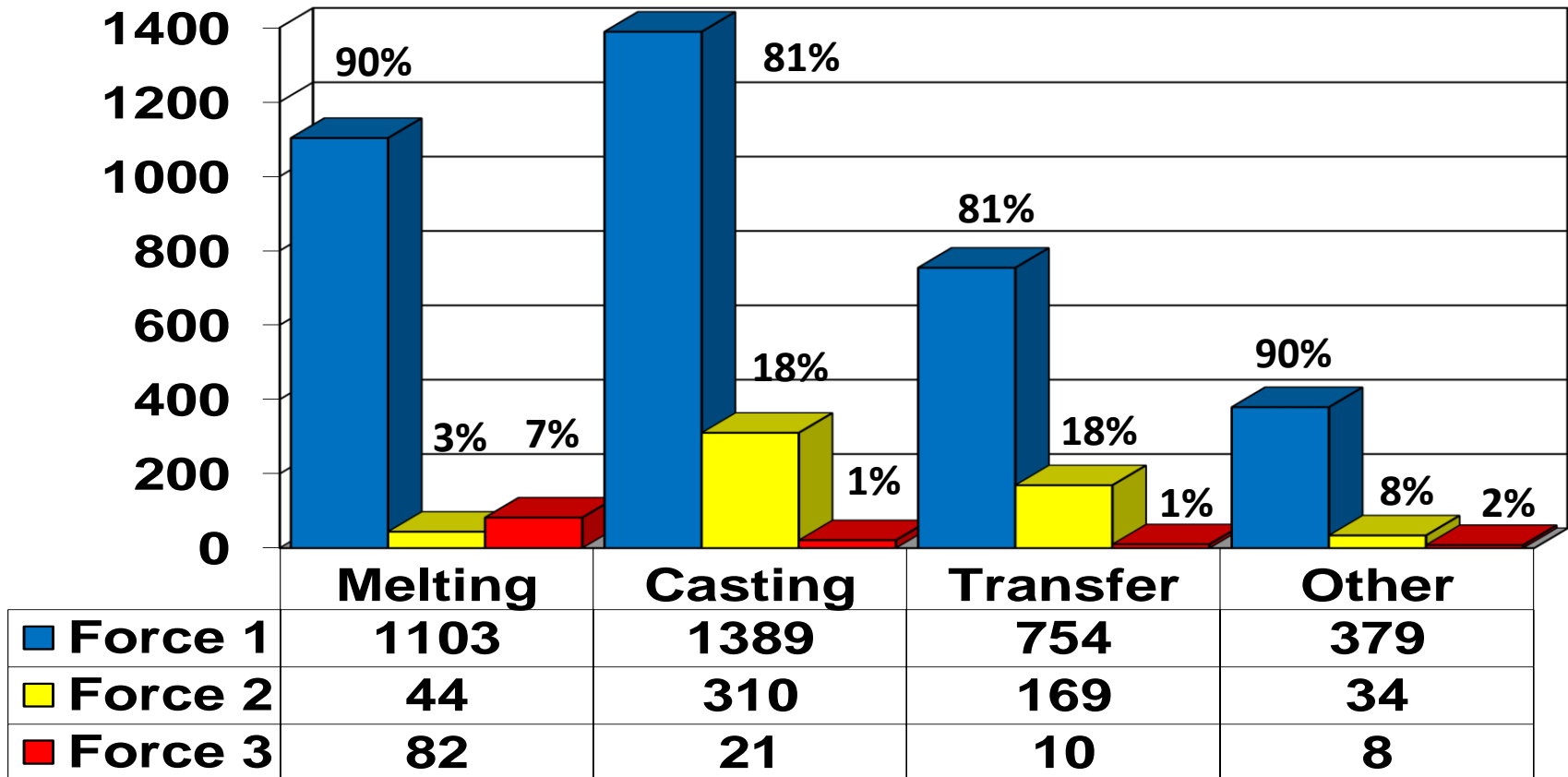
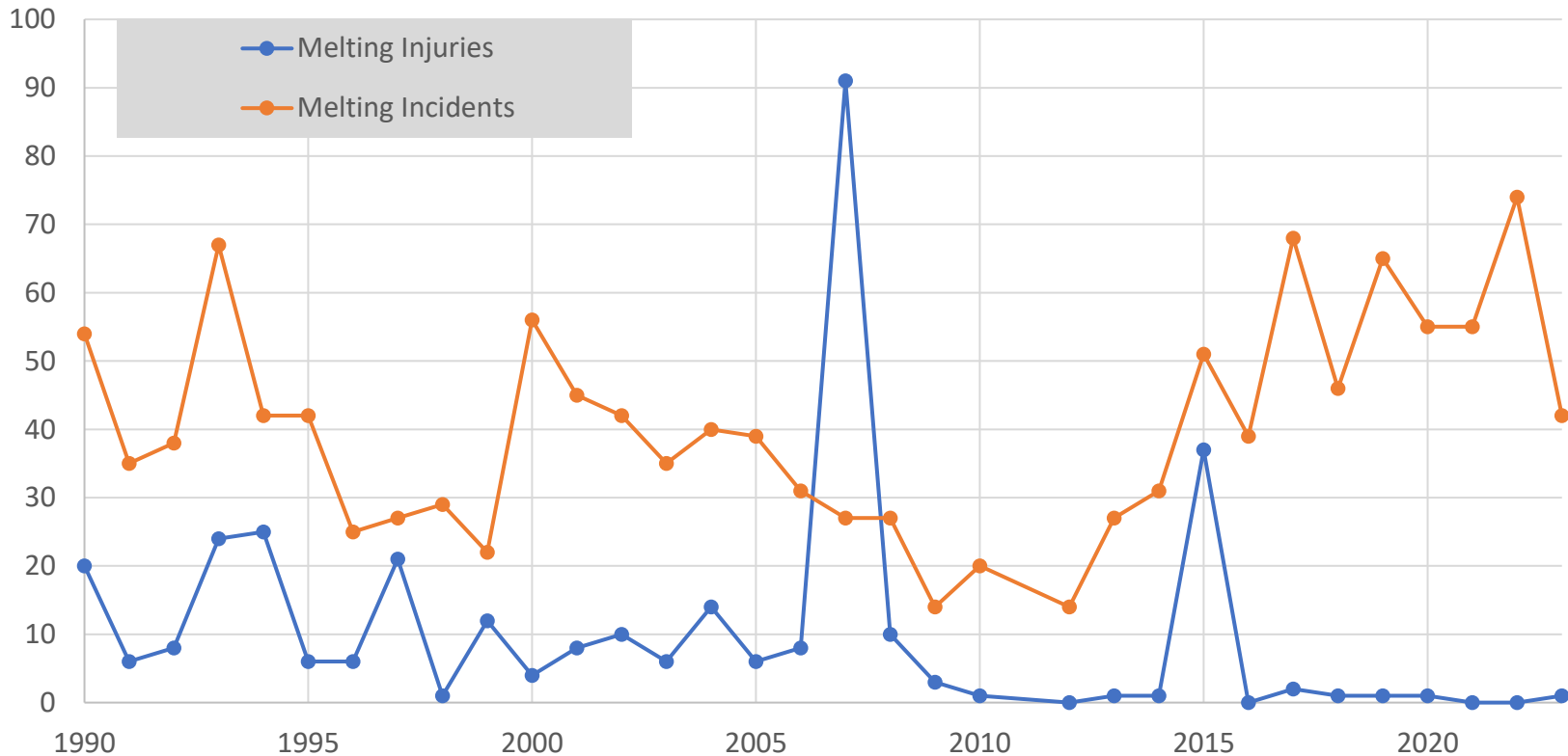


FIGURE 15. Force Level & % Incidents By Operation For 1980 – 2023

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# Melting Injuries and Incidents 1990 – 2023 (Total 335 Injuries)



**FIGURE 16. Melting Injuries and Incidents 1990 – 2023**

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# Melting Injuries per Incidents 1990 – 2023

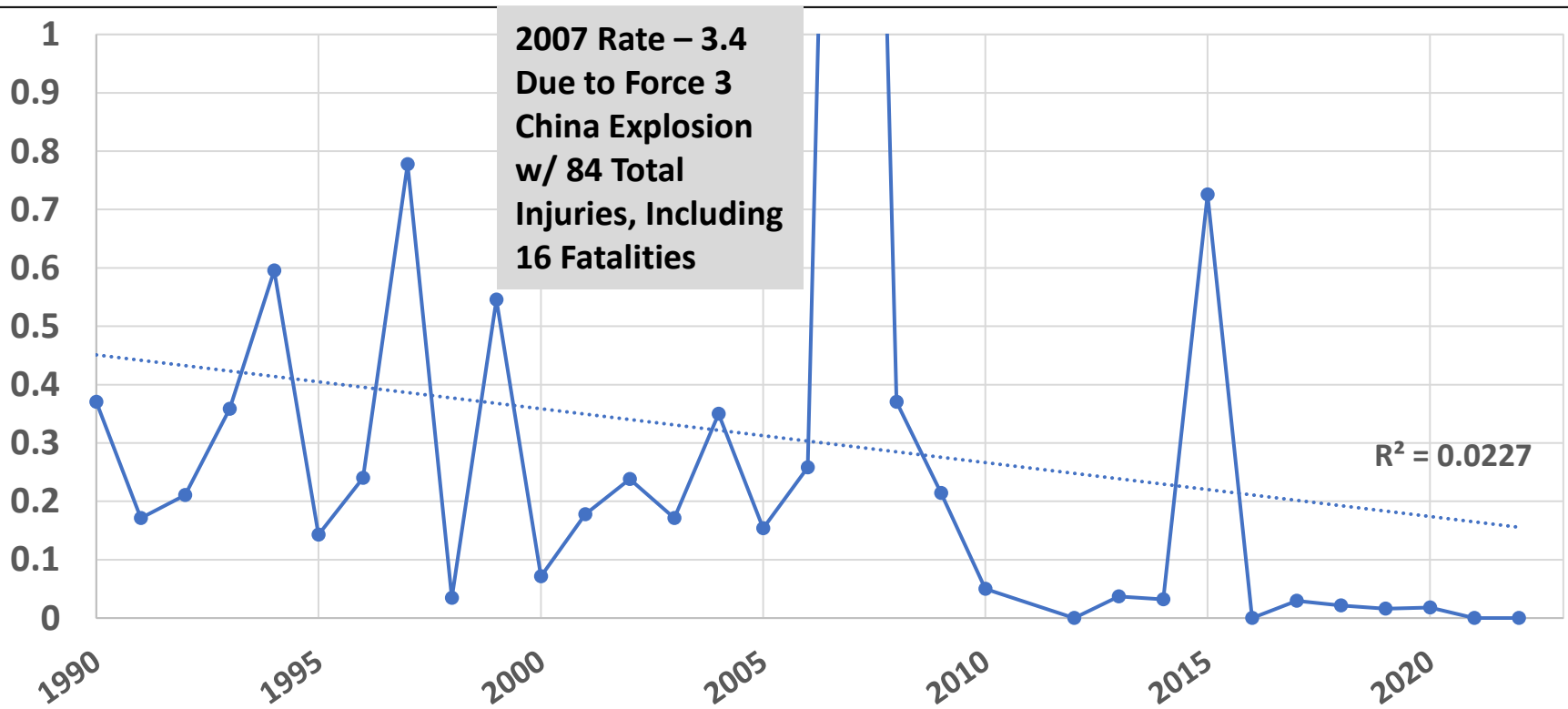


FIGURE 17. Melting Injuries Per Incidents 1990 – 2023 Sep. 2024



# Casting Injuries and Incidents 1990 – 2023 (Total 348 Injuries)

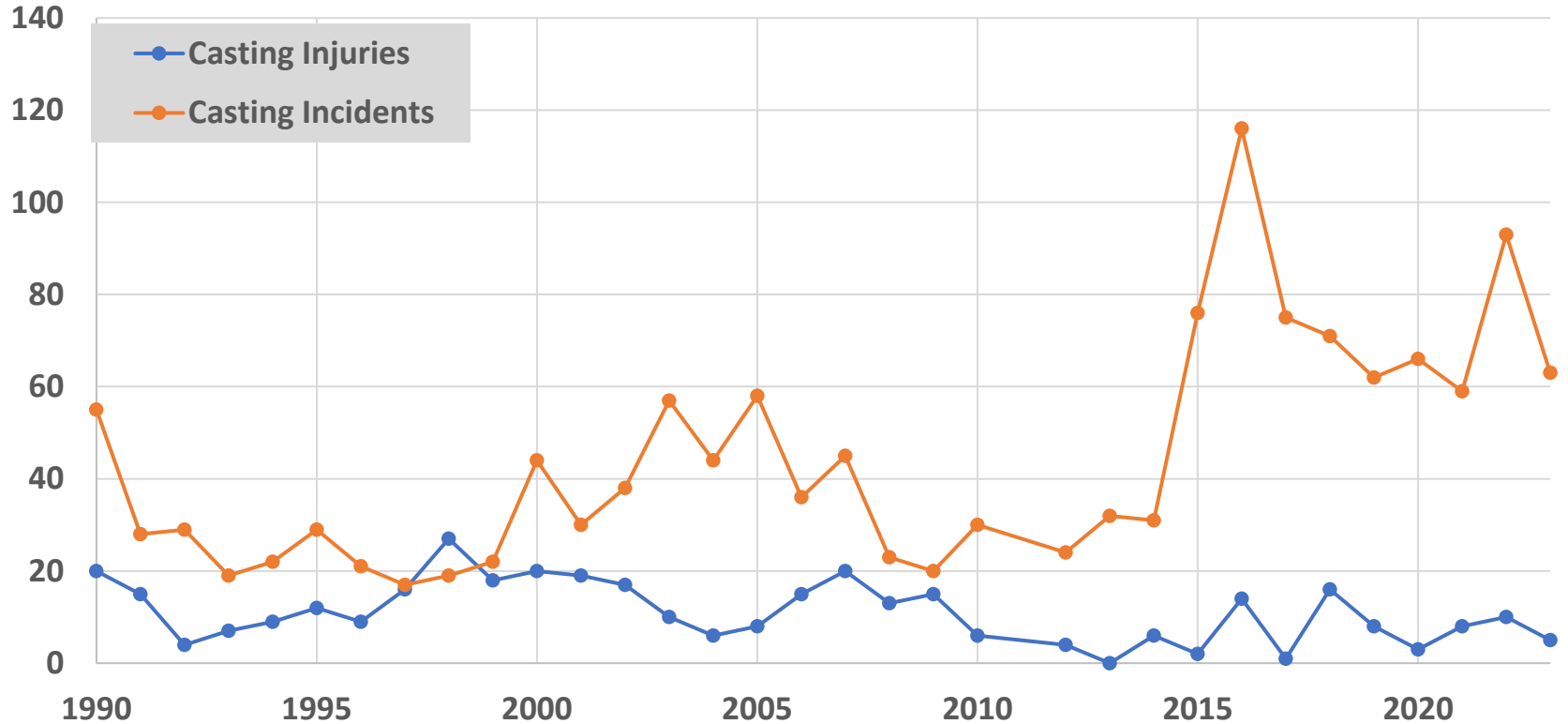
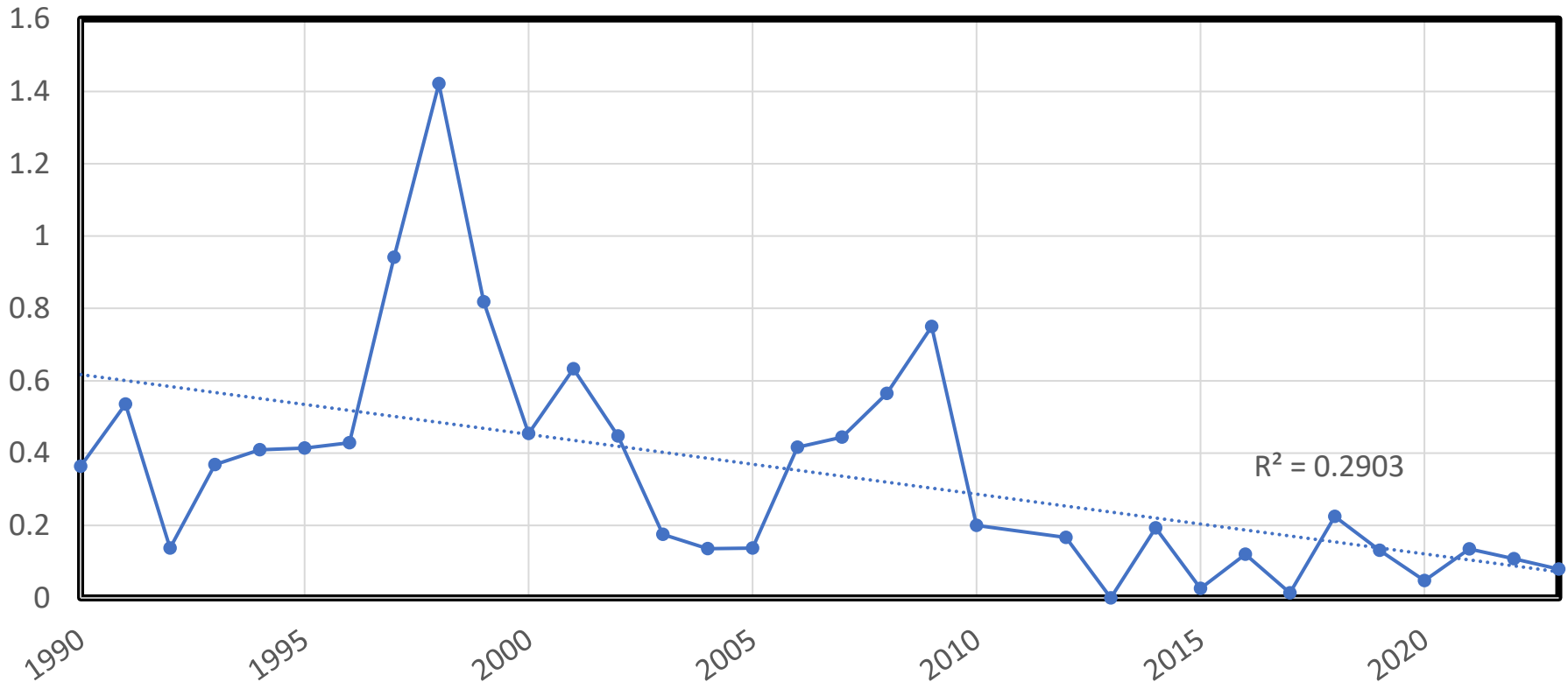


