

Annual Summary of Molten Metal Incidents in 2023

September 2024



Explosion Rating Force Criteria



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

TABLE 1. Explosion Rating Force Criteria

Sep. 2024



Incidents by Year

1981 – 2023 (Total 4693)

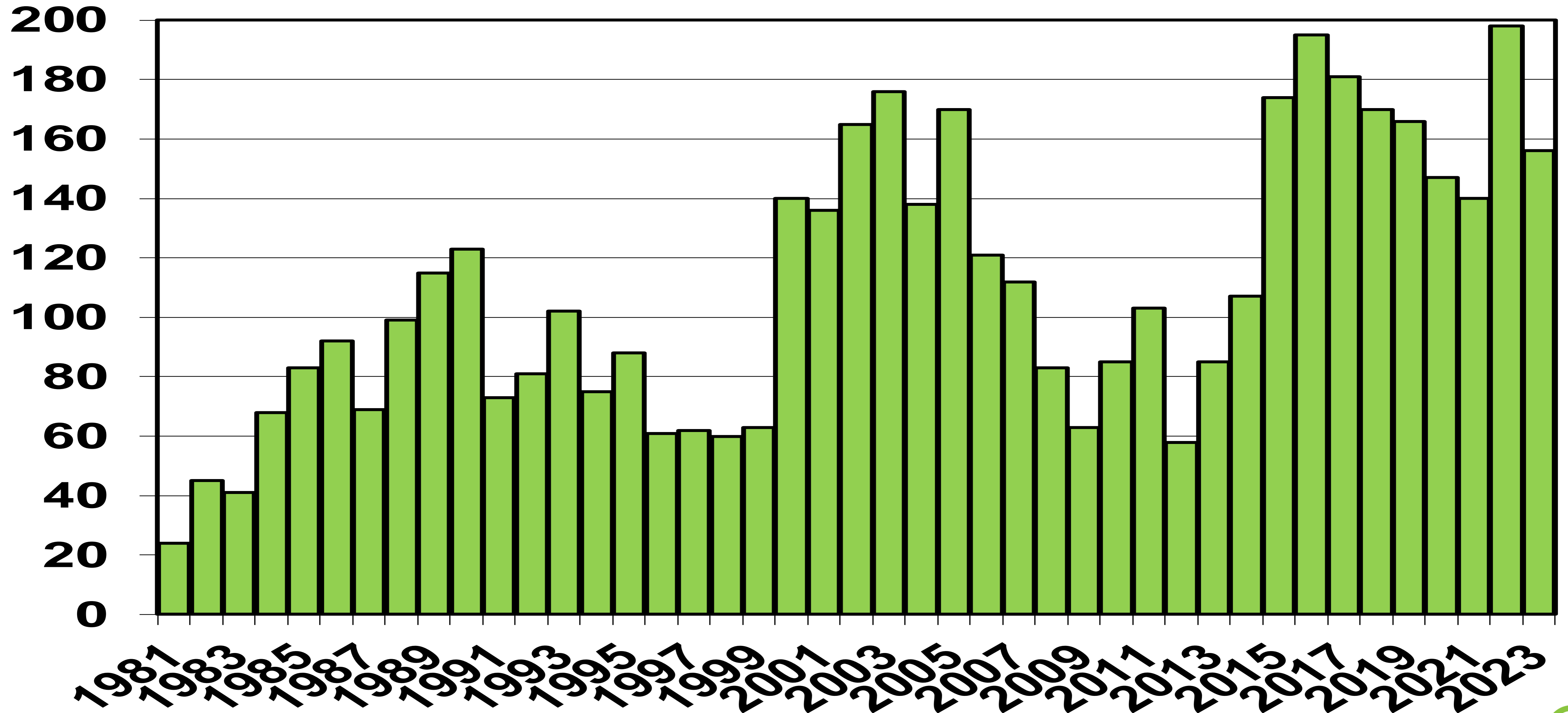


FIGURE 1. Incidents Reported For The Period 1981 – 2023

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Incidents by Force Level 1981 – 2023 (Total 4693)

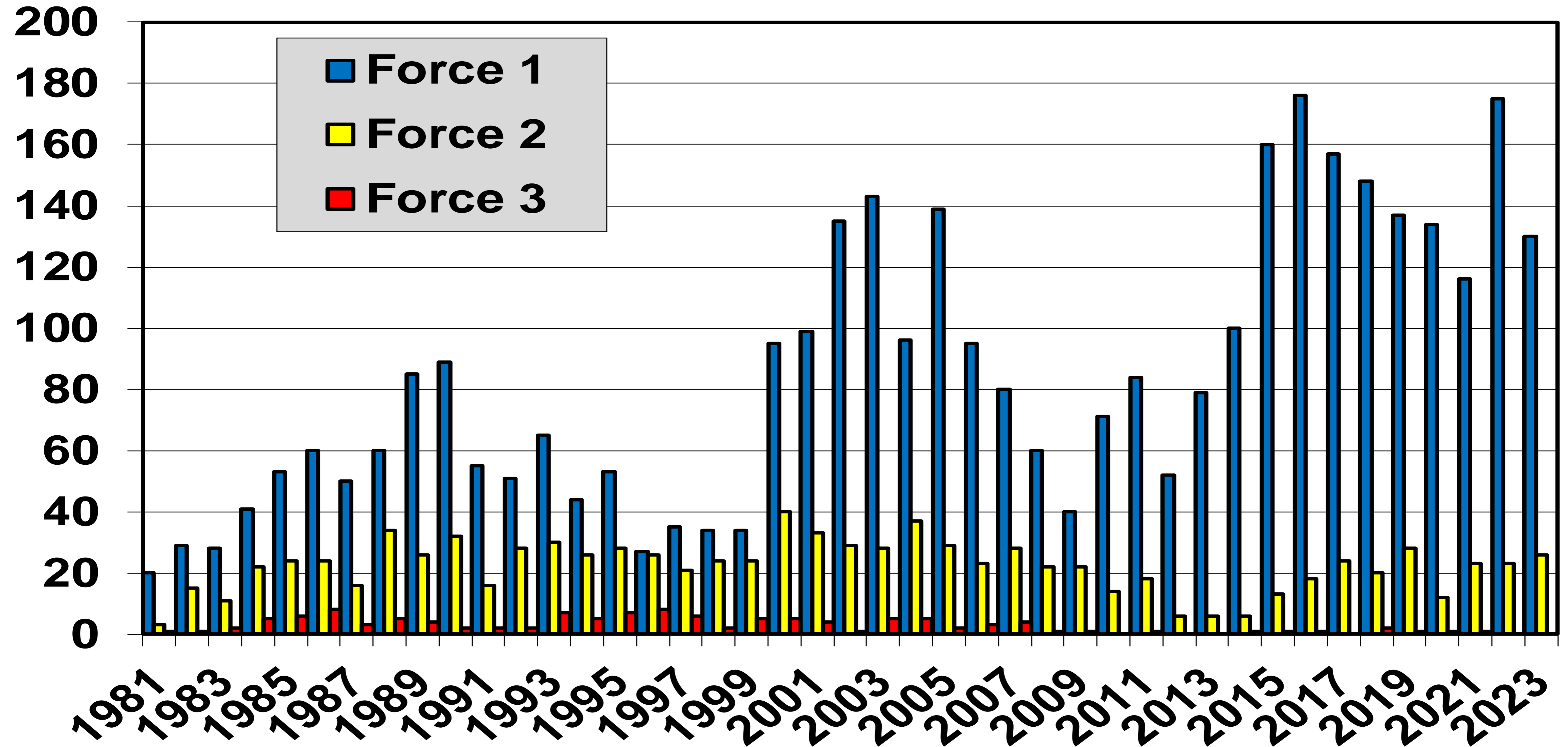


FIGURE 2. Incidents By Force Level 1981 – 2023

Sep. 2024



Incidents by Force Levels 2 & 3 1981 – 2023

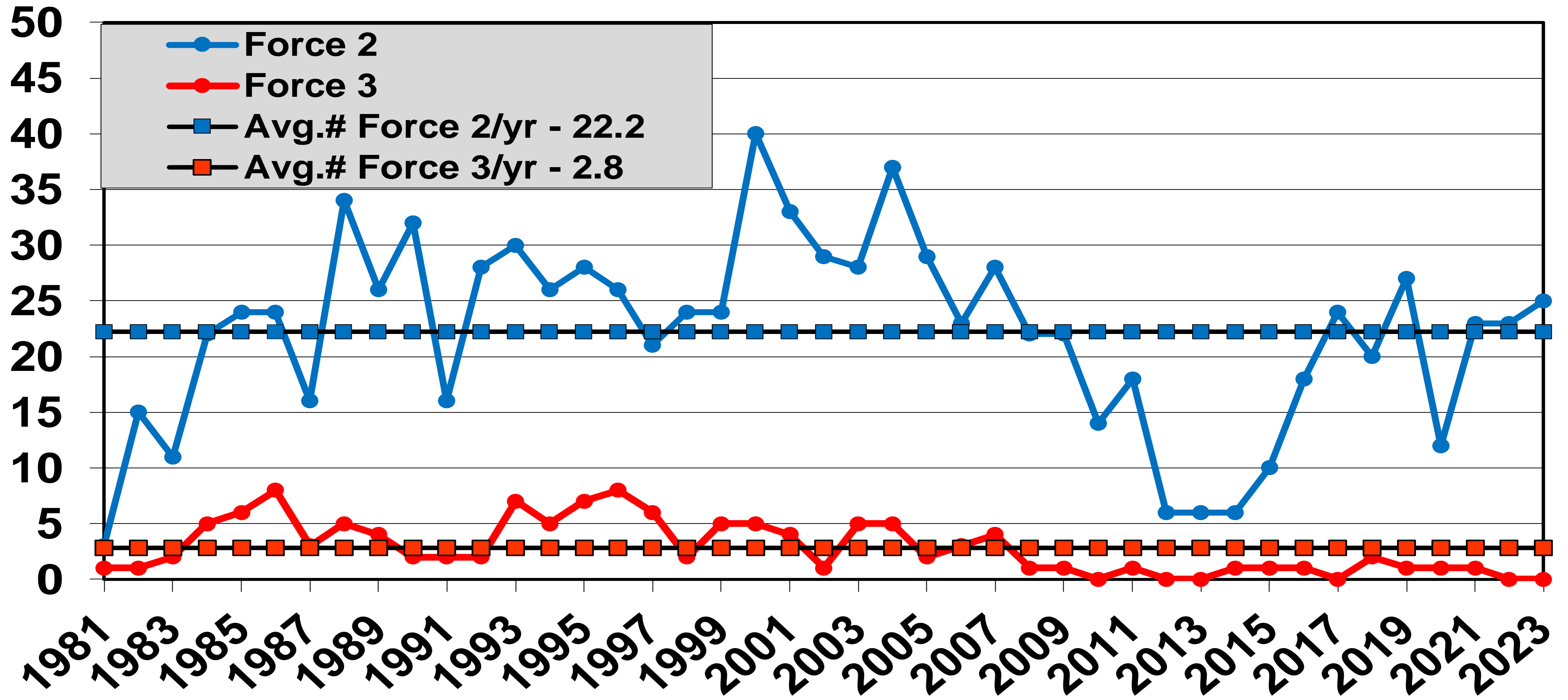


FIGURE 3. Incidents By Force Levels 2 & 3 For 1981 – 2023

Sep. 2024



Force 3 Incidents Only 1981 – 2023

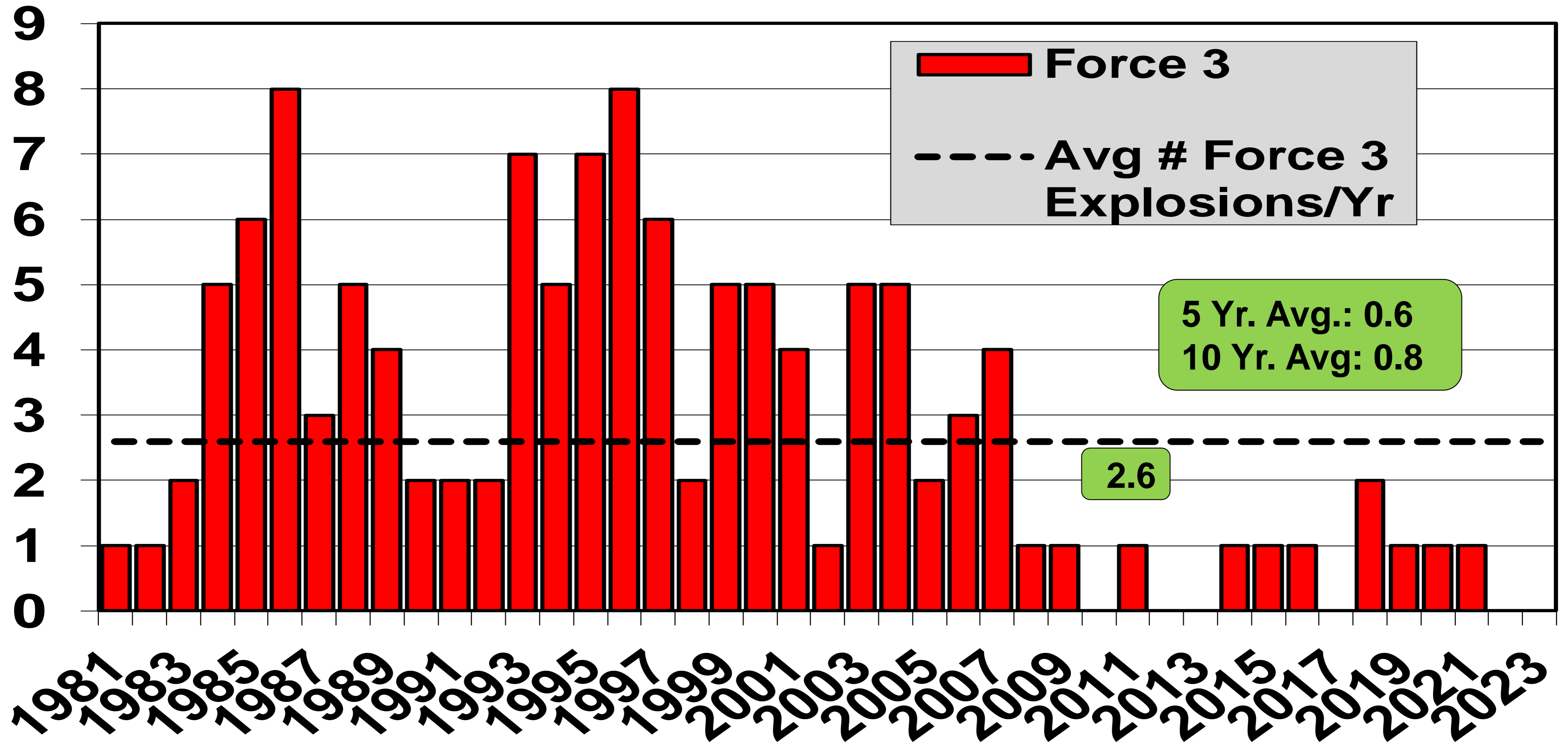


FIGURE 4. Force 3 Incidents For 1981 – 2023

Sep. 2024



Incidents by Force Level 1981 – 2023 (Total 4693)

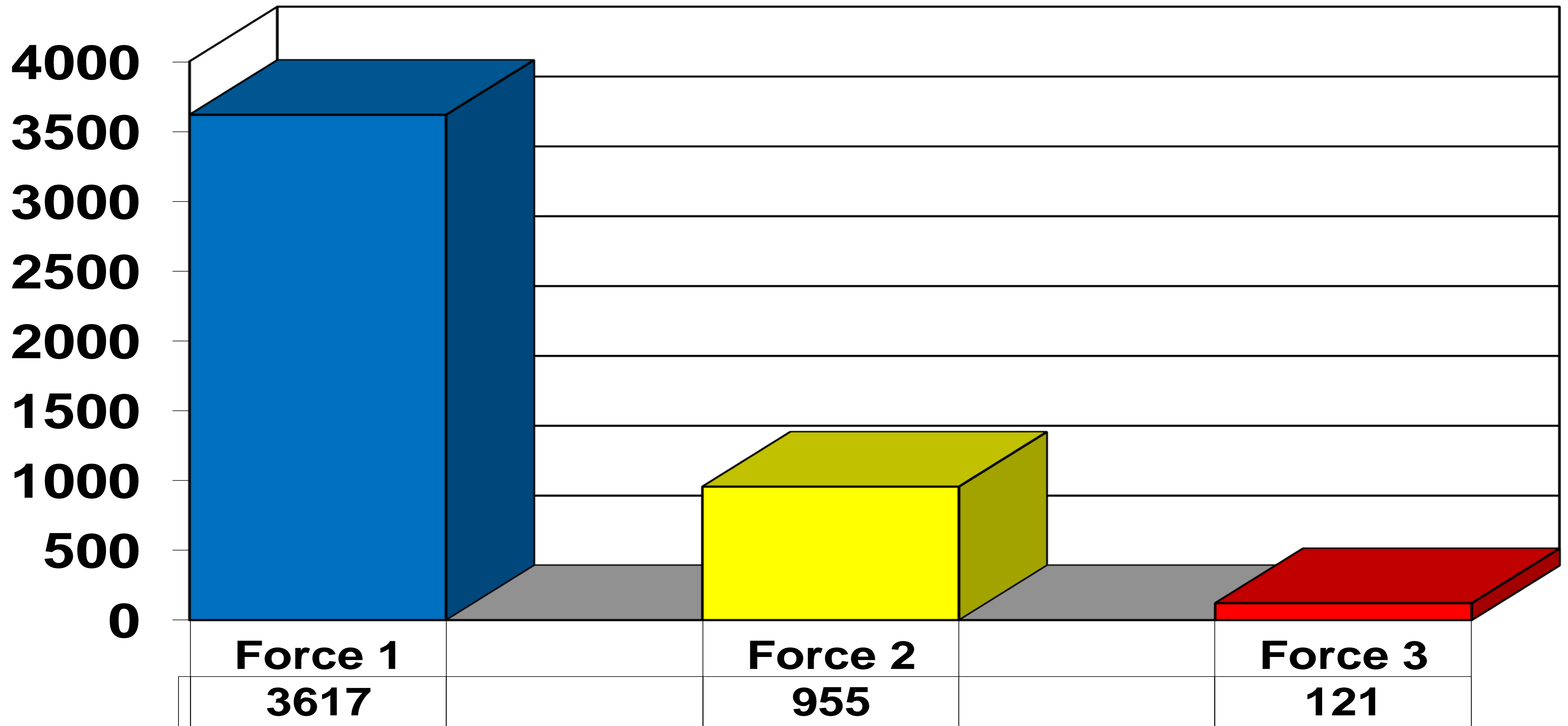


FIGURE 5. Incidents By Force Level 1981 – 2023



All Force Levels by Percentage 1981 – 2023

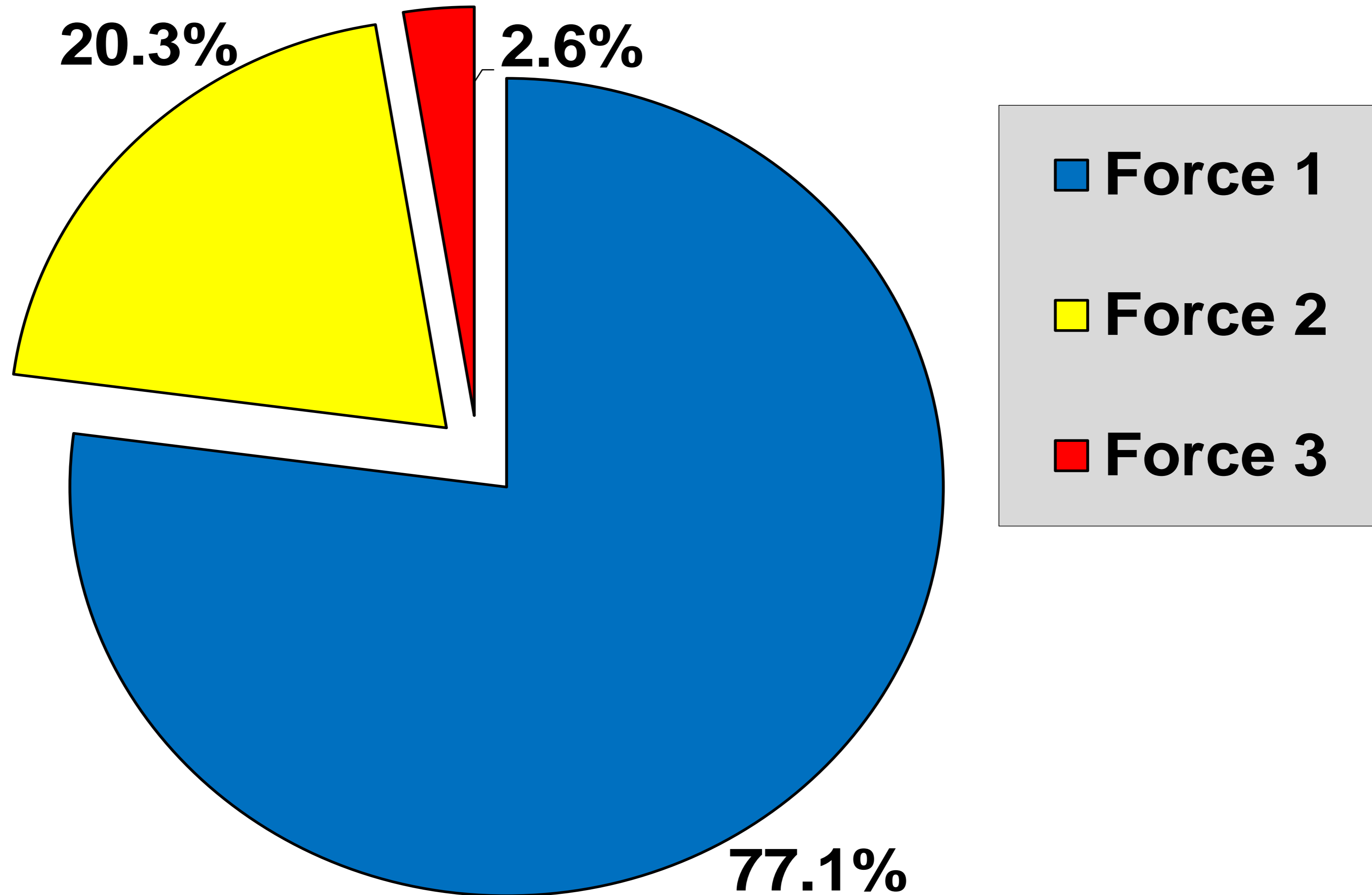


FIGURE 6. All Force Levels By Percentage 1981 – 2023



Injuries from Incidents 1981 – 2023 (Total 1645)