FIGURE 18. Casting Injuries and Incidents 1990 – 2023

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# Casting Injuries per Incidents 1990 – 2023



**FIGURE 19. Casting Injuries Per Incidents 1990 – 2023**

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# Transfer Injuries and Incidents 1990 – 2023 (Total 260 Injuries)

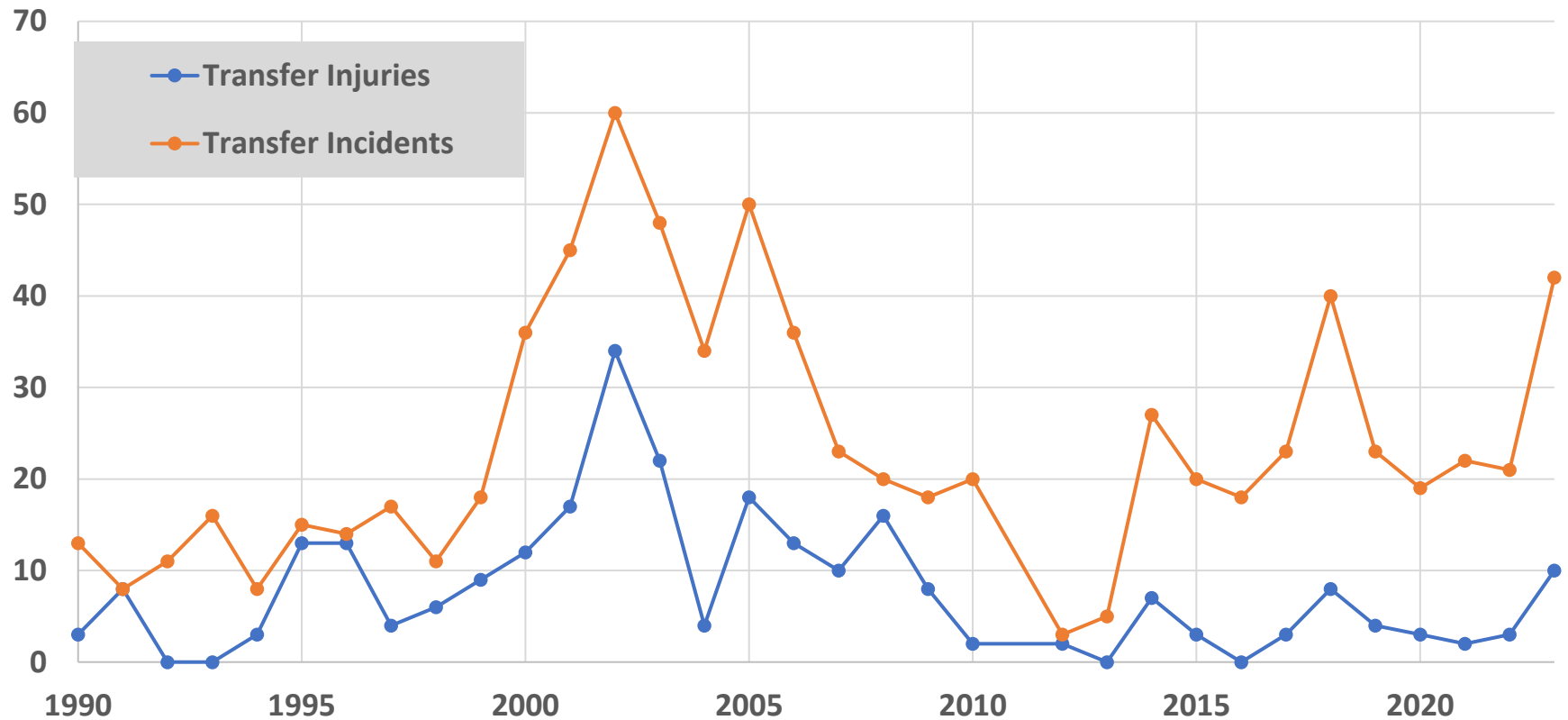


FIGURE 20. Transfer Injuries and Incidents 1990 – 2023

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# Transfer Injuries per Incidents 1990 – 2023

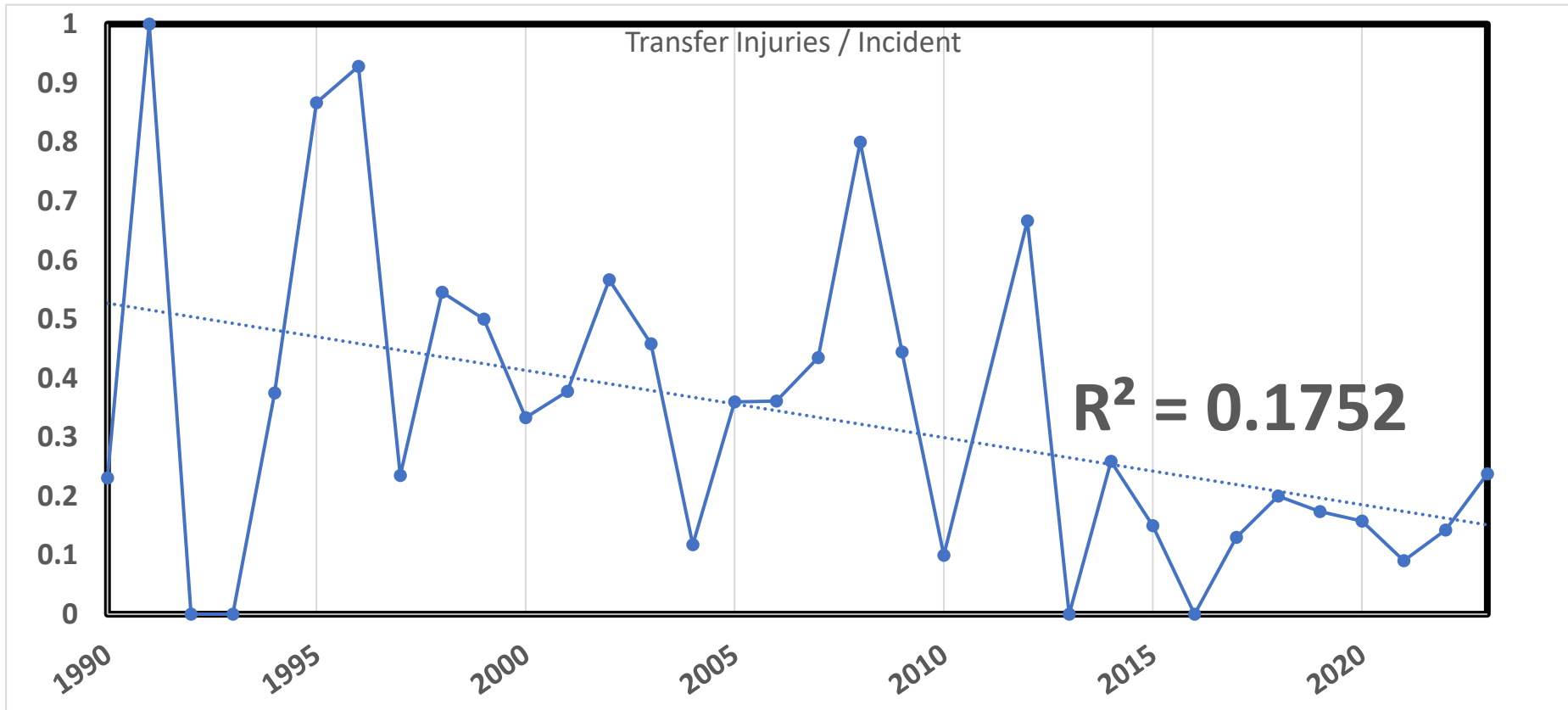


FIGURE 21. Transfer Injuries Per Incidents 1990 – 2023 Sep. 2024



# 42 Melting Explosions – 2023

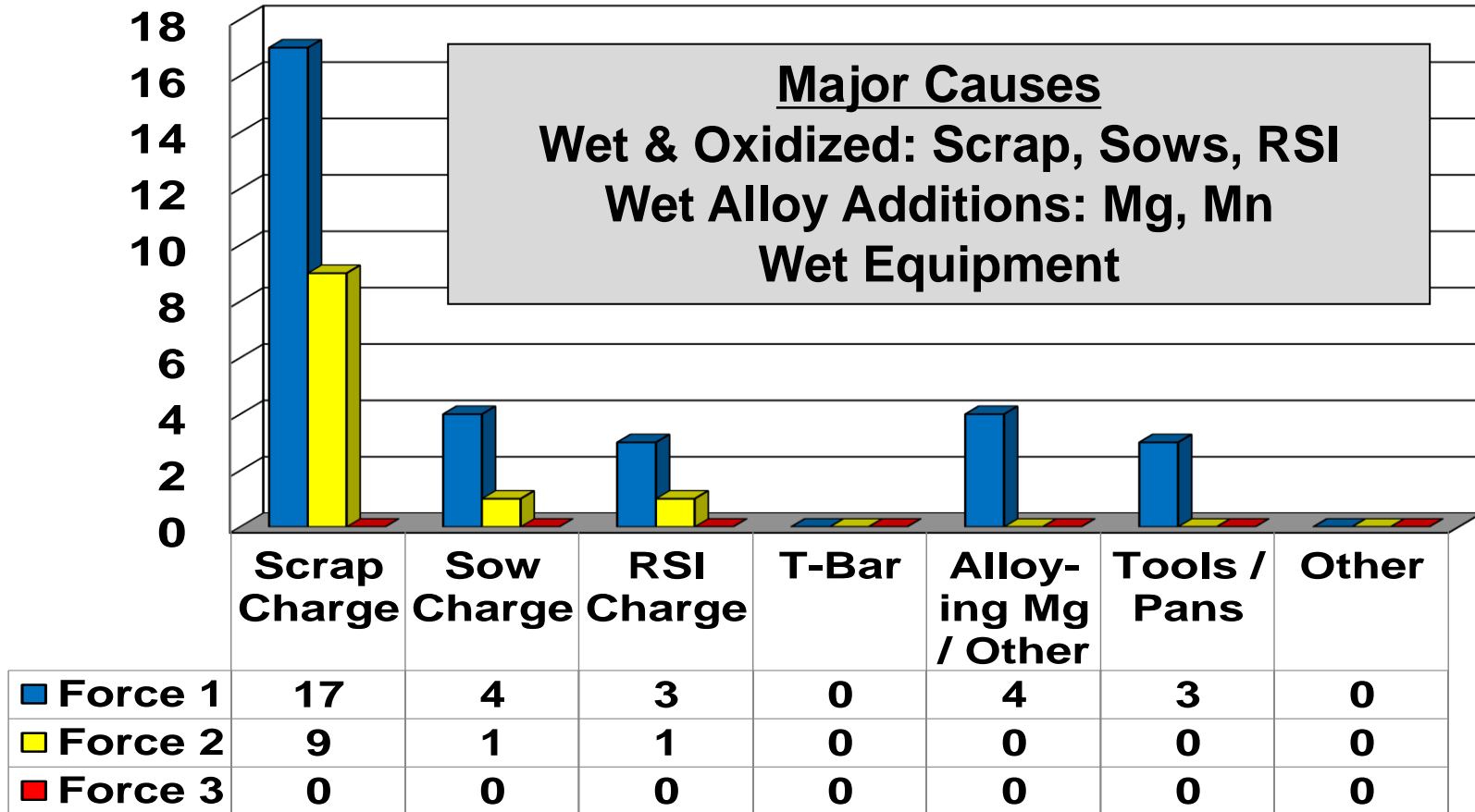


FIGURE 22. Melting Explosions By Cause For 2023

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# Melting Explosions – Charge Material Involved 1980 – 2023