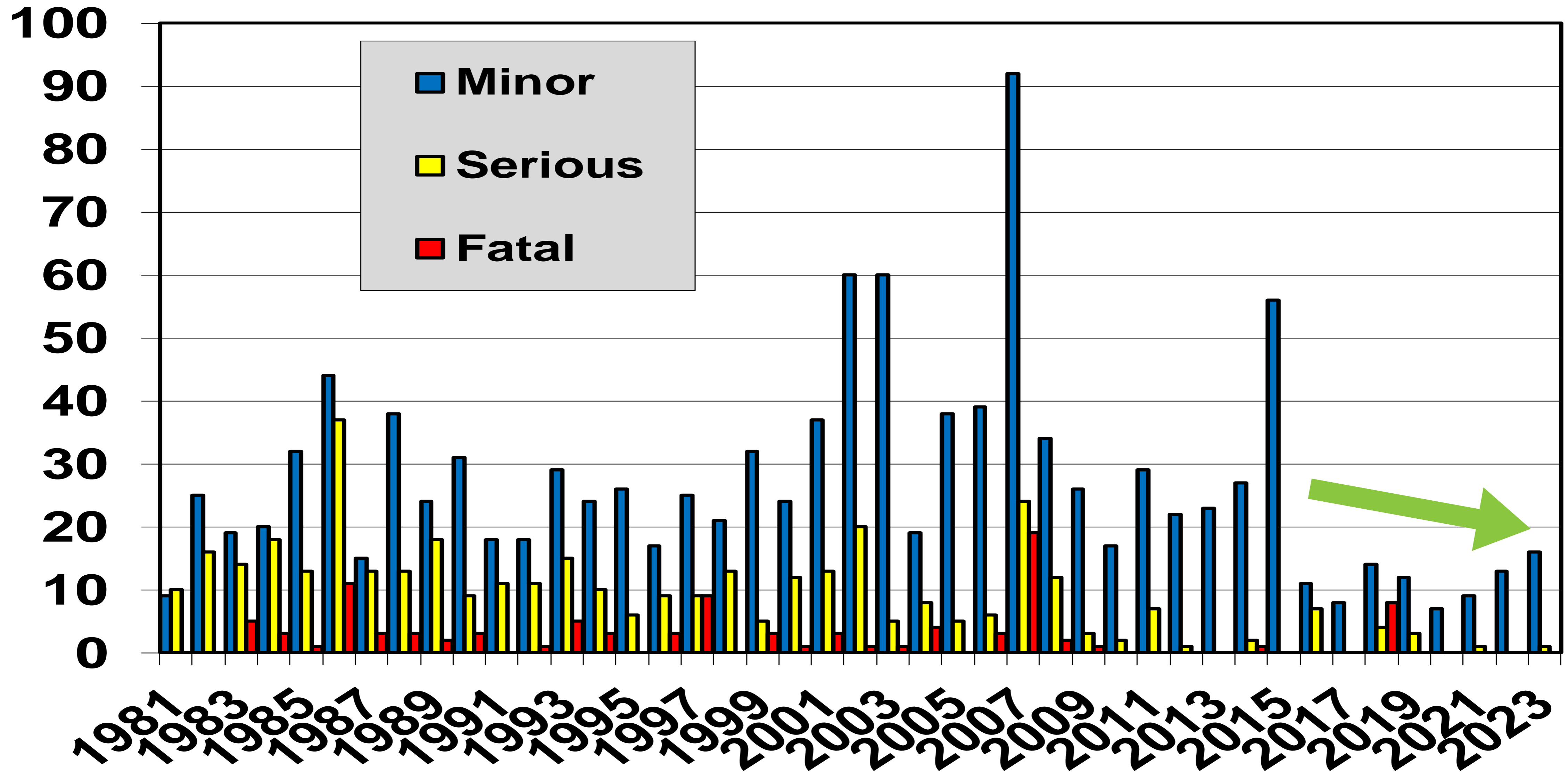


FIGURE 7. Injuries From Incidents For 1981 – 2023

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

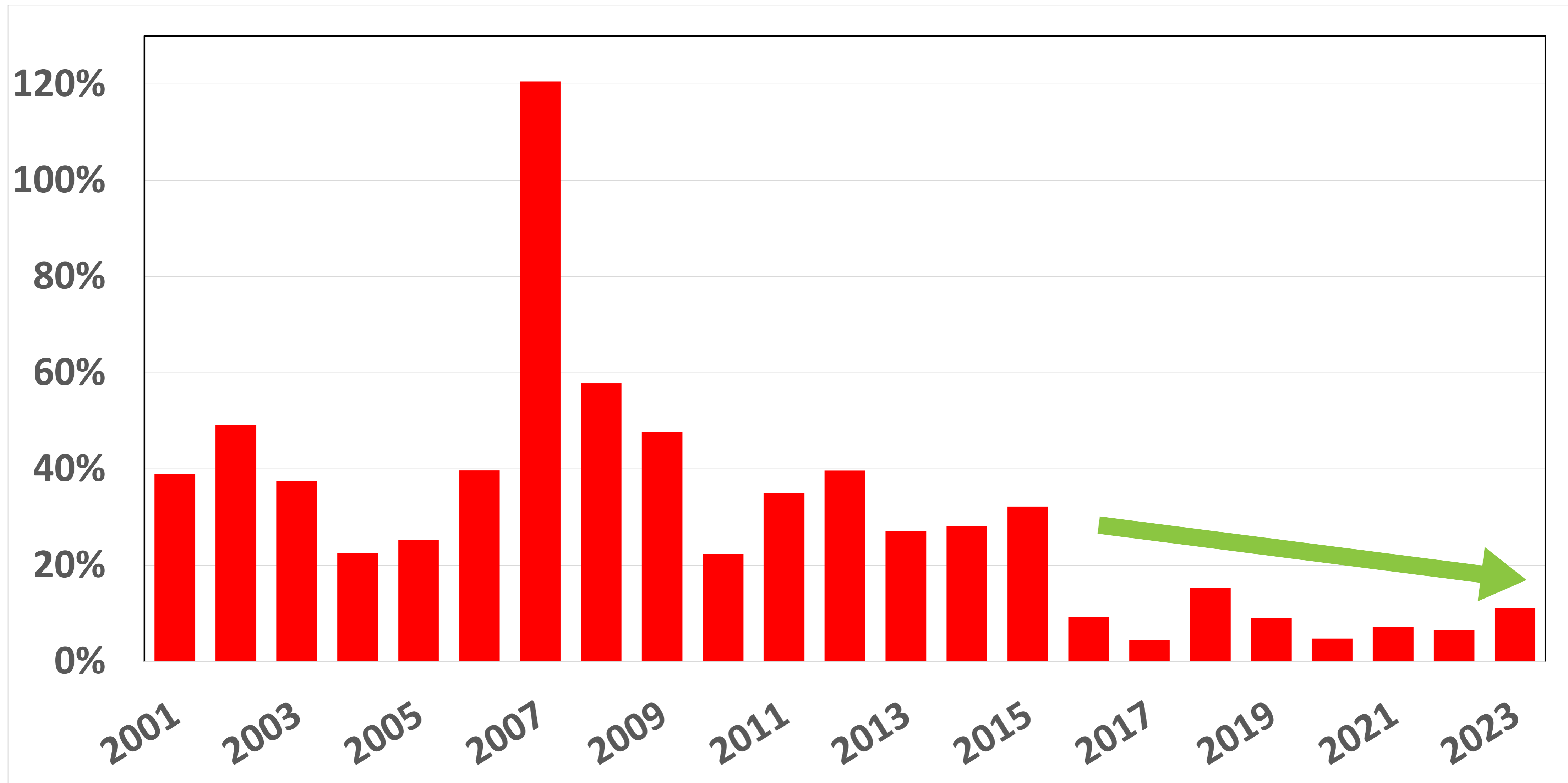


FIGURE 8. % Injuries/Total Annual Incidents 2001 – 2023

Sep. 2024



Average # of Injuries / Year from Explosions

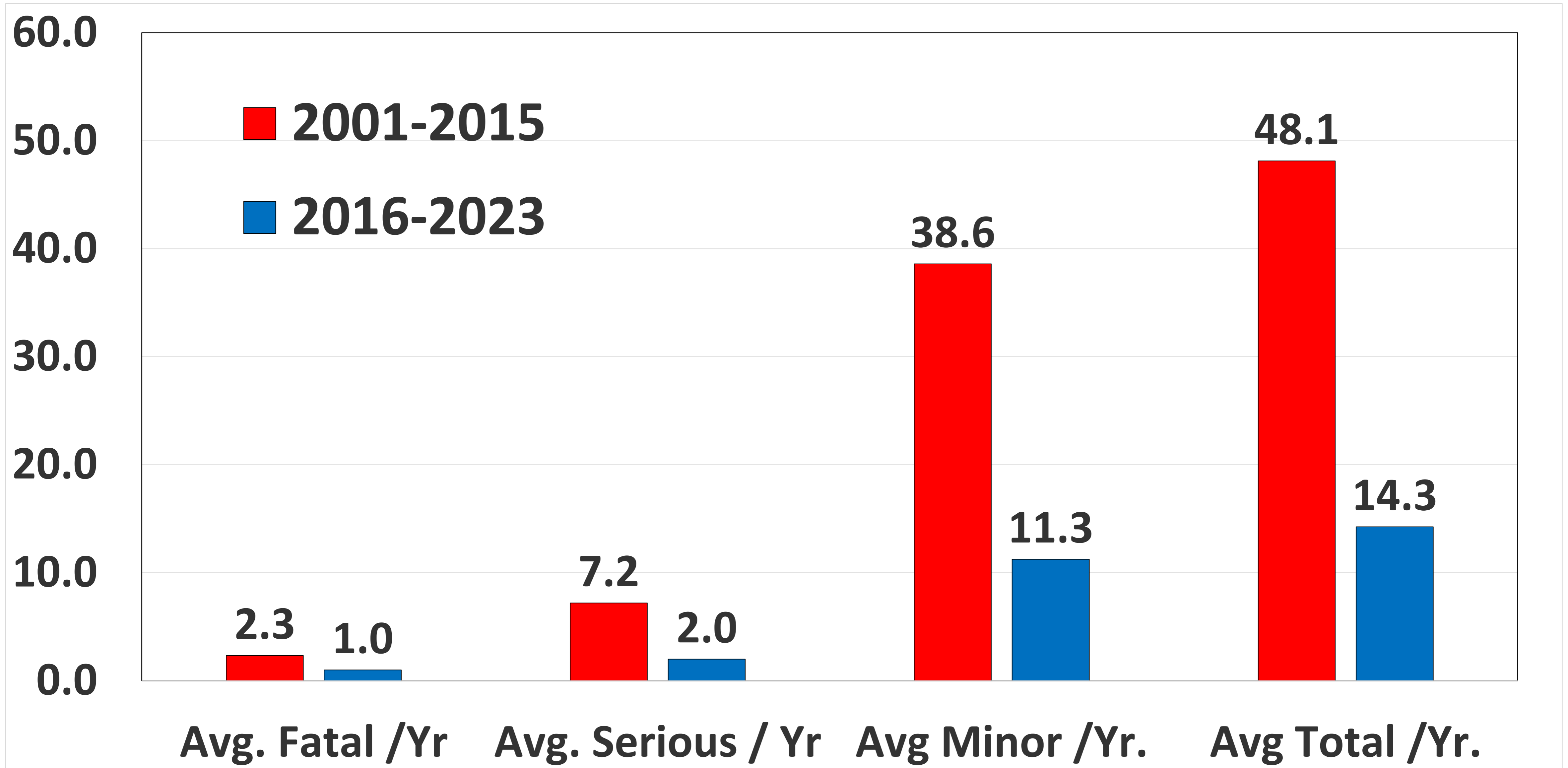


FIGURE 9. Avg. # Injuries / Yr. For 2001-2015 & 2016-2023

Sep. 2024 11



Injuries by Severity – Total 1645 1981 – 2023