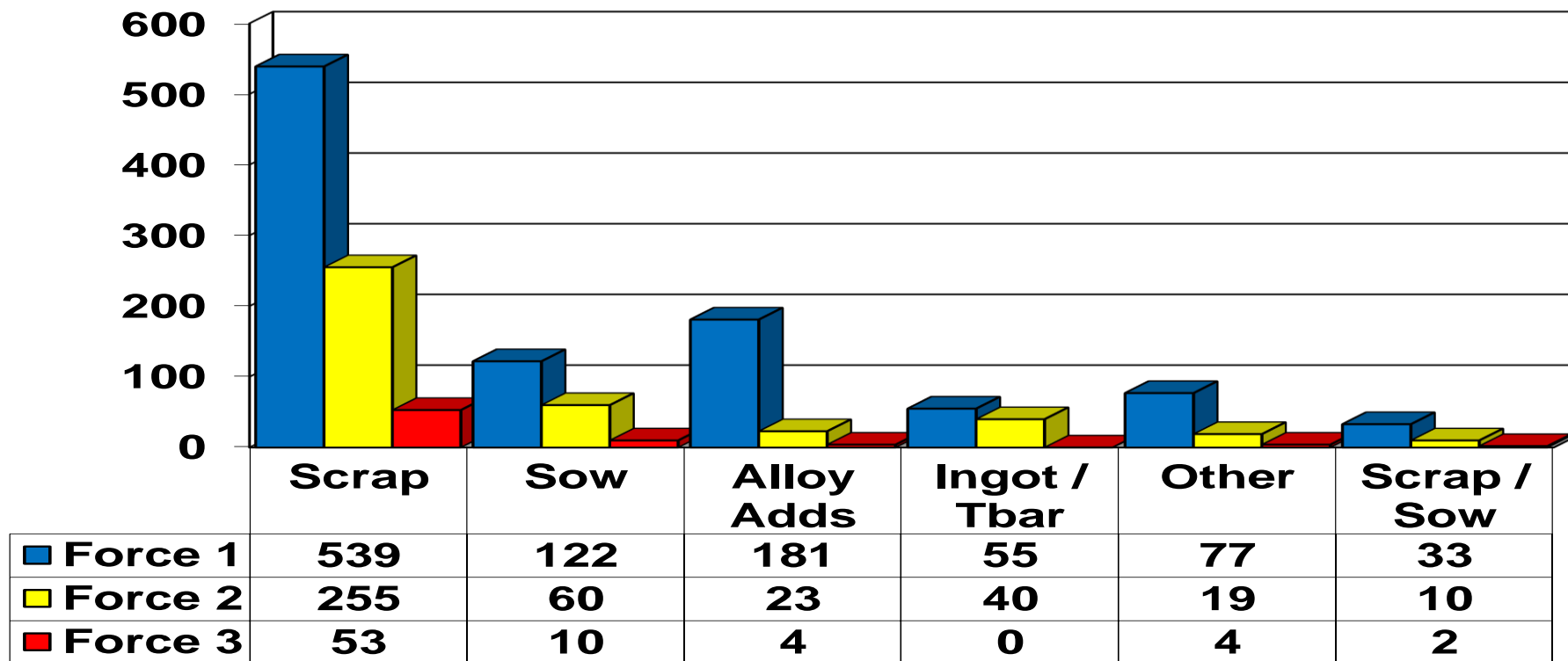


FIGURE 23. Melting Explosions By Charge Material 1980 – 2023

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# 62 Casting Explosions – 2023

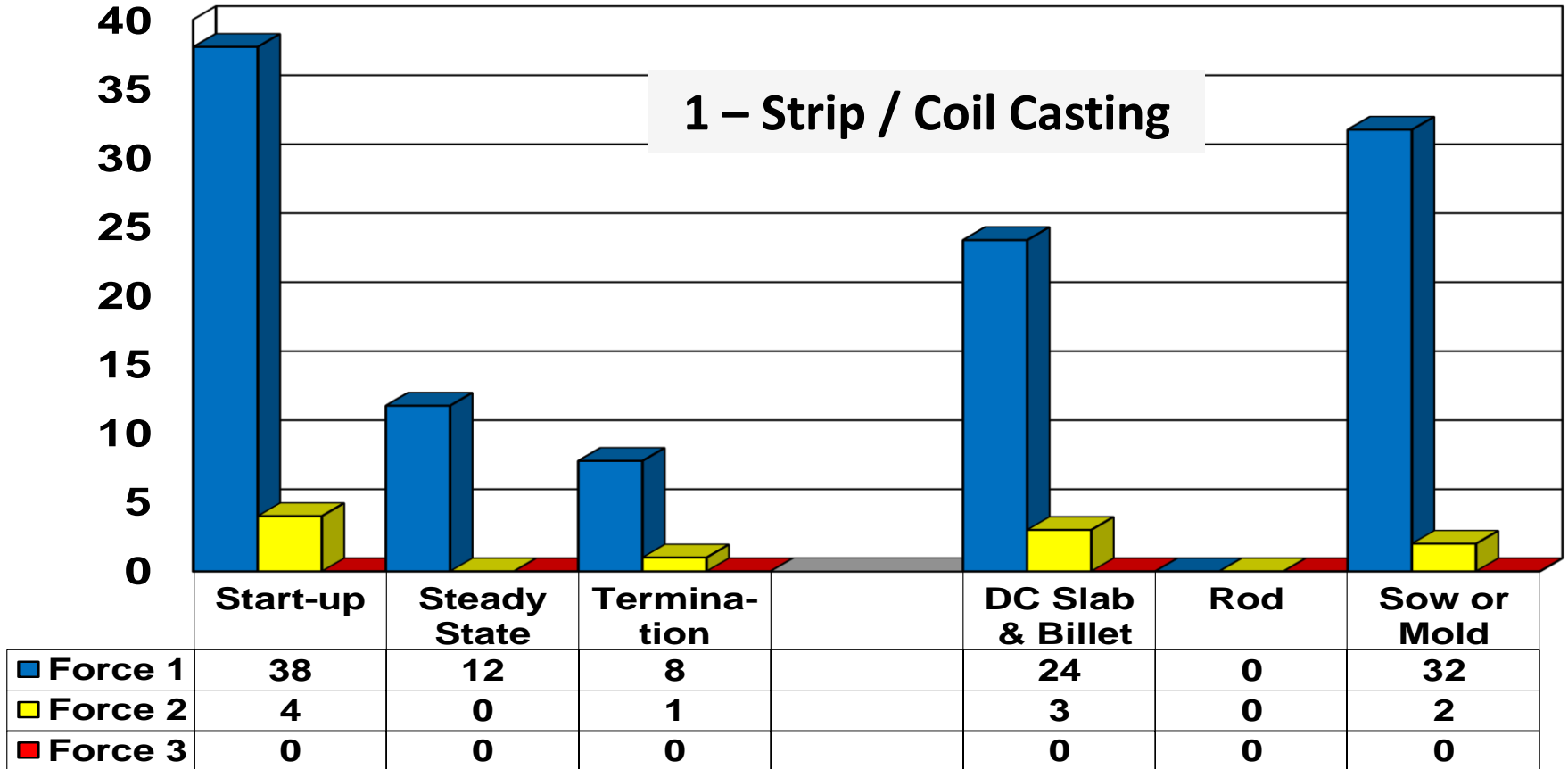


FIGURE 24. Casting Explosions For 2023

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# DC/HDC/EMC Explosions by Cast Segment 1980 – 2023

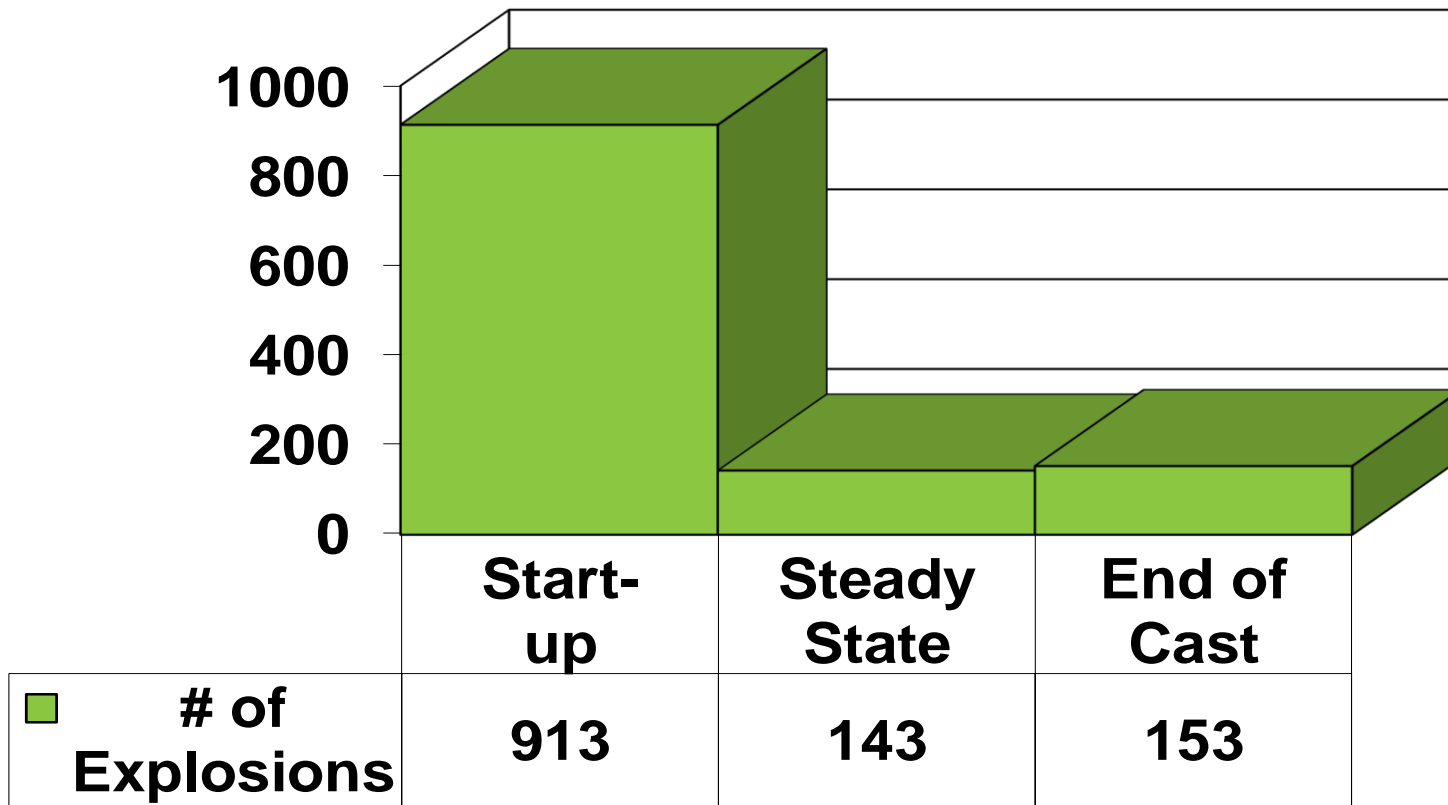


FIGURE 25. Casting Explosions By Cast Segment 1980 – 2023 Sep. 2024

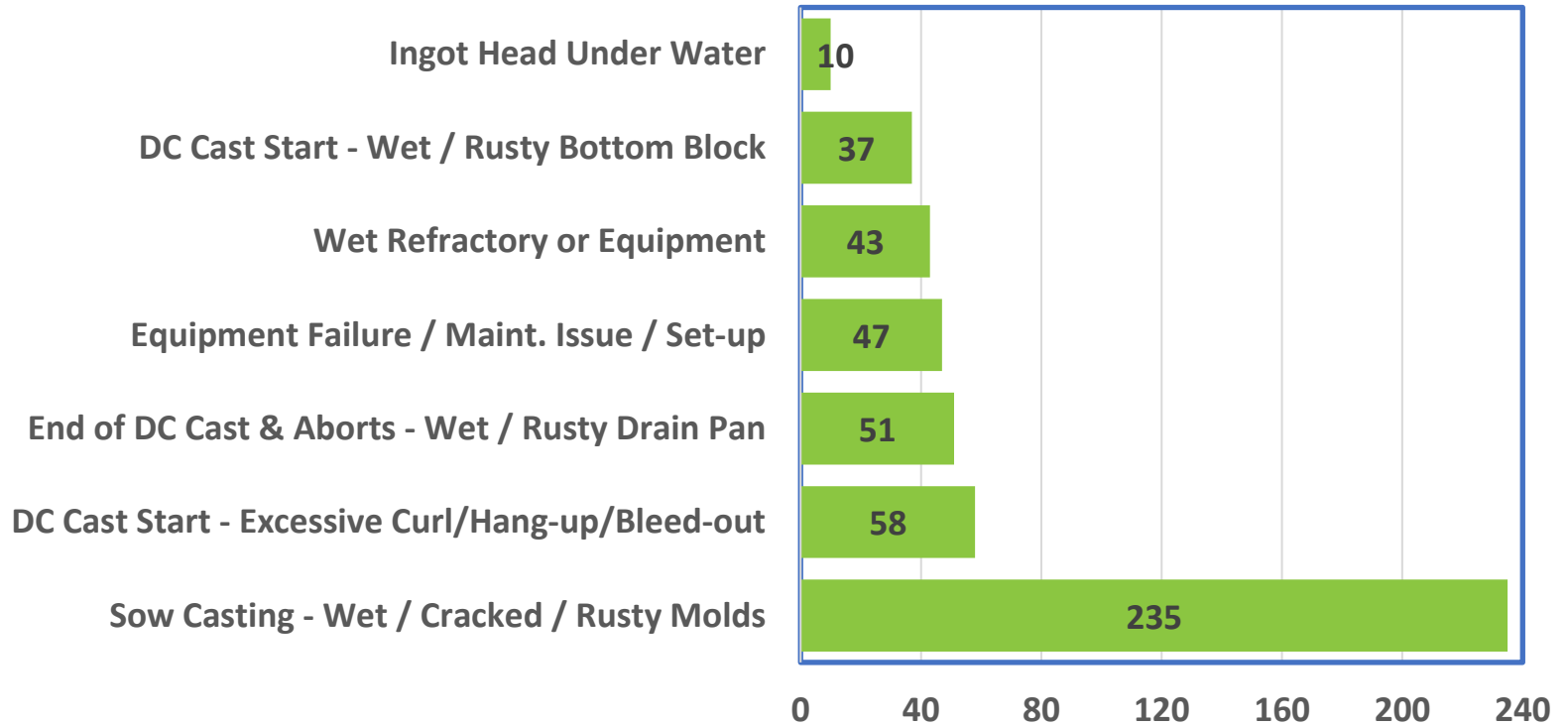


# Major Causes of 62 Casting Incidents – 2023

- DC Start-up Issues: Wet Starting Blocks, Wet Equipment, Butt Curl –Bleed-outs, Equipment Failures
- DC Steady State Issues: Power Loss / Equipment Failure
- DC Termination Issues: Wet / Rusty Drain Pan, Wet Hand Tool
- Strip / Coil Casting Termination Issues: Drain Pan Rust & Debris
- Sow / Mold Casting Issues: Wet / Unpreheated / Cracked Molds

FIGURE 26. Major Causes of Casting Incidents For 2023 Sep. 2024

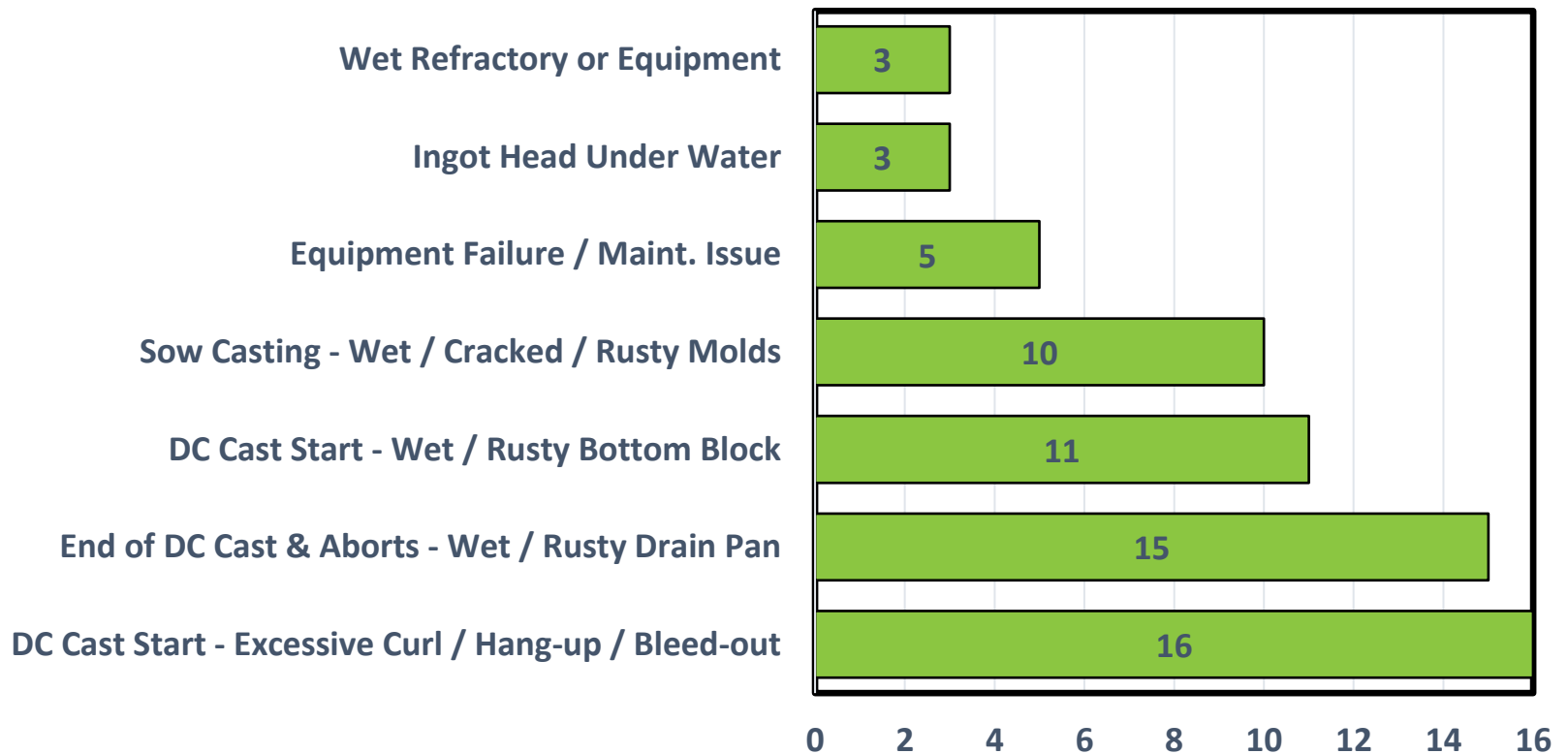
# Major Causes of Casting Explosions 2015 – 2023



**FIGURE 27. Casting Explosions by Major Causes 2015 – 2023 Sep. 2024**



# Major Causes of Force 2 & 3 Casting Explosions 2015 – 2023



**FIGURE 28. Casting Explosions by Major Causes 2015 – 2023 Sep. 2024**



# Major Causes of 42 Transfer Explosions – 2023

**25 - Wet Hand or Furnace Tools, Equipment (2 Force 2)**

**14 – Wet / Rusty Drain or Skim Pan (4 Force 2)**

**3 – Metal on Floor (1 Force 2)**

**FIGURE 29. Causes of Transfer Explosions For 2023**

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# Transfer Explosions by Equipment 1980 – 2023 (Total 927)

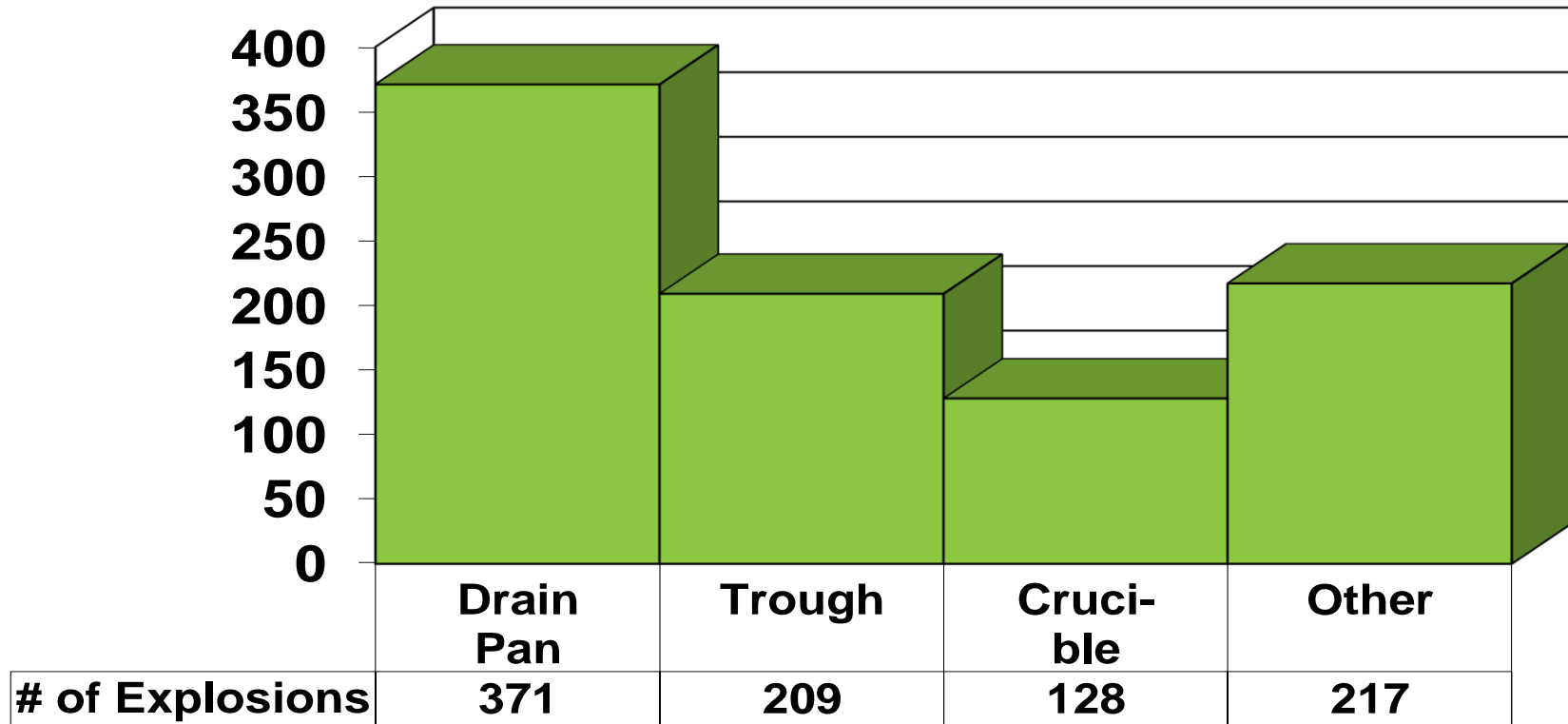
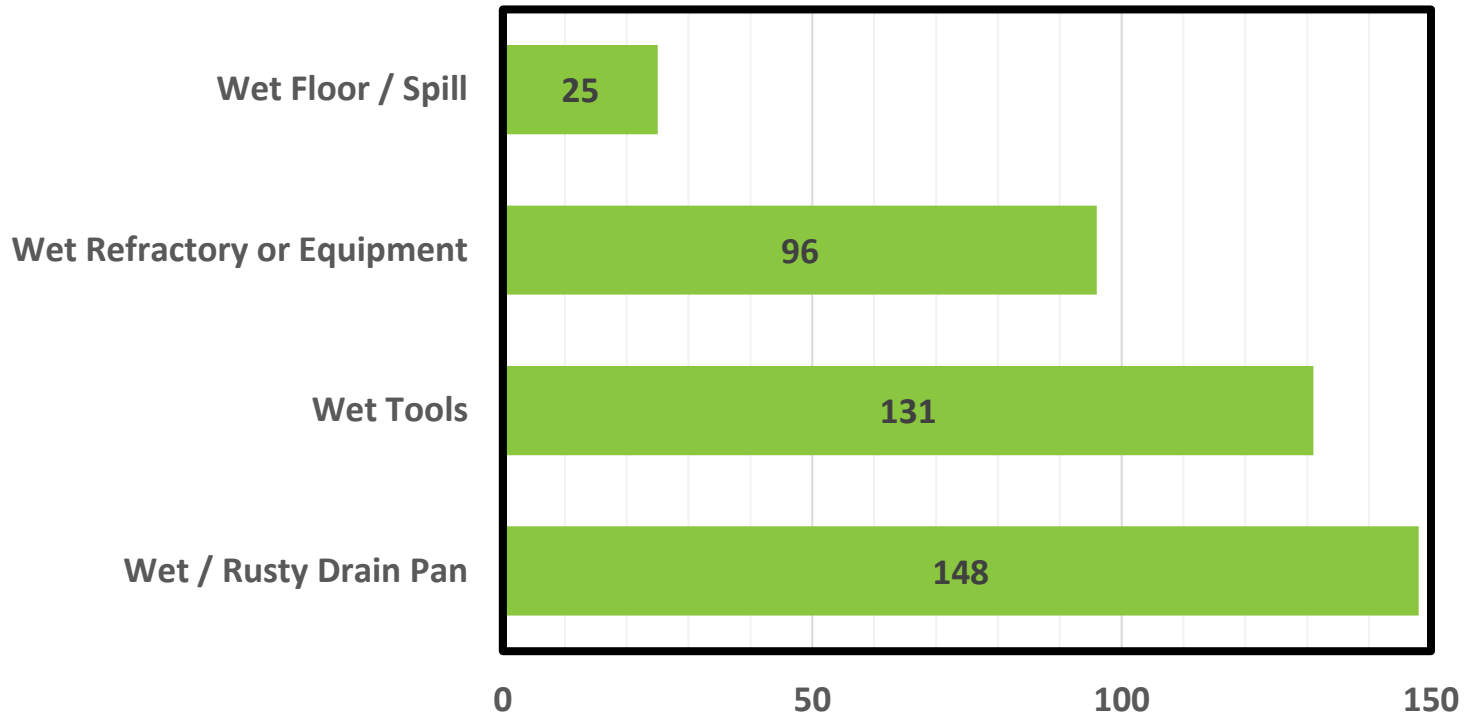