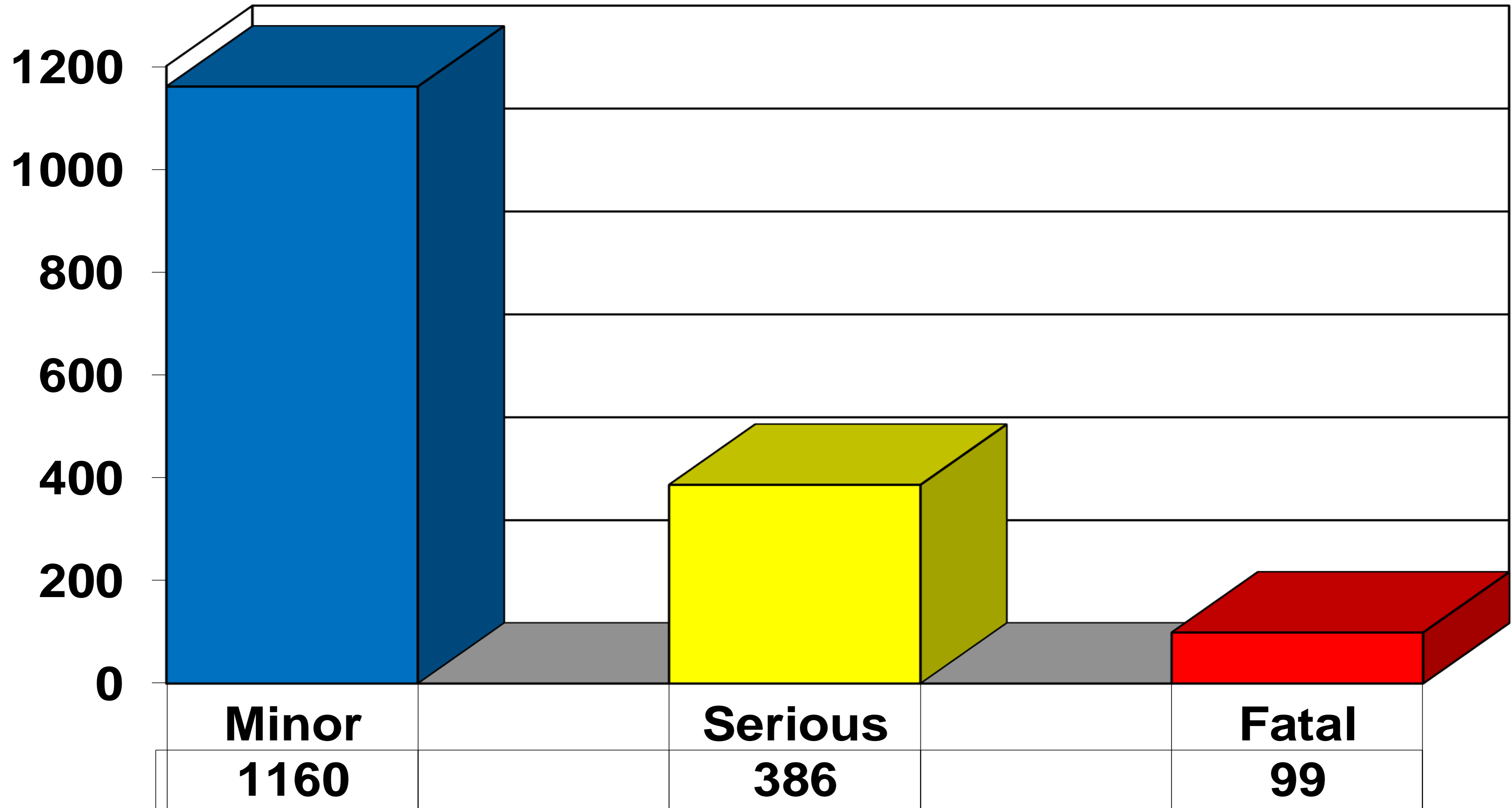


FIGURE 10. Injuries By Severity For 1981 – 2023

Sep. 2024¹²



Injury Levels by Percentage 1981 - 2023

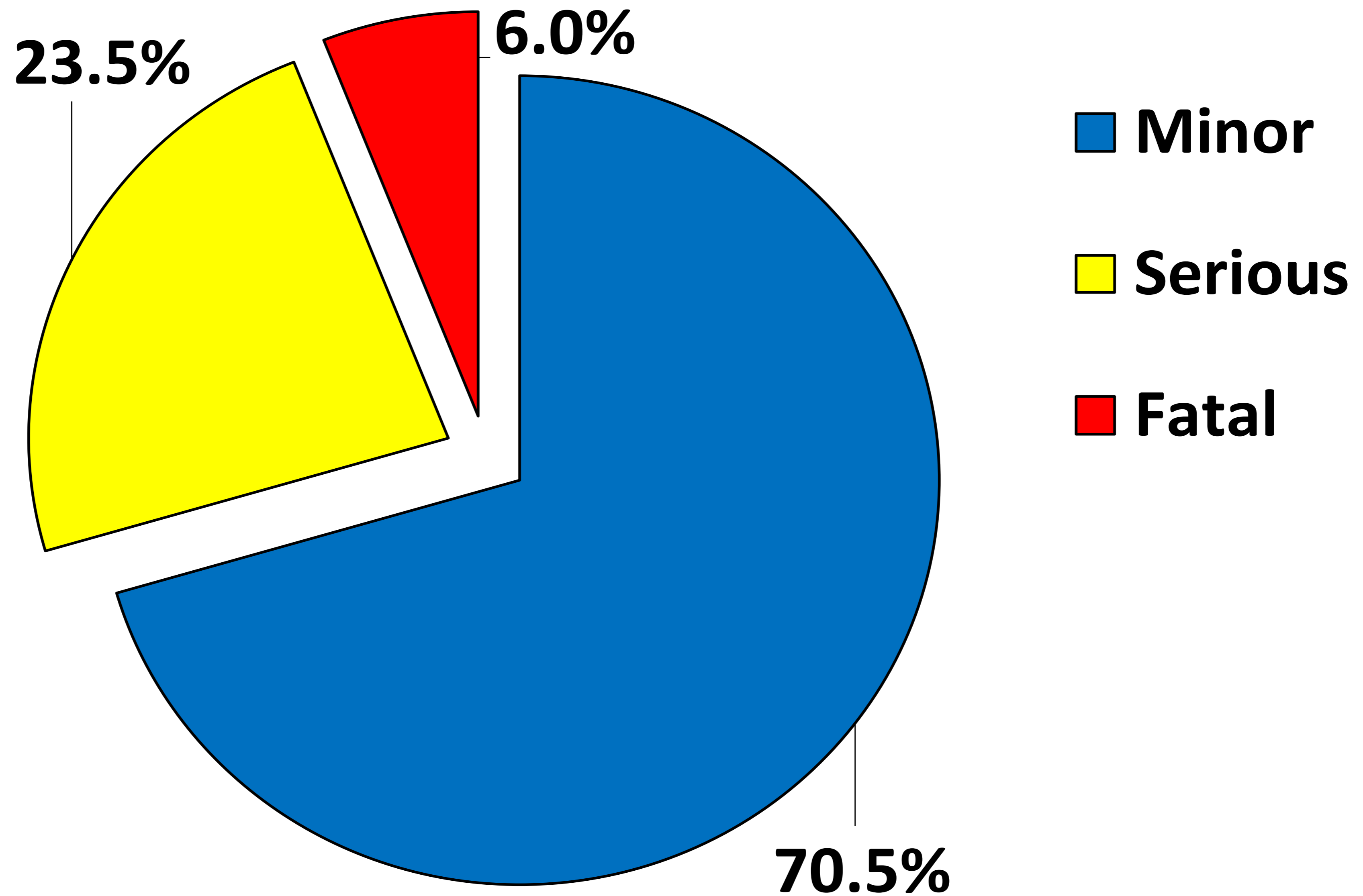


FIGURE 11. Injuries Levels By Percentage For 1981 – 2023



Injury Risk per 100 Explosions 1981 - 2023

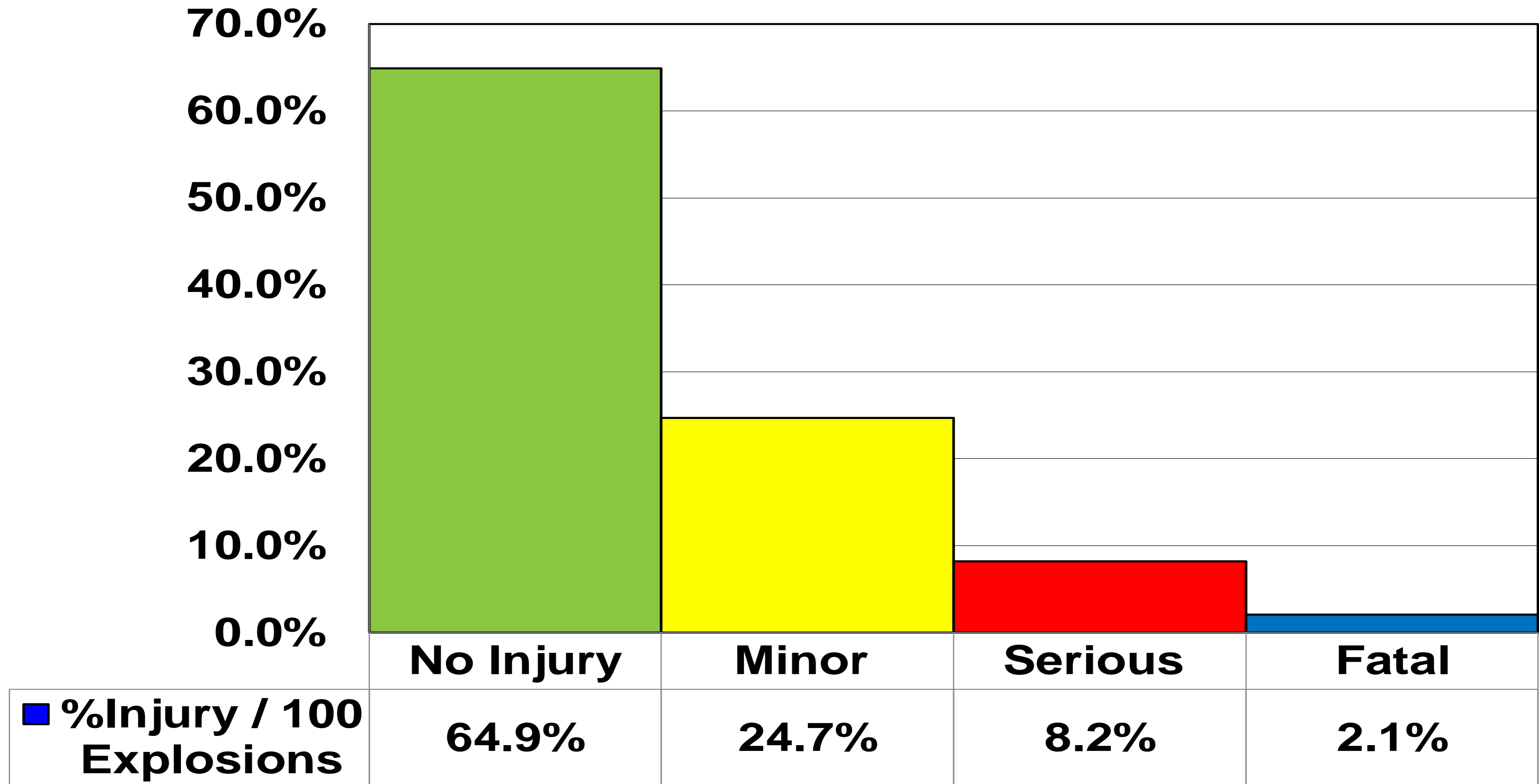


FIGURE 12. Injury Risk Per 100 Explosions For 1981 – 2023

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Fatalities from Explosions 1981 - 2023