FIGURE 30. Transfer Explosions by Equipment 1980 – 2023 Sep. 2024



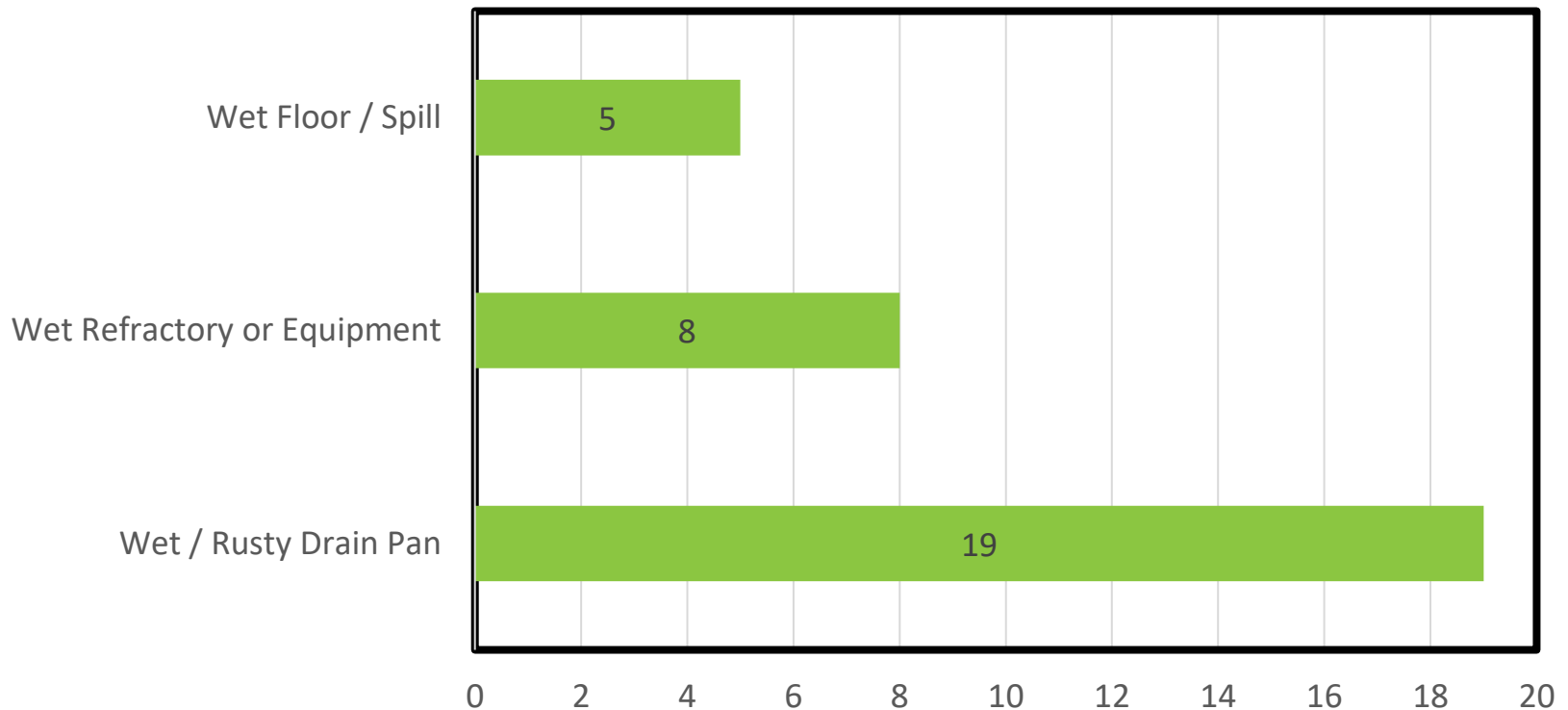


# Major Causes of Transfer Explosions 2008 – 2023 (w/o 2011)



**FIGURE 31. Transfer Explosions – Major Causes 2008 – 2023 Sep. 2024**

# Major Causes of Force 2 & 3 Transfer Explosions 2008 – 2023 (w/o 2011)



**FIGURE 32. Transfer Explosions – Major Causes 2008 – 2023** Sep. 2024

# 17 Injuries by Operation – 2023

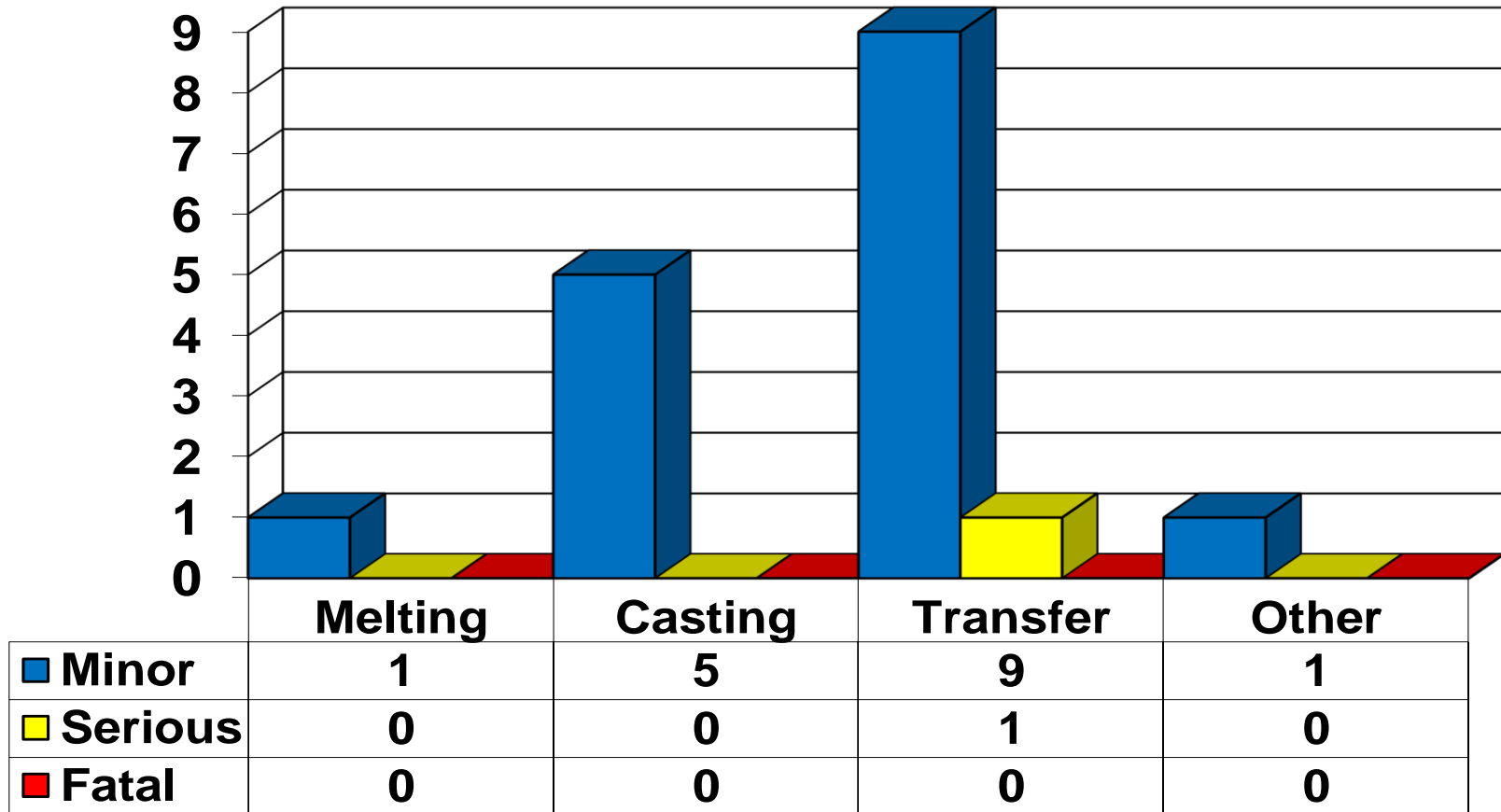
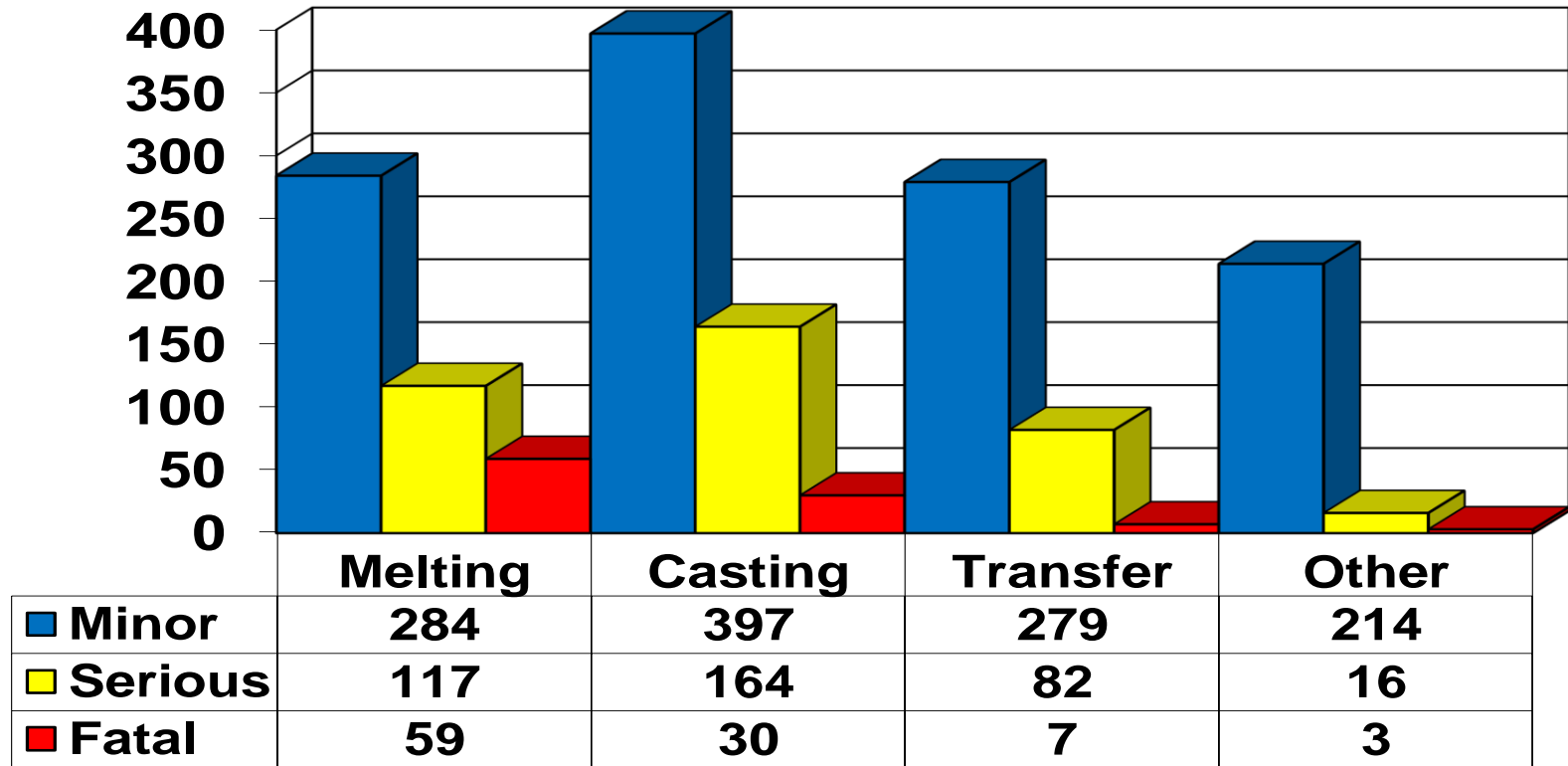


FIGURE 33. Injuries By Operation For 2023

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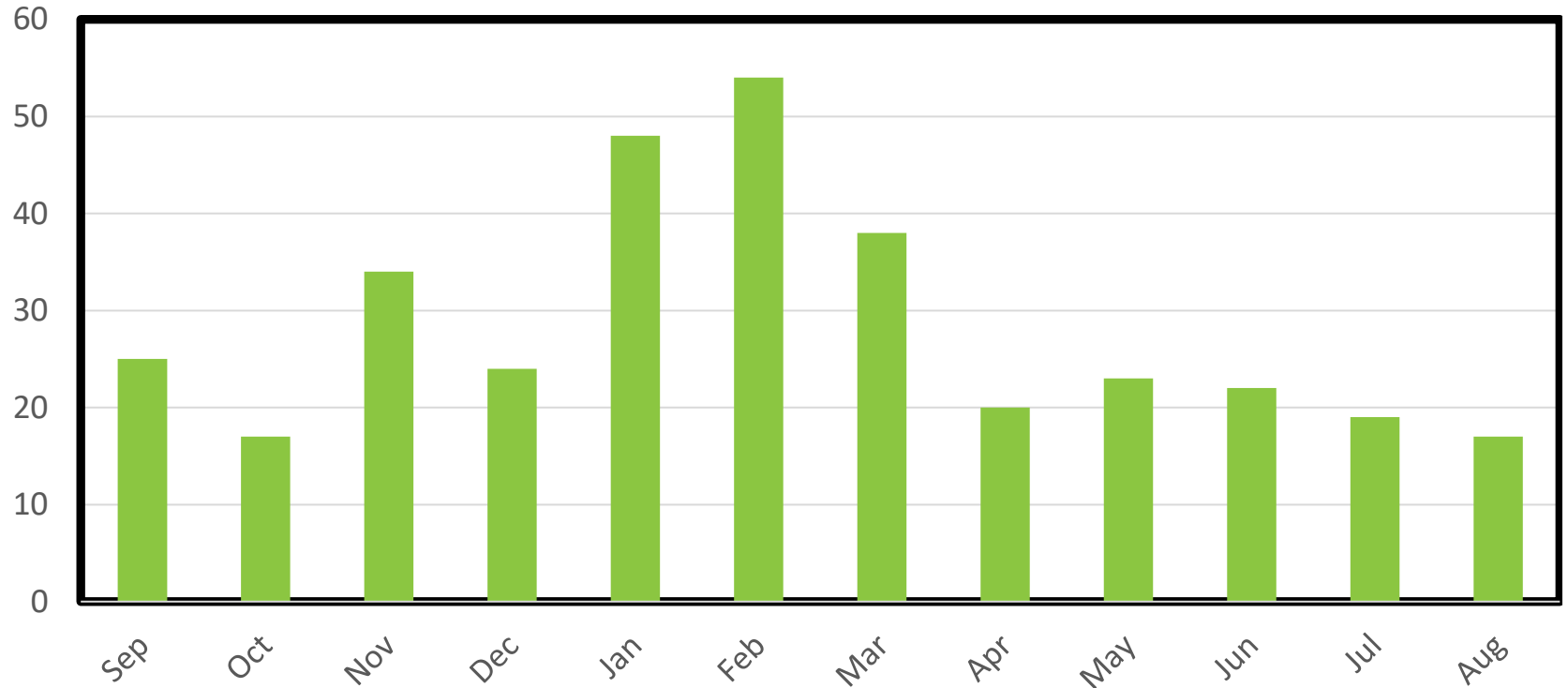
# 1652 Injuries by Operation: 1980 – 2023



**FIGURE 34. Injuries By Operation For 1980 – 2023 Sep. 2024**



# Melting Explosions By Month 2017 – 2023

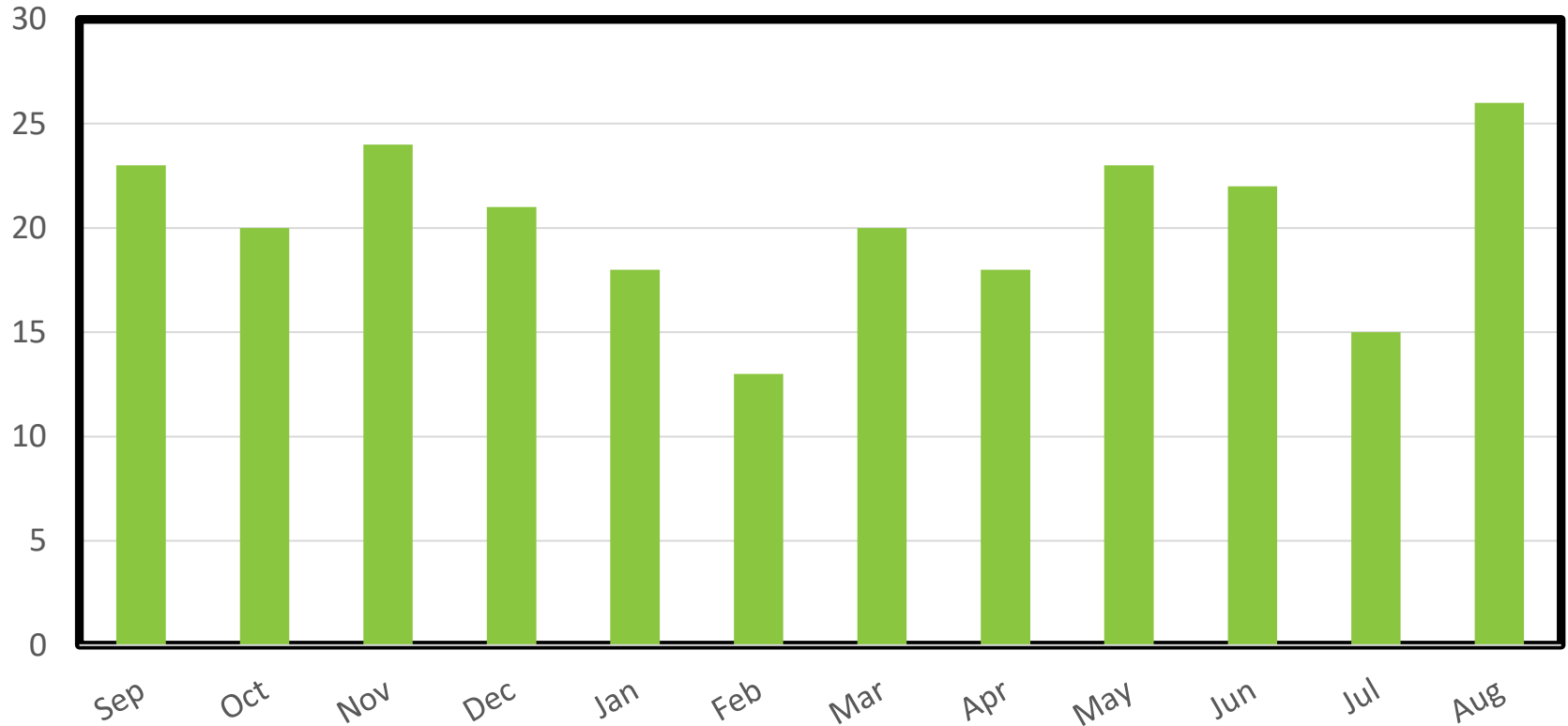


**FIGURE 35. Melting Explosions By Month 2017 – 2023**

**Sep. 2024**



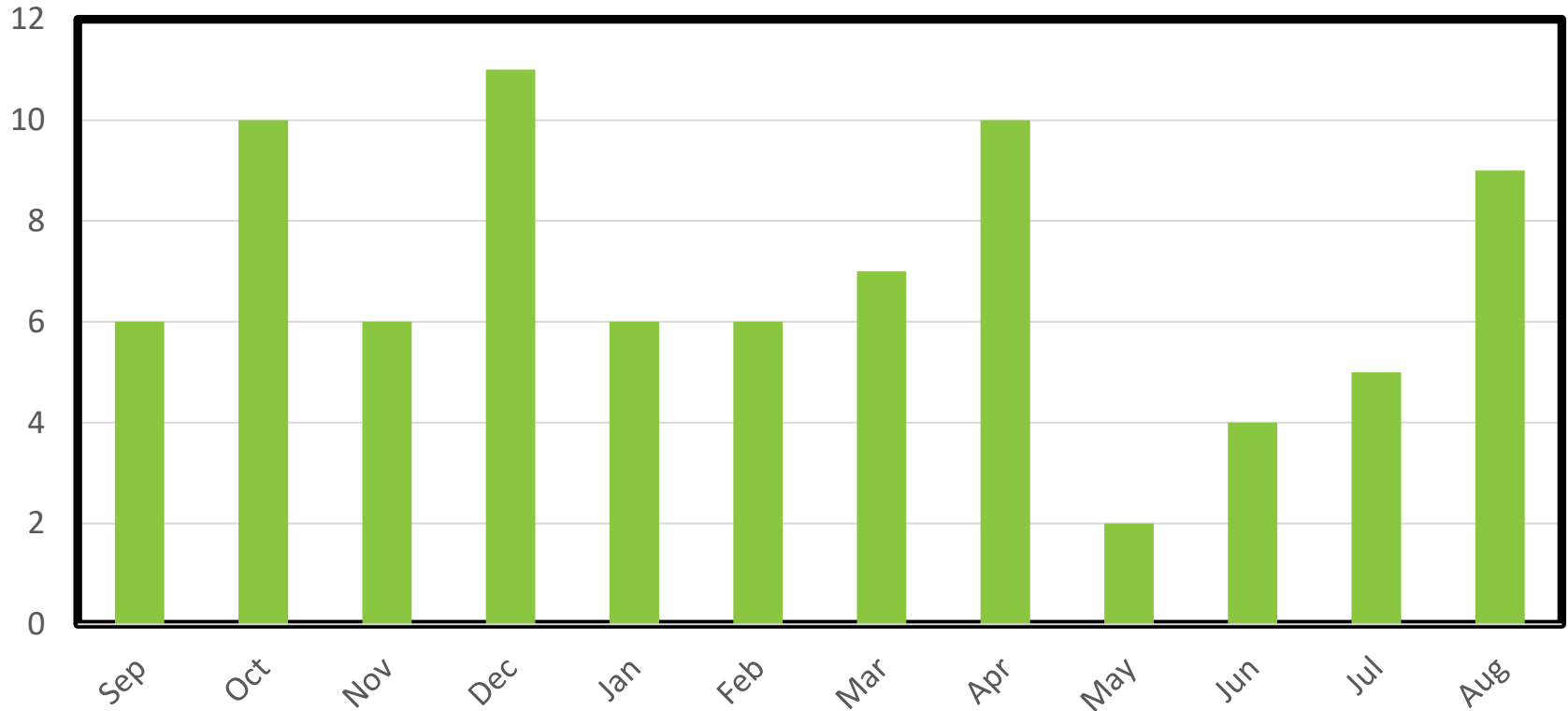
# Casting Explosions By Month 2017 – 2023



**FIGURE 36. Casting Explosions By Month 2017 – 2023      Sep. 2024**



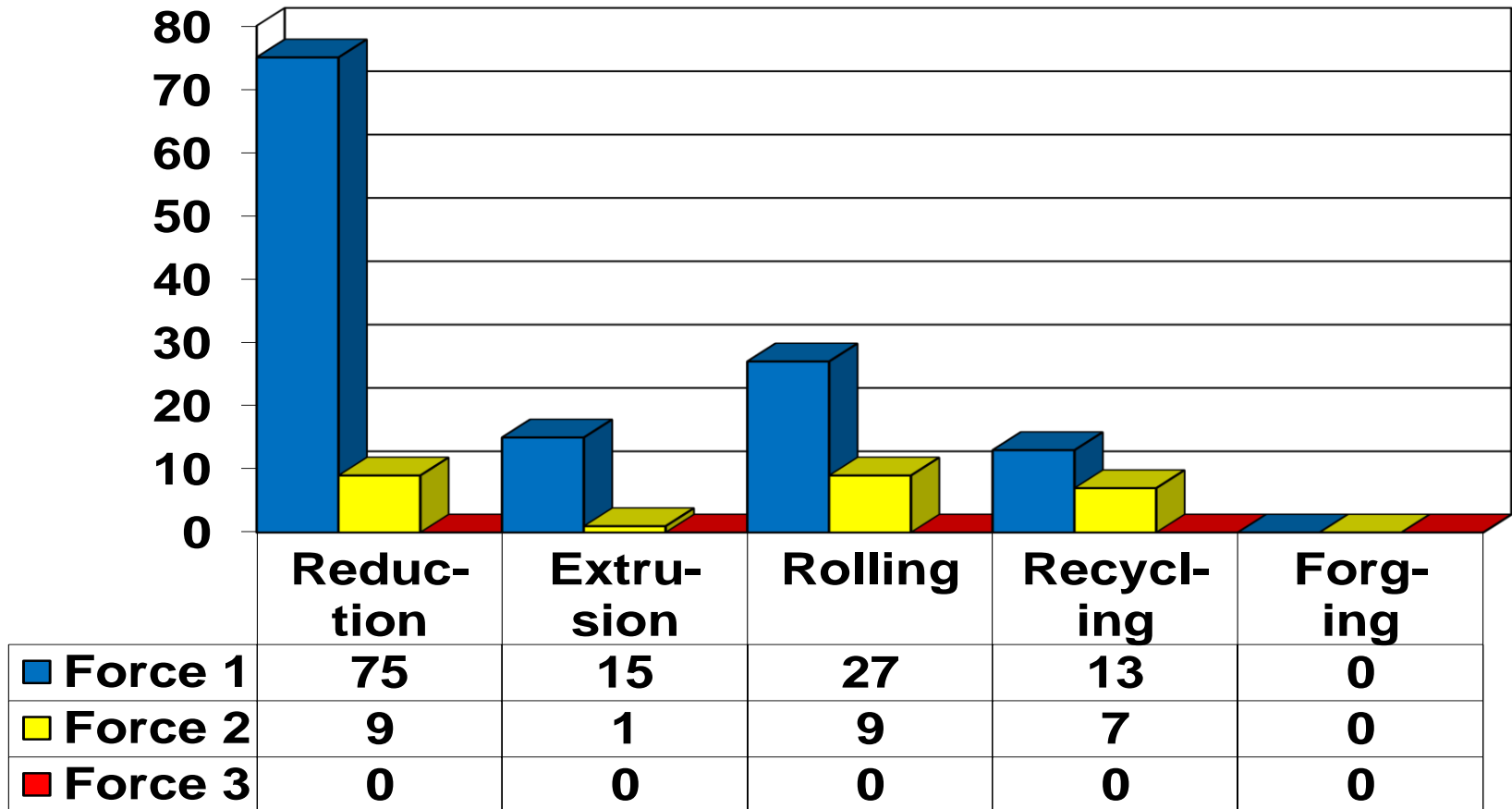
# Transfer Explosions By Month 2017 – 2023



**FIGURE 37. Transfer Explosions By Month 2017 – 2023      Sep. 2024**



# Force Level By Process Plant – 2023



**FIGURE 38. Force Level By Process Plant Reported For 2023 Sep. 2024**





# Force Level By Process Plant

## 1980 – 2023

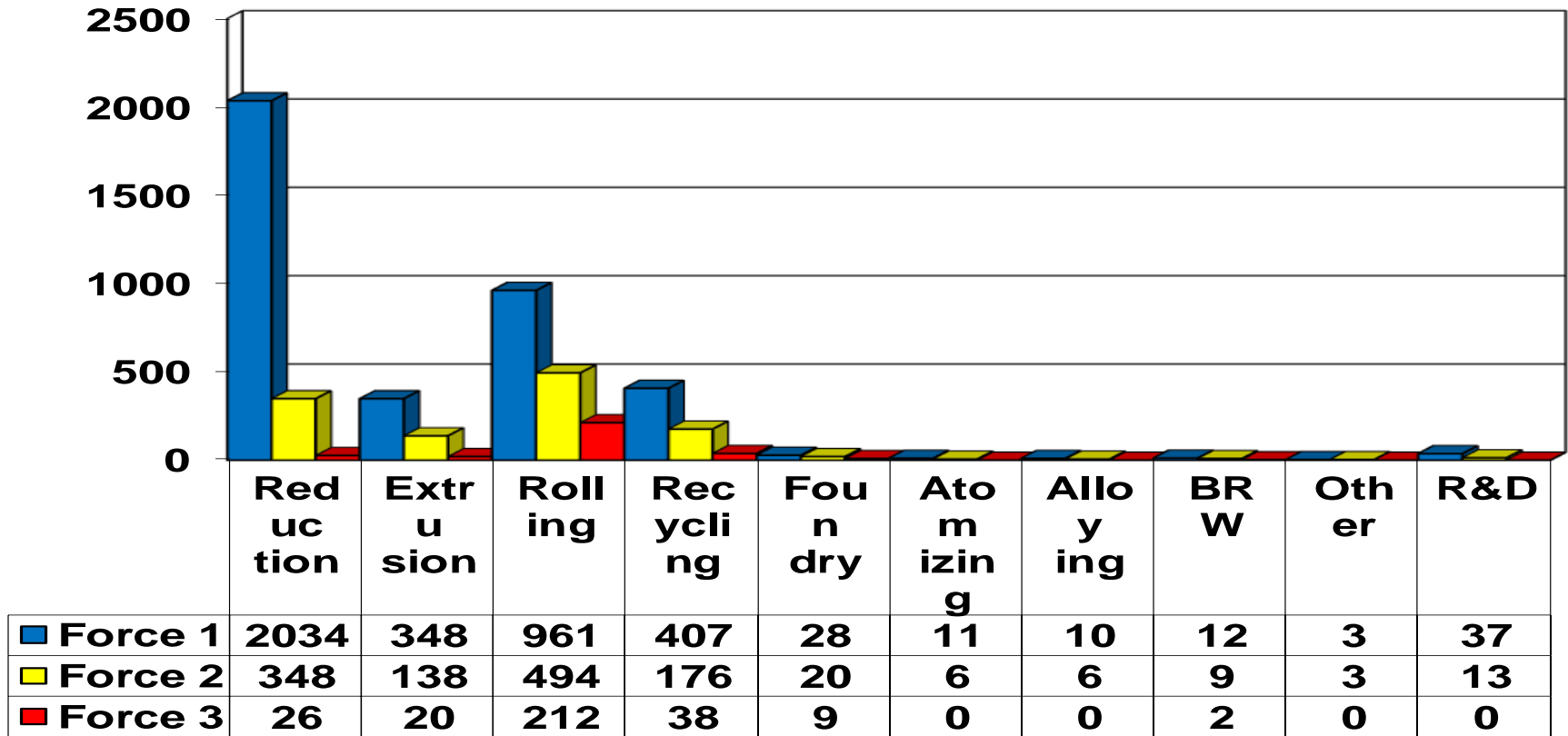


FIGURE 39. Force Level By Process Plant Reported For 1980 – 2023 Sep. 2024



# Reduction Plant

## Main Causes of 84 Incidents – 2023

Melting Incidents	Casting Incidents
<b>4 – Wet Charge: Scrap / Sow</b> <b>2 – Wet Charge: Wet RSI</b> <b>2 – Wet Tool</b> <b>1 – Wet Alloy</b>	<b>Sow Casting:</b> <b>33 – Cracked, Wet or Rusty Molds</b> <b>1 – Tool Maintenance</b>
	<b>VDC – Billet &amp; Slab</b> <b>4 –Start-up – Wet Refractory / Equip.</b> <b>2 –Termination – Wet/Rusty Drain Pan</b> <b>1 – Termination – Hand Tool</b> <b>1 – SOP Unadapted or Not Respected</b>

**FIGURE 40. Reduction Plant Incidents Summary 2023**  
**Sep. 2024**



# Reduction Plant

## Main Causes of 84 Incidents – 2023

Transfer Incidents	Reduction Cell
12 – Wet Tools & Equipment	3 – Contact with Wet Alumina
7 –Wet Refractory / Equip.	2 – Wet Tool
6 –Wet / Rusty Drain or Skim Pan	1 – Wet Anode
1 – Crucible	1 – Spill on Wet Ground
1 – Rusty Mold	1 – Wet Tabular
1- Spill on Concrete	

FIGURE 41. Reduction Plant Incidents Summary 2023

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# Recycling Plant

## Main Causes of 21 Incidents – 2023

Melting Incidents	Casting Incidents
14 - Wet Charge: Scrap, Sow, Dross (6/14 – Force 2)	Sow Casting: 1 - Wet Mold (Force 2)
Transfer Incidents 1 - Wet Tool	VDC – Slab: 1 - Start-up – Wet Bottom Block 1 - Start-up – Bleedout