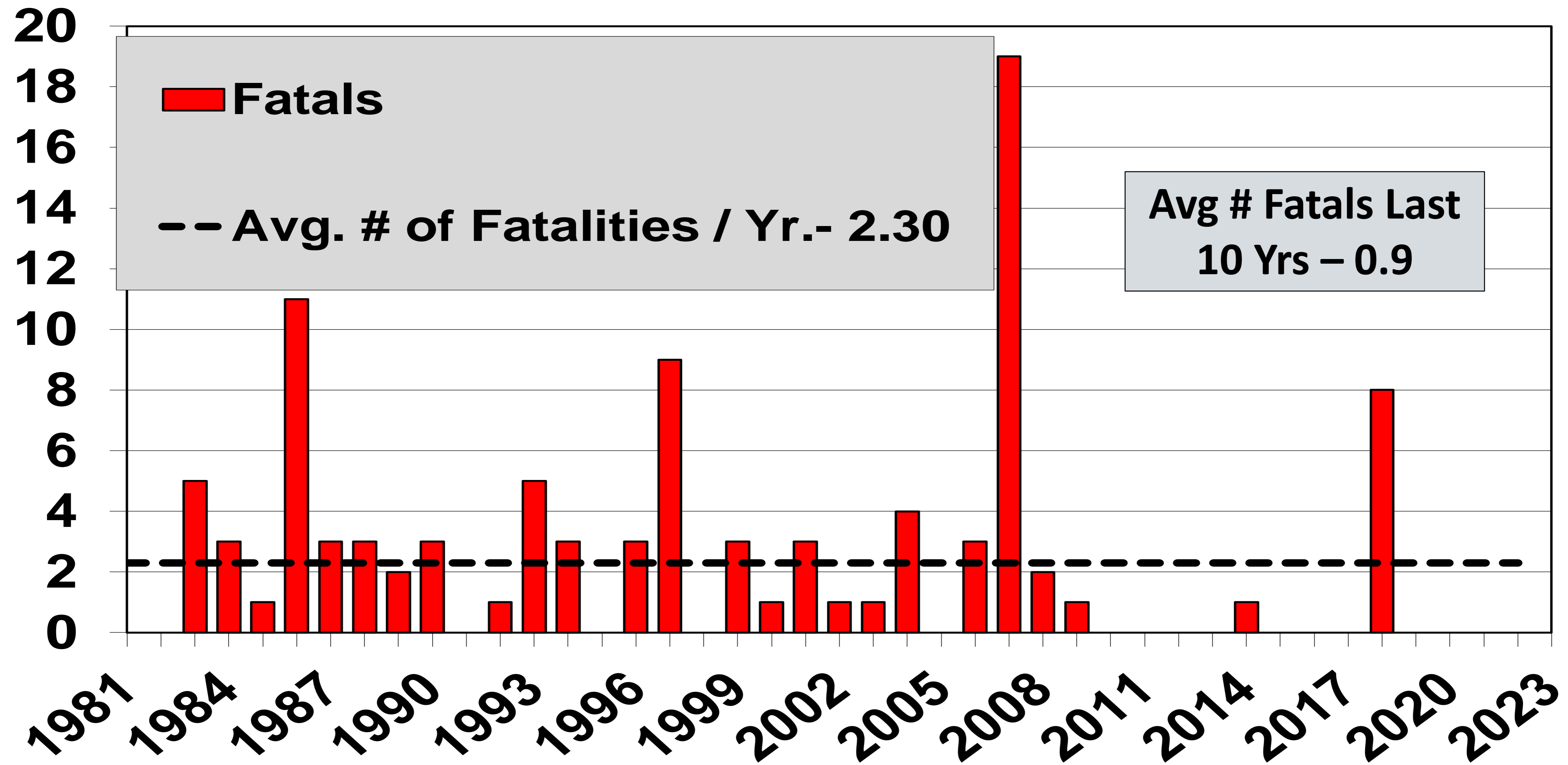


FIGURE 13. Fatalities From Explosions For 1981 – 2023

Sep. 2024



Force Level Incidents by Operation – 2023

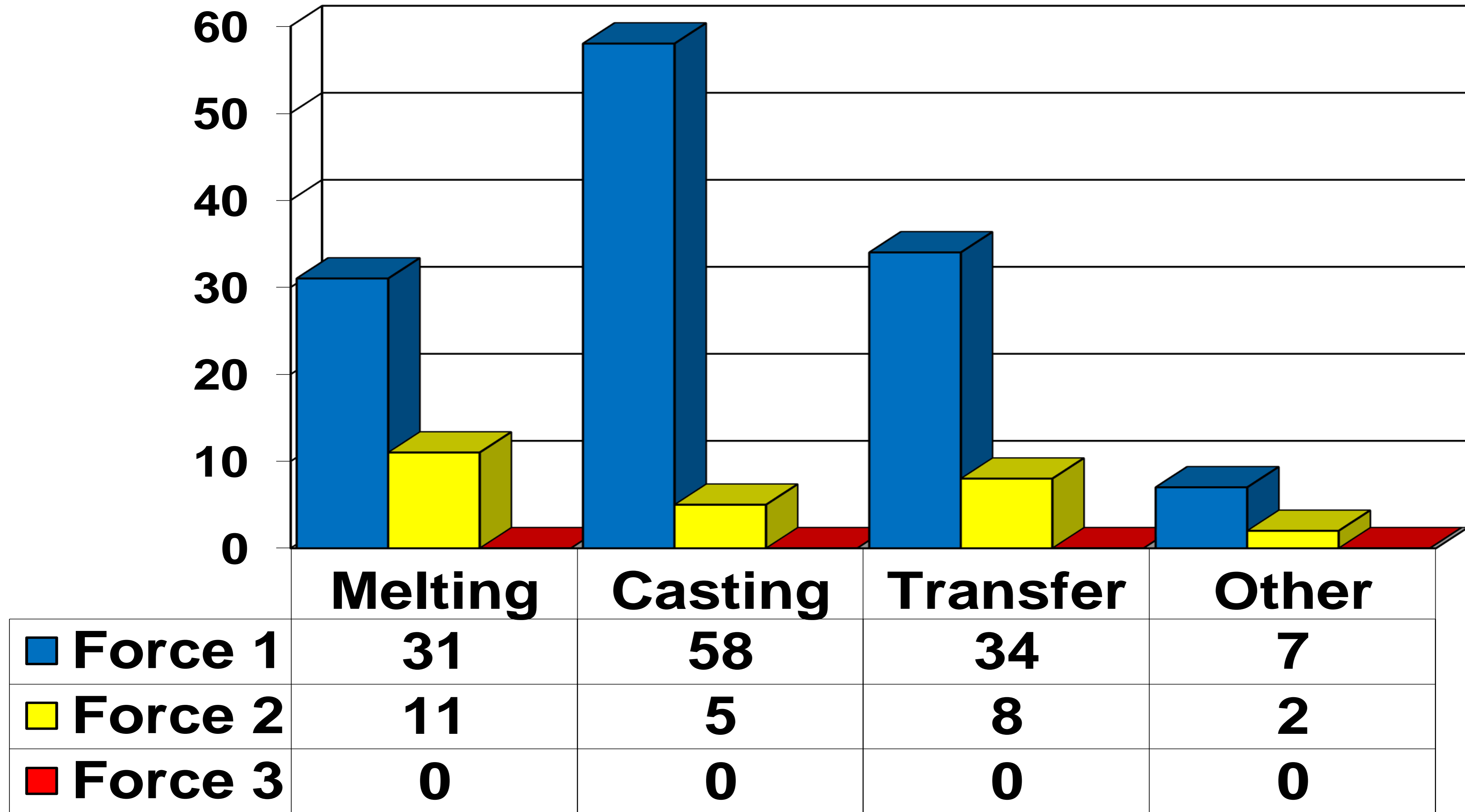
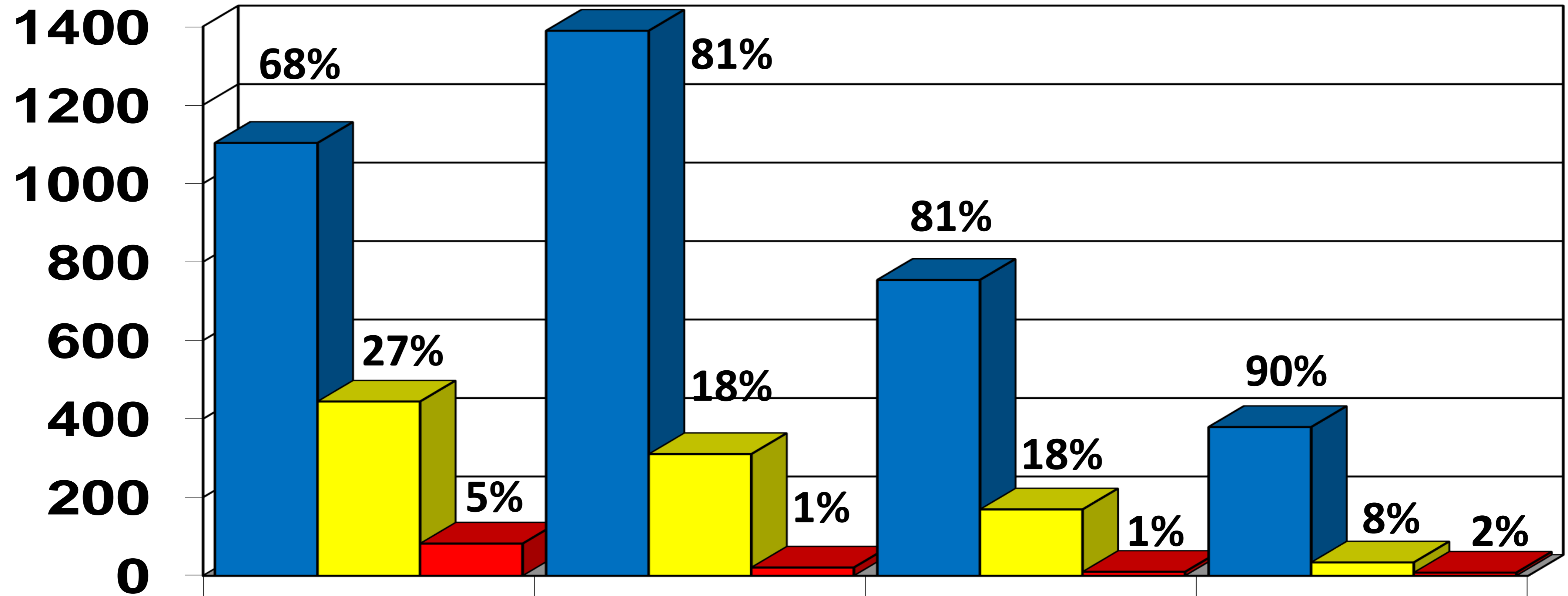


FIGURE 14. Force Level Incidents By Operation For 2023 Sep. 2024



Force Level & % Incidents by Operation

1980 – 2023



	Melting	Casting	Transfer	Other
Force 1	1103	1389	754	379
Force 2	444	310	169	34
Force 3	82	21	10	8