**FIGURE 42. Recycling Plant Incidents Summary 2023  
Sep. 2024**



# Reduction Plant Injuries & Incident Causes – 2023

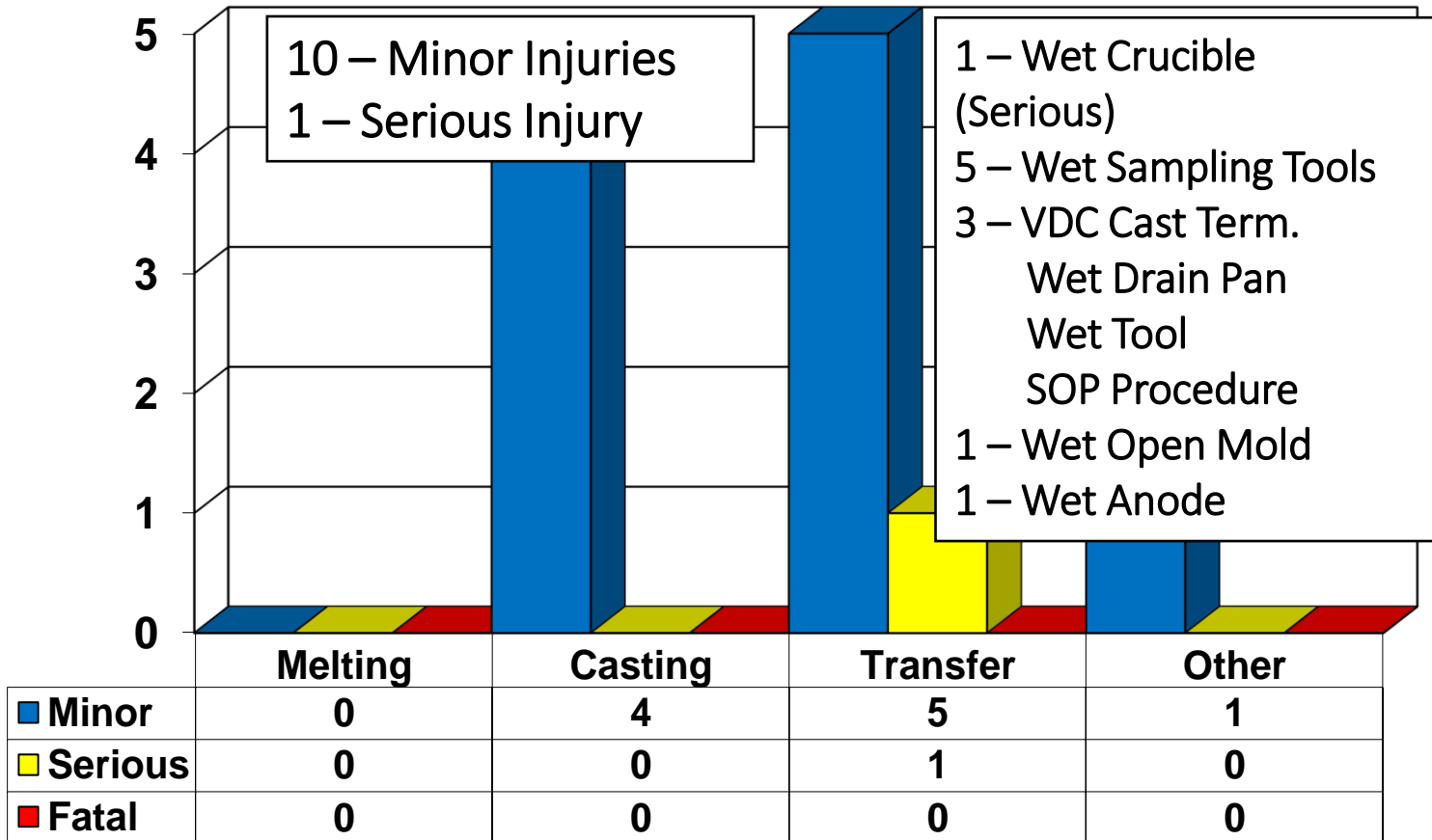


FIGURE 43. Reduction Plant Injuries By Operation 2023Sep. 2024



# Rolling Plant Injuries – 2023

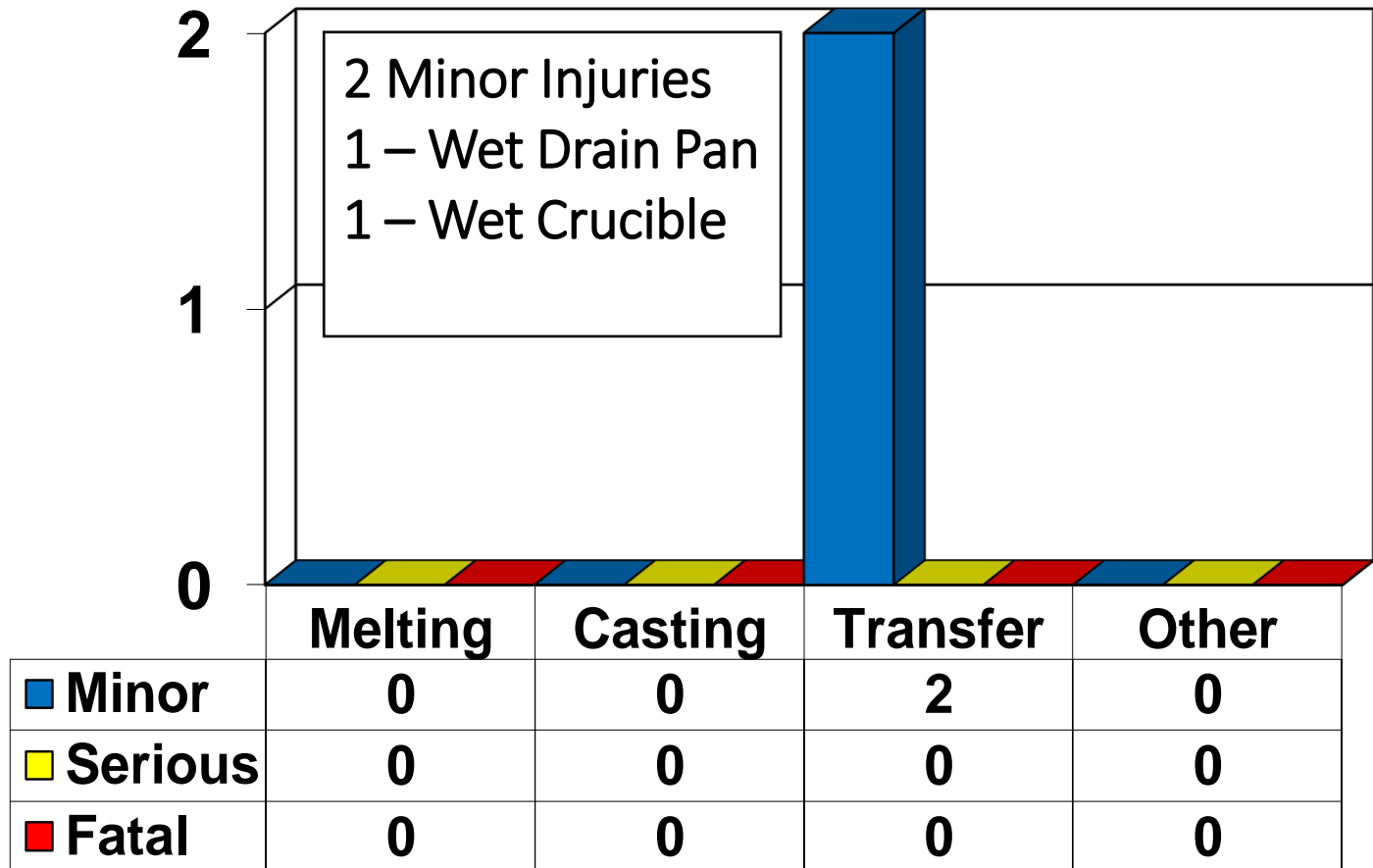
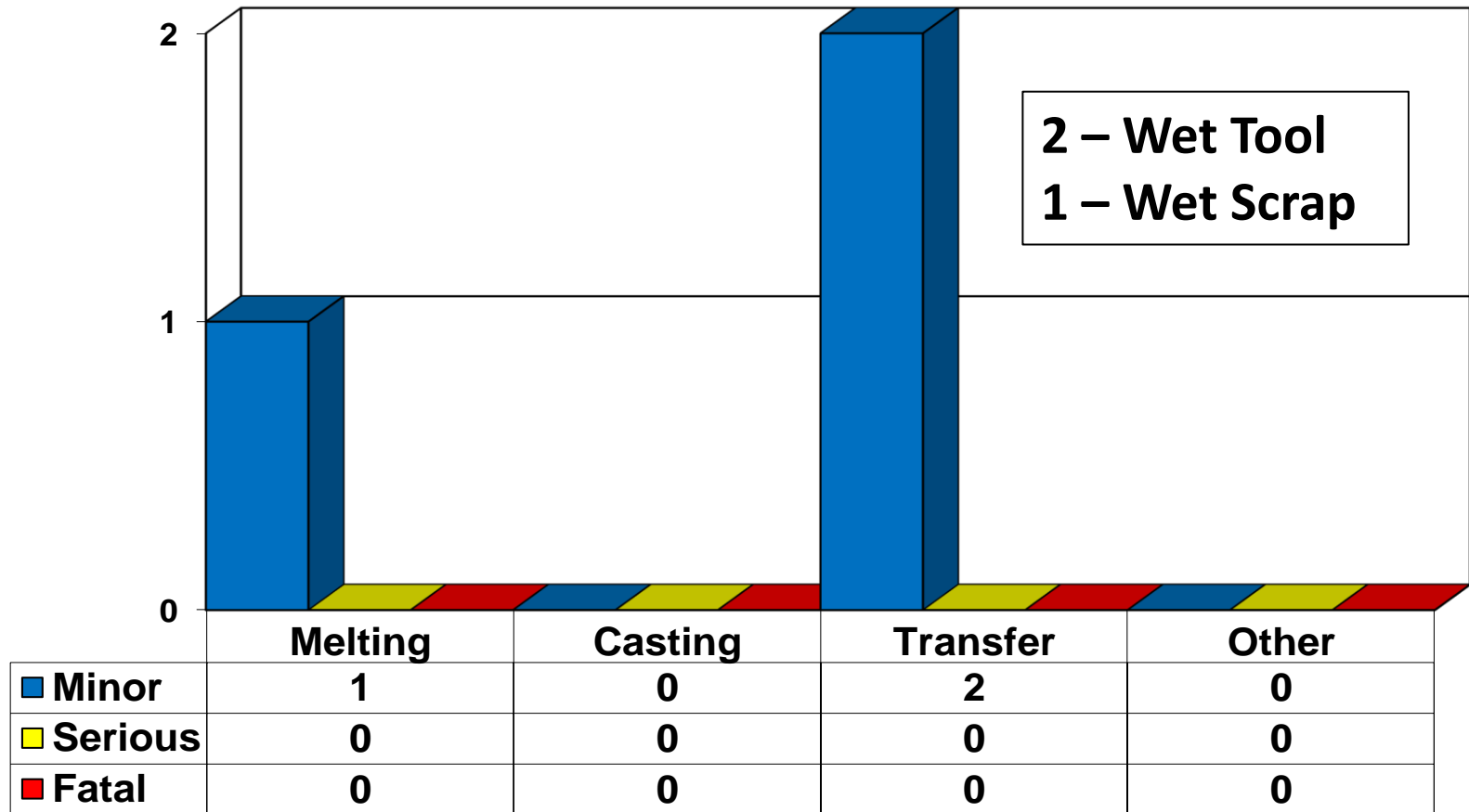


FIGURE 44. Rolling Plant Injuries By Operation 2023 Sep. 2024



# Extrusion Plant Injuries – 2023



**FIGURE 45. Extrusion Plant Injuries By Operation 2023**  
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# Recycling Plant Injuries – 2023

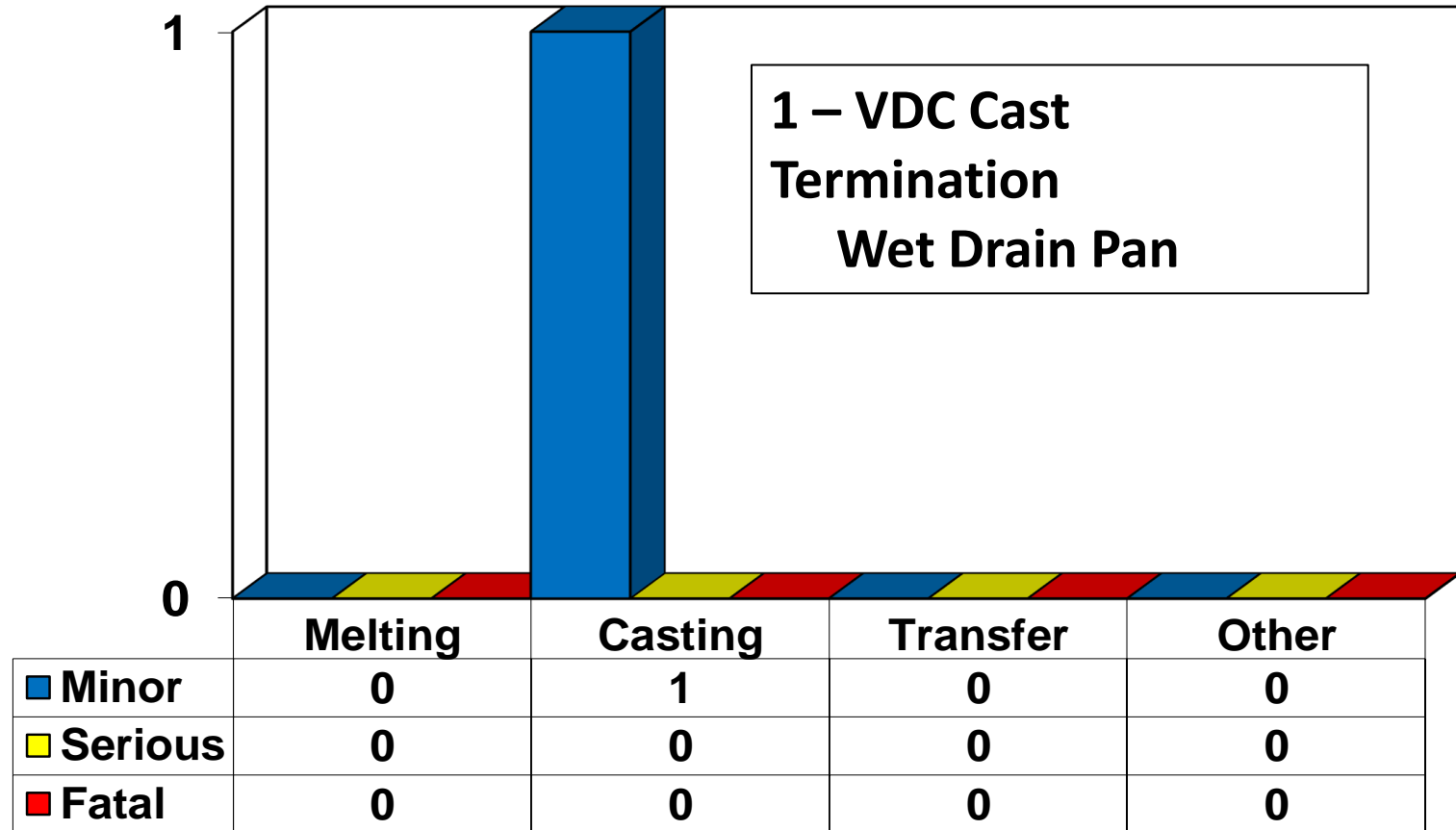


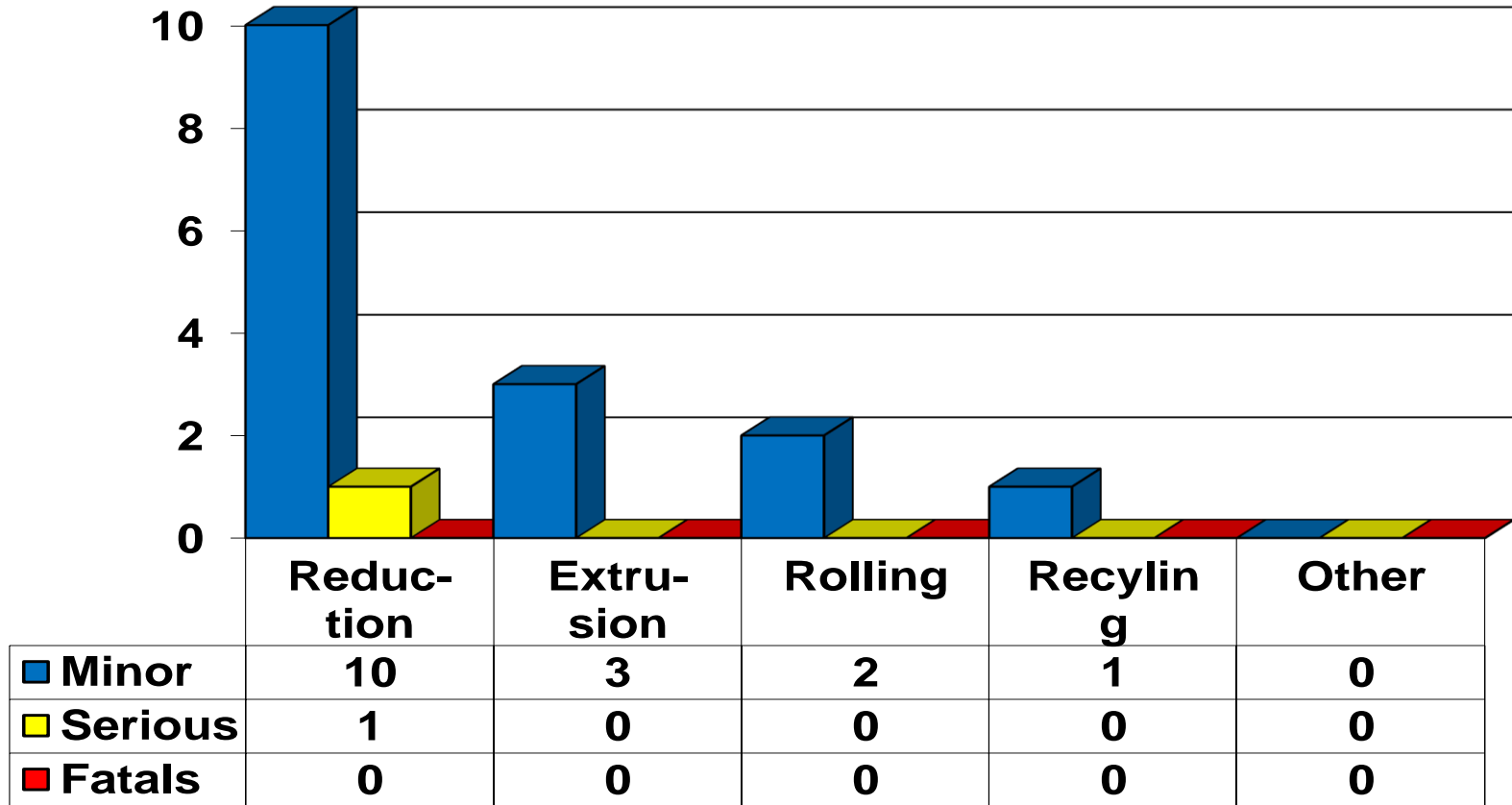
FIGURE 46. Recycling Plant Injuries By Operation 2023