FIGURE 15. Force Level & % Incidents By Operation For 1980 – 2023 Sep. 2024¹⁷



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

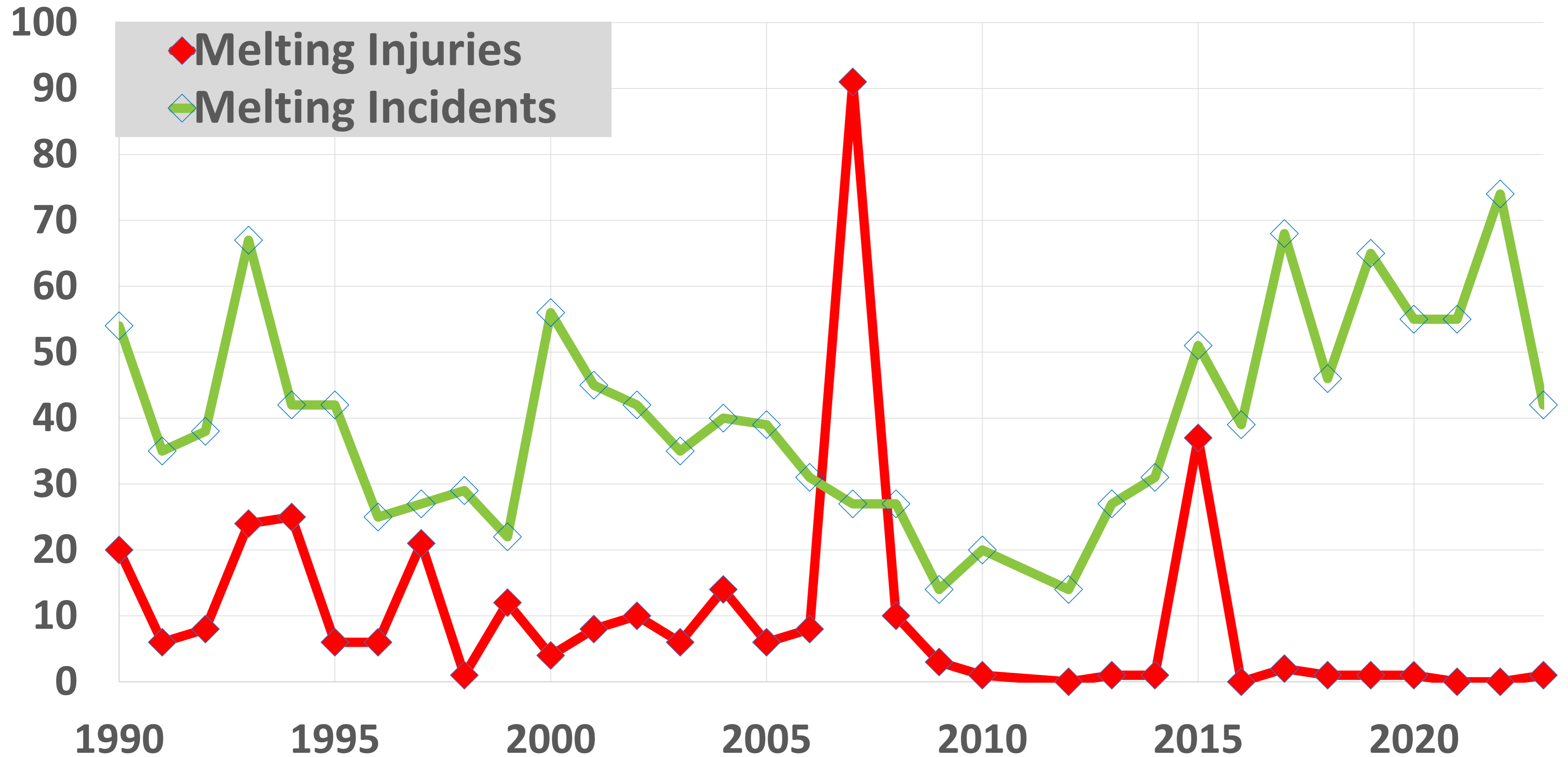


FIGURE 16. Melting Injuries and Incidents 1990 – 2023

Sep. 2024¹⁸



Melting Injuries per Incidents 1990 – 2023

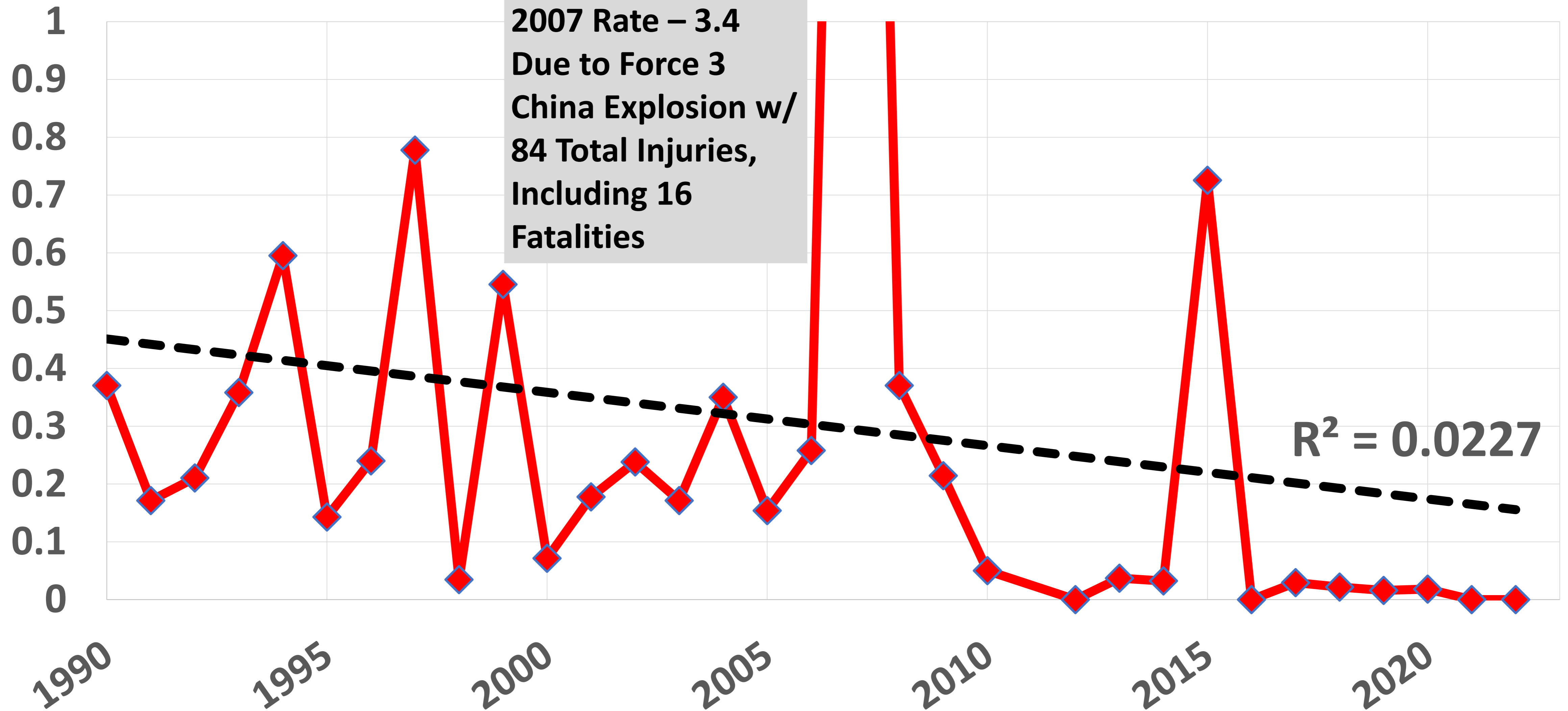


FIGURE 17. Melting Injuries Per Incidents 1990 – 2023



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

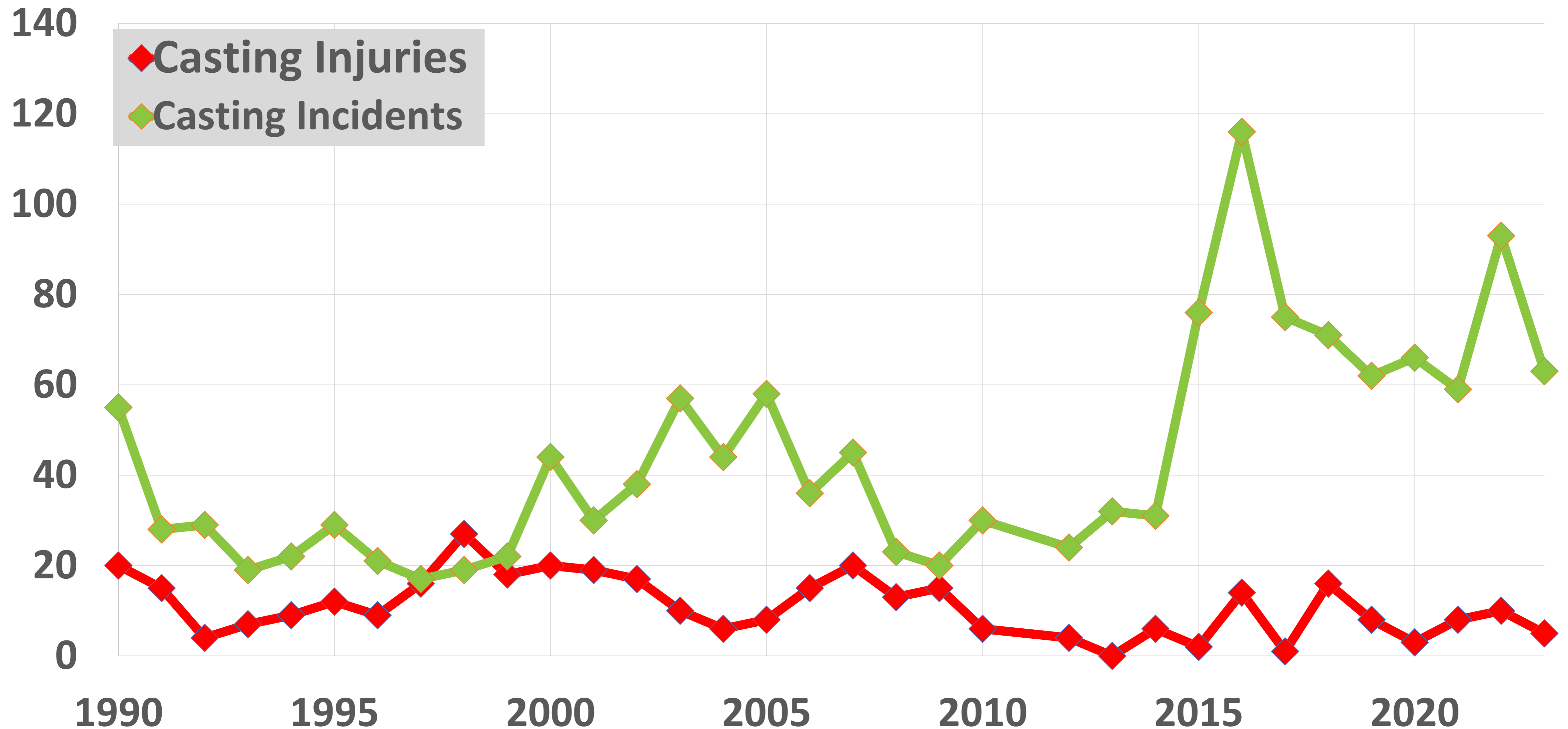


FIGURE 18. Casting Injuries and Incidents 1990 – 2023

Sep. 2024



Casting Injuries per Incidents 1990 – 2023

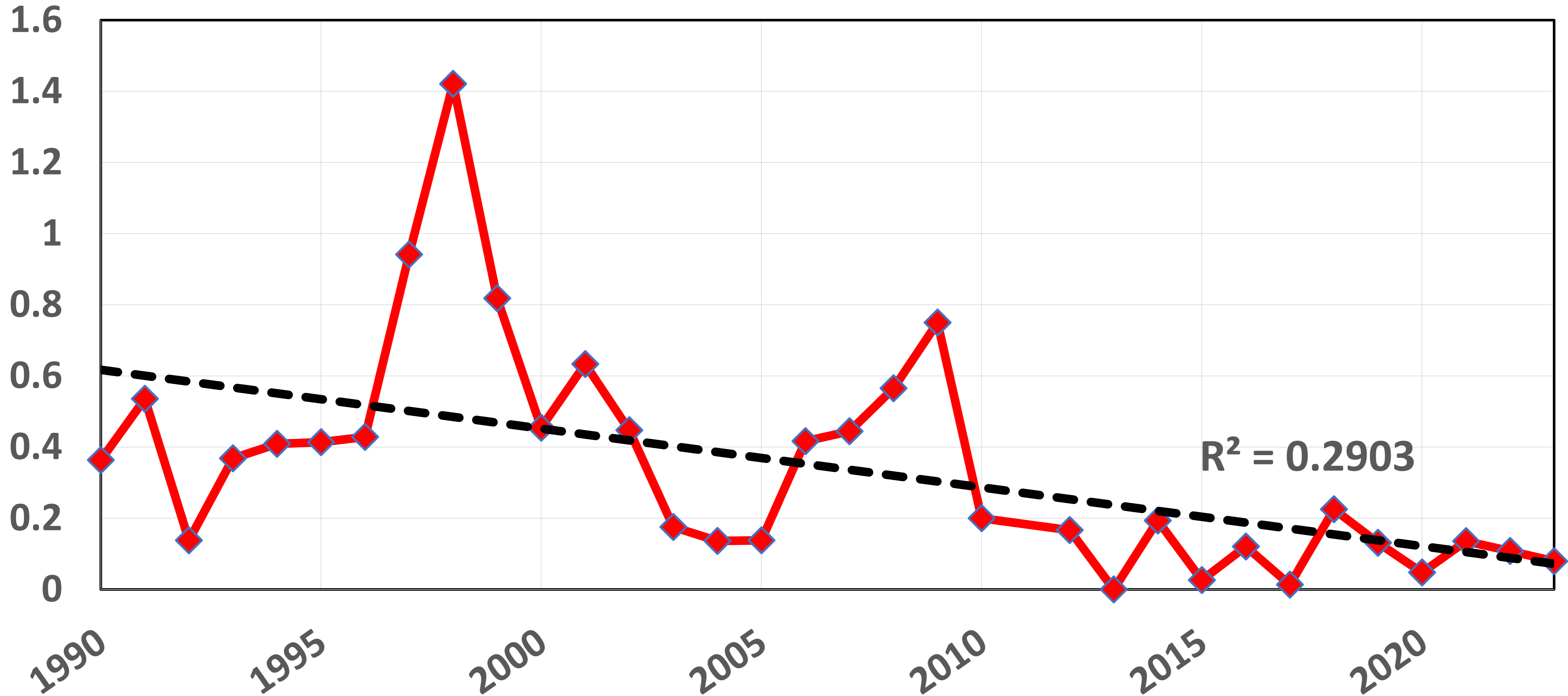


FIGURE 19. Casting Injuries Per Incidents 1990 – 2023

Sep. 2024



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

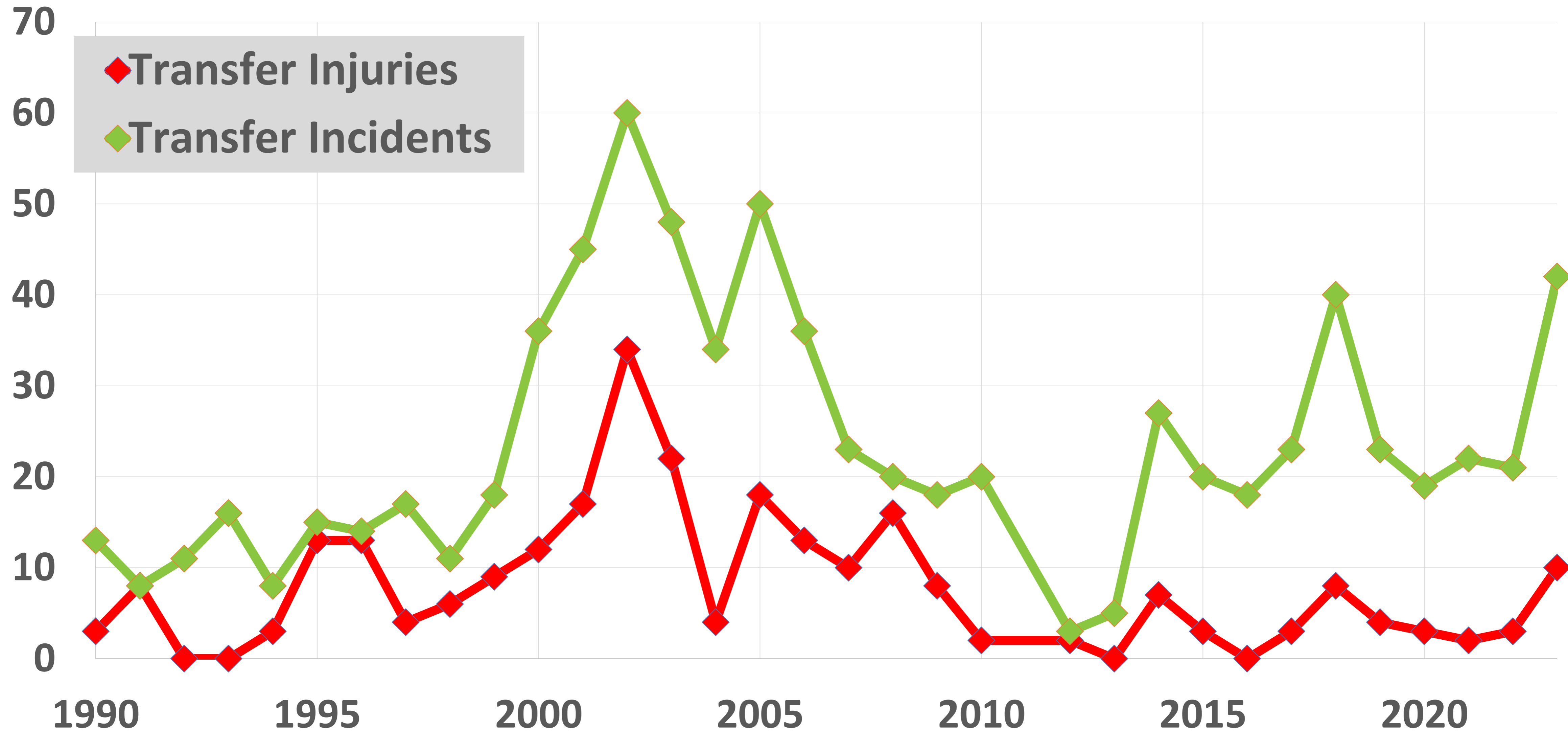


FIGURE 20. Transfer Injuries and Incidents 1990 – 2023



Transfer Injuries per Incidents 1990 – 2023

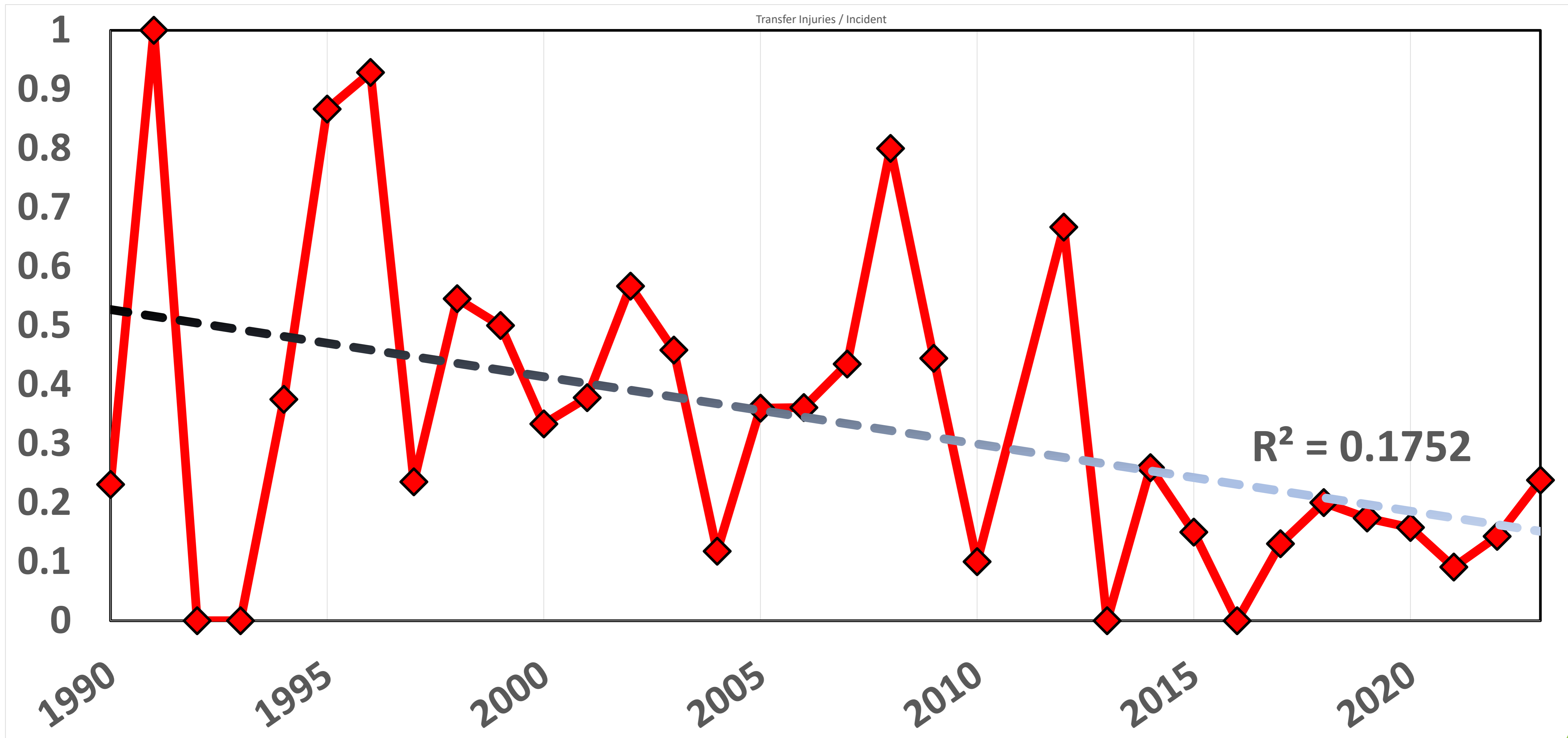
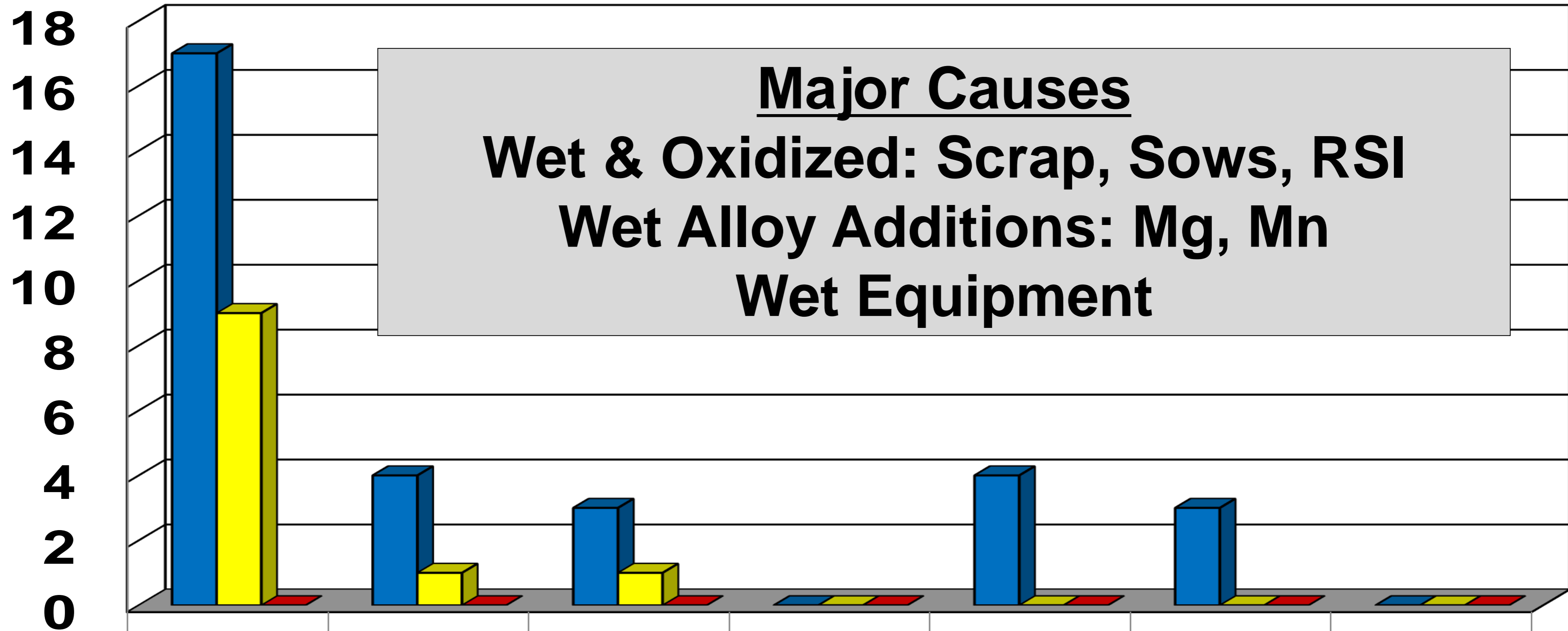