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# Injury Severity by Process Plant – 2023

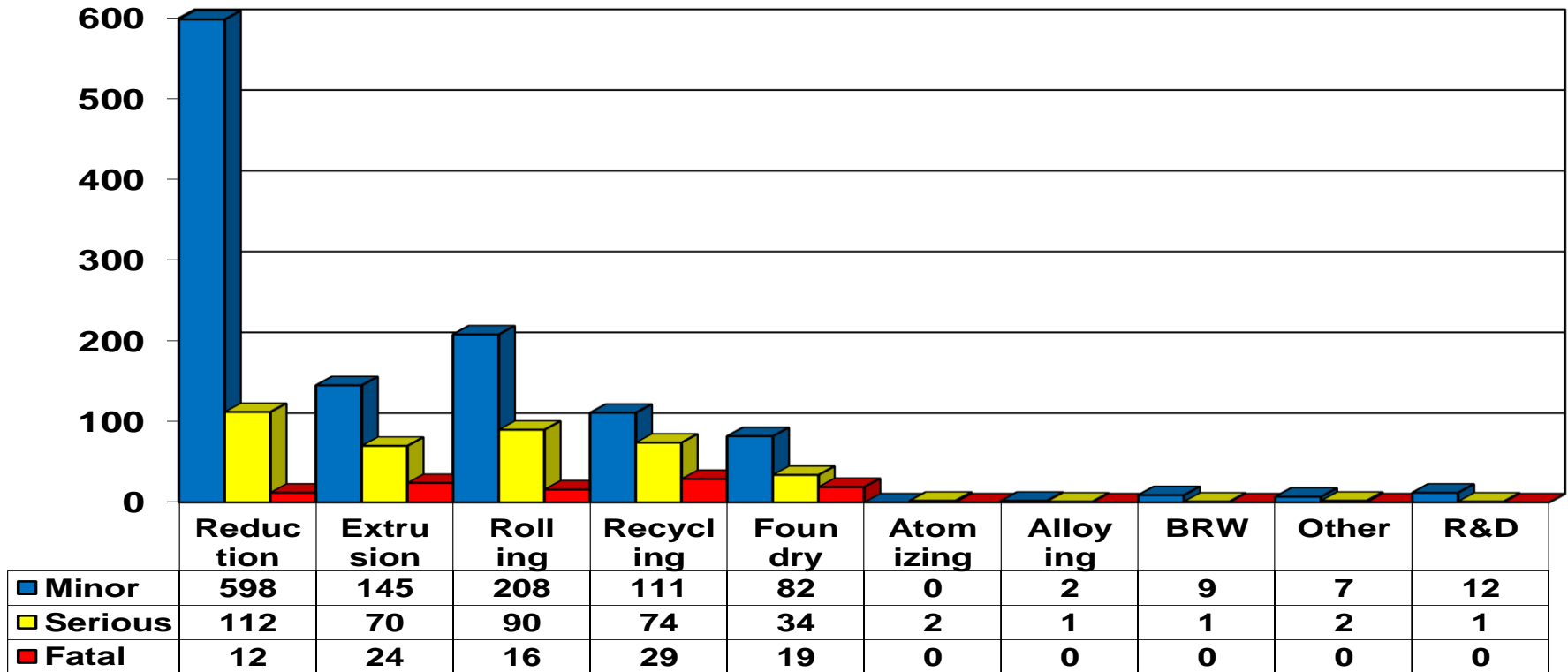


**FIGURE 47. Injury Severity By Process Plant – 2023** Sep. 2024



# Injury Severity by Process Plant

## 1980 – 2023

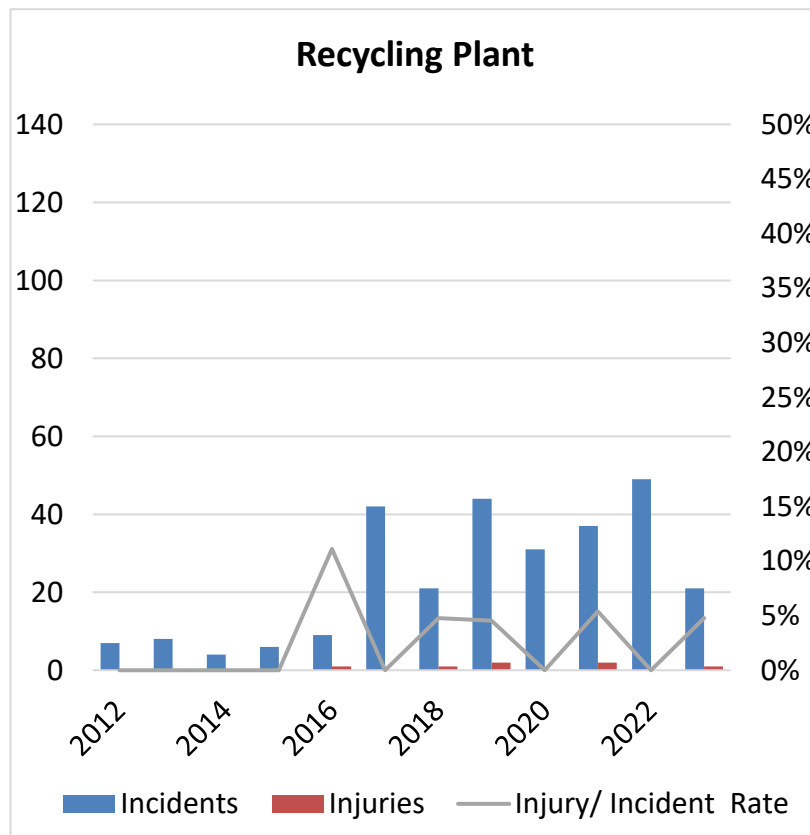
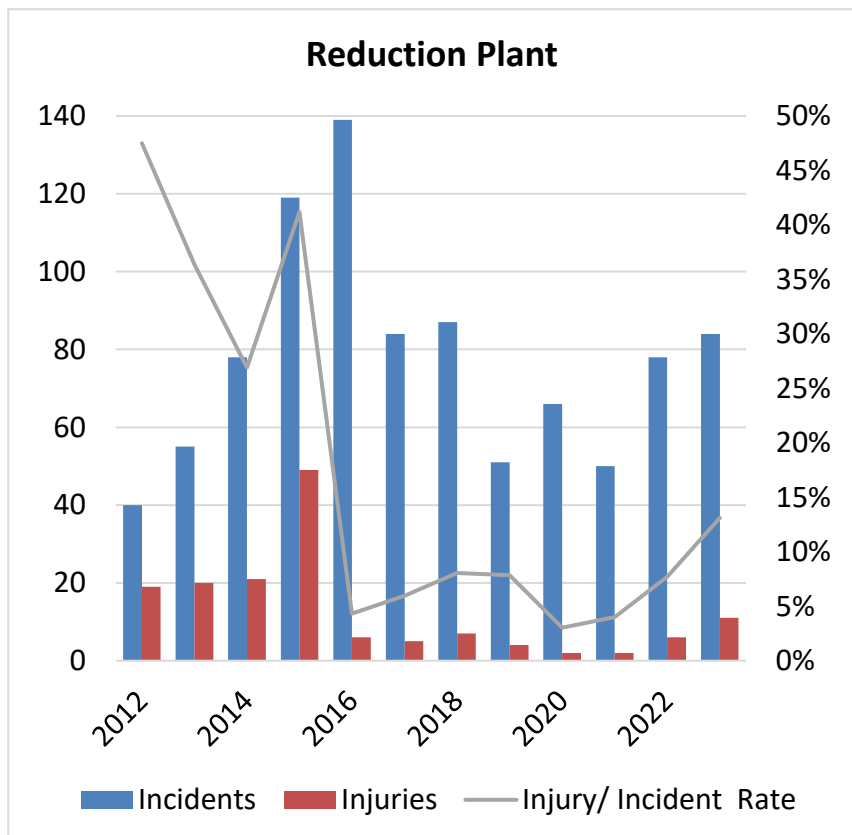


**FIGURE 48. Injuries Severity By Plant Reported For 1980 – 2023 Sep. 2024**



# Reduction & Recycling Plant Incidents, Injuries / Incident Rate

## 2012 – 2023



**FIGURE 49. Reduction & Recycling Incident, Injury & Injury Rate 2012-2023 Sept. 2024**



# Rolling & Extrusion Plant Incidents, Injuries / Incident Rate

## 2012 – 2023

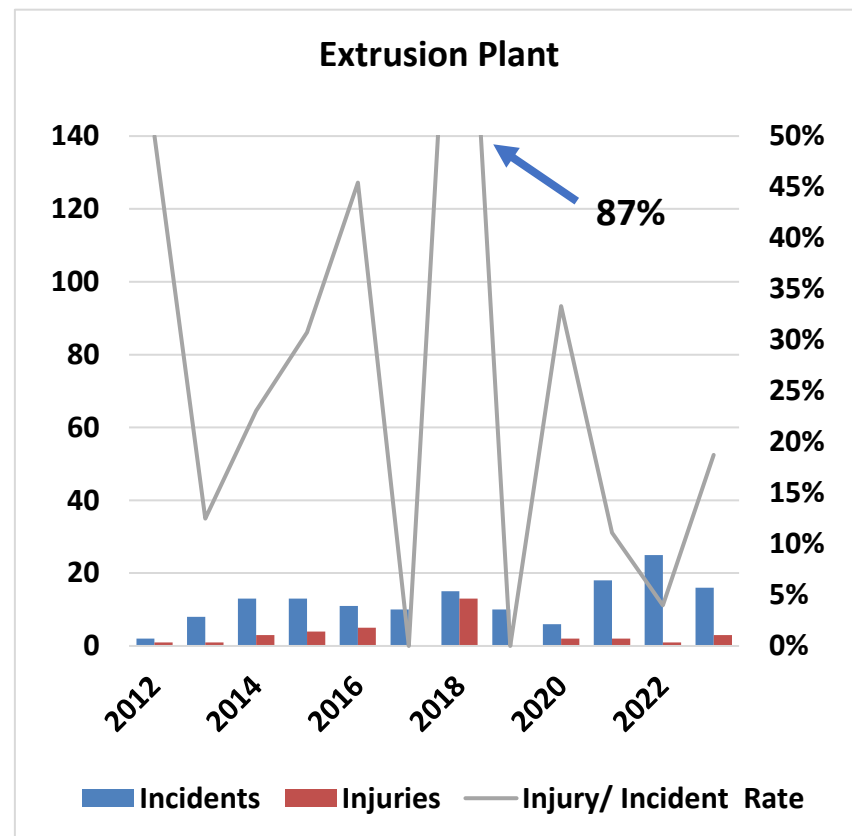
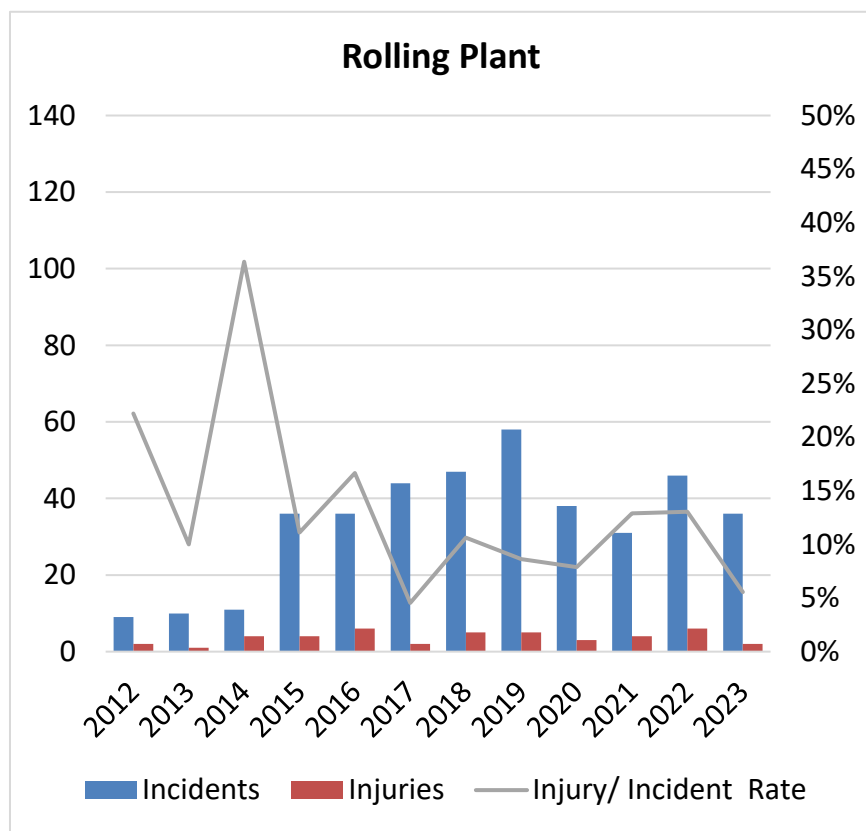


FIGURE 50. Rolling & Extrusion Incident, Injury & Injury Rate 2012-2023 Sept. 2024



# Thank you!

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