FIGURE 21. Transfer Injuries Per Incidents 1990 – 2023

Sep. 2024



42 Melting Explosions – 2023



	Scrap Charge	Sow Charge	RSI Charge	T-Bar	Alloying Mg / Other	Tools / Pans	Other
Force 1	17	4	3	0	4	3	0
Force 2	9	1	1	0	0	0	0
Force 3	0	0	0	0	0	0	0

FIGURE 22. Melting Explosions By Cause For 2023

Sep. 2024



Melting Explosions – Charge Material Involved 1980 – 2023

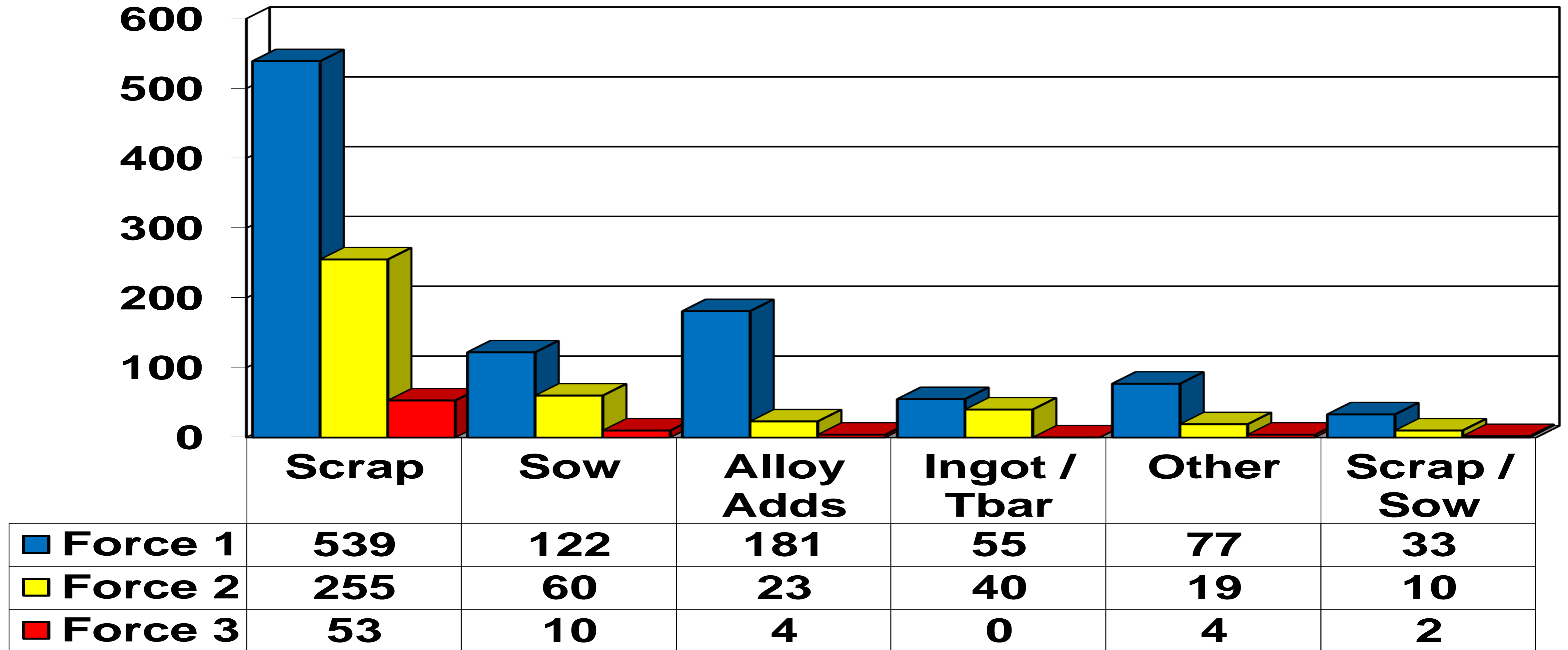


FIGURE 23. Melting Explosions By Charge Material 1980 – 2023 Sep. 2024 ²⁵



62 Casting Explosions – 2023

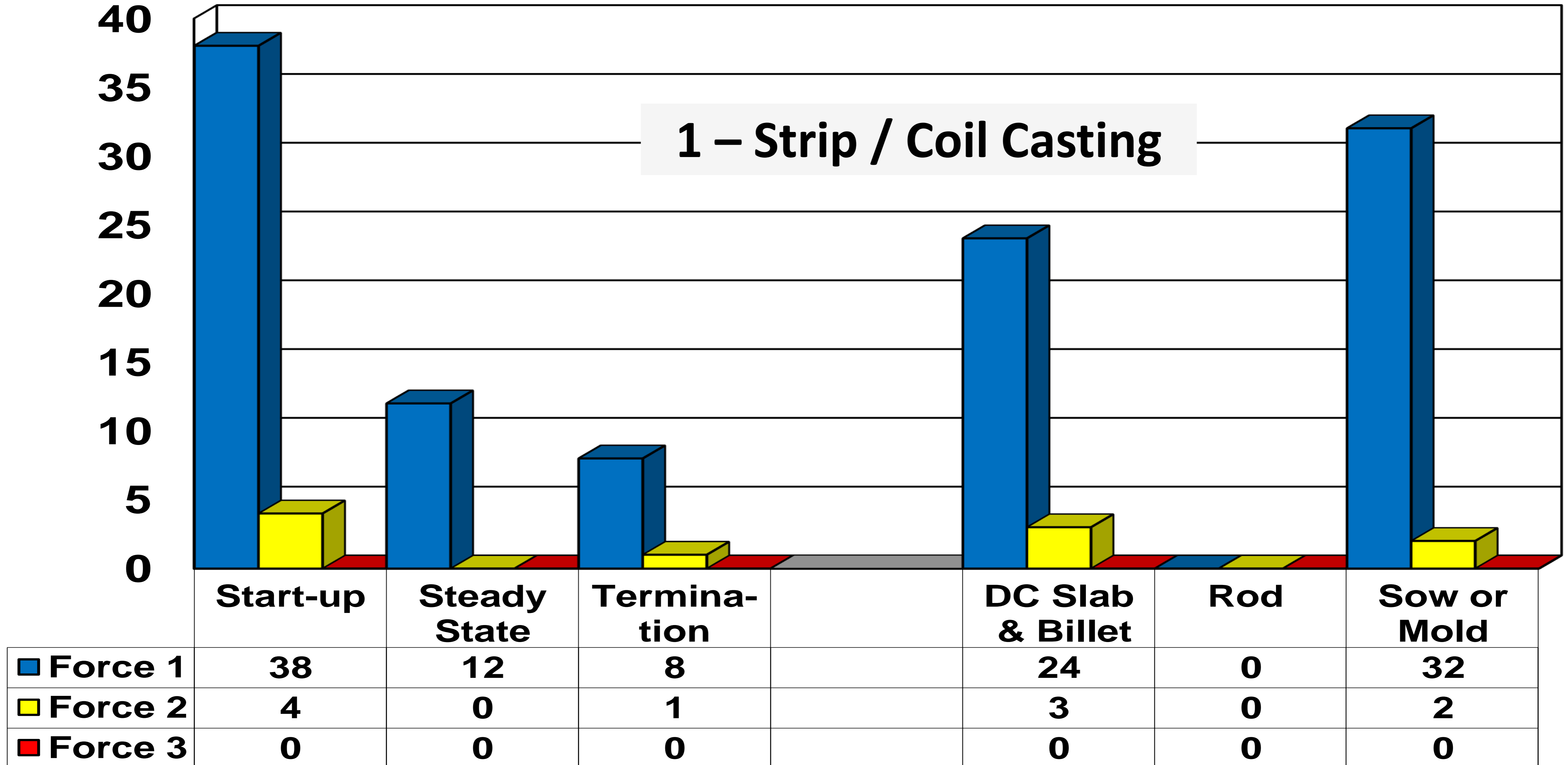


FIGURE 24. Casting Explosions For 2023



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

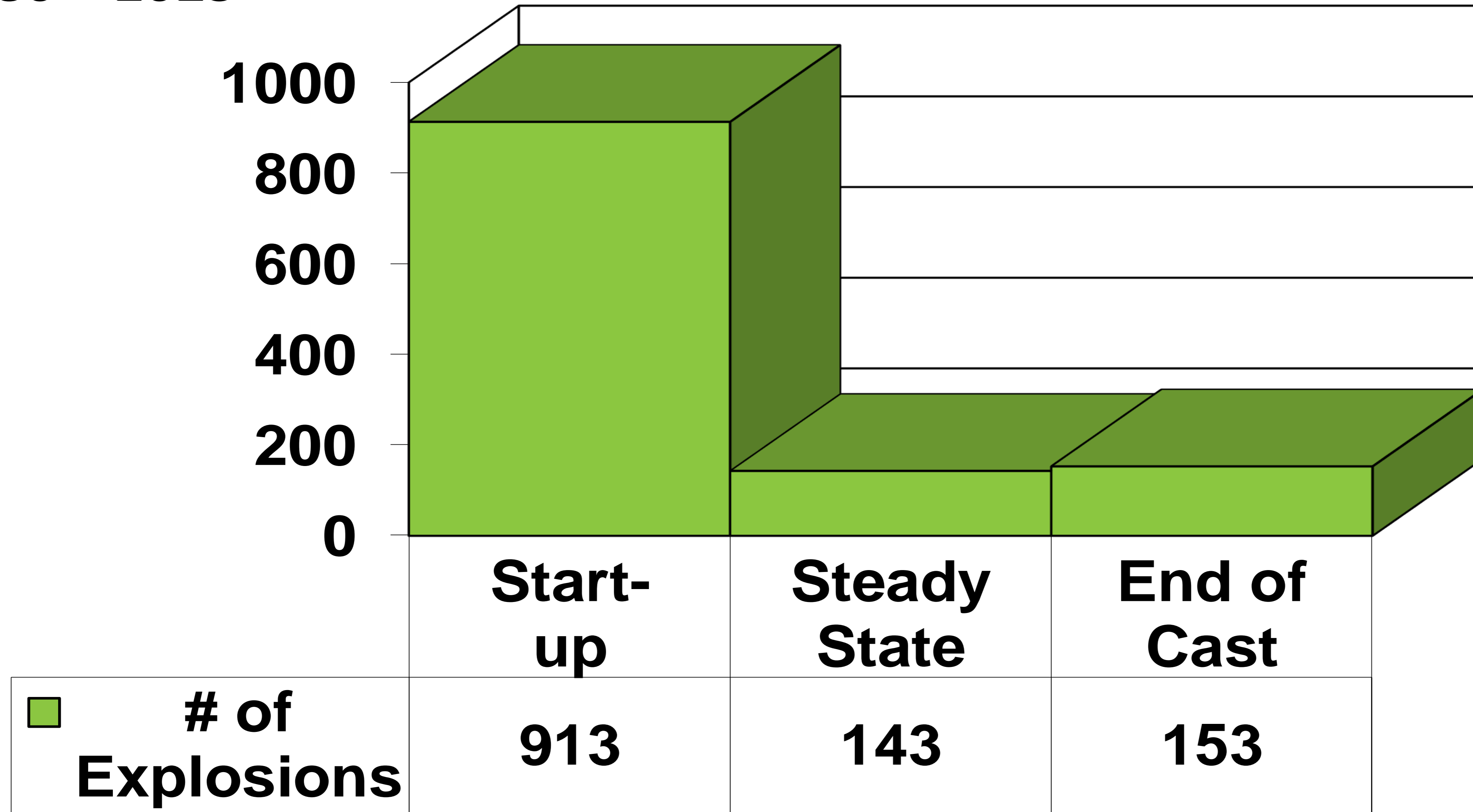


FIGURE 25. Casting Explosions By Cast Segment 1980 – 2023



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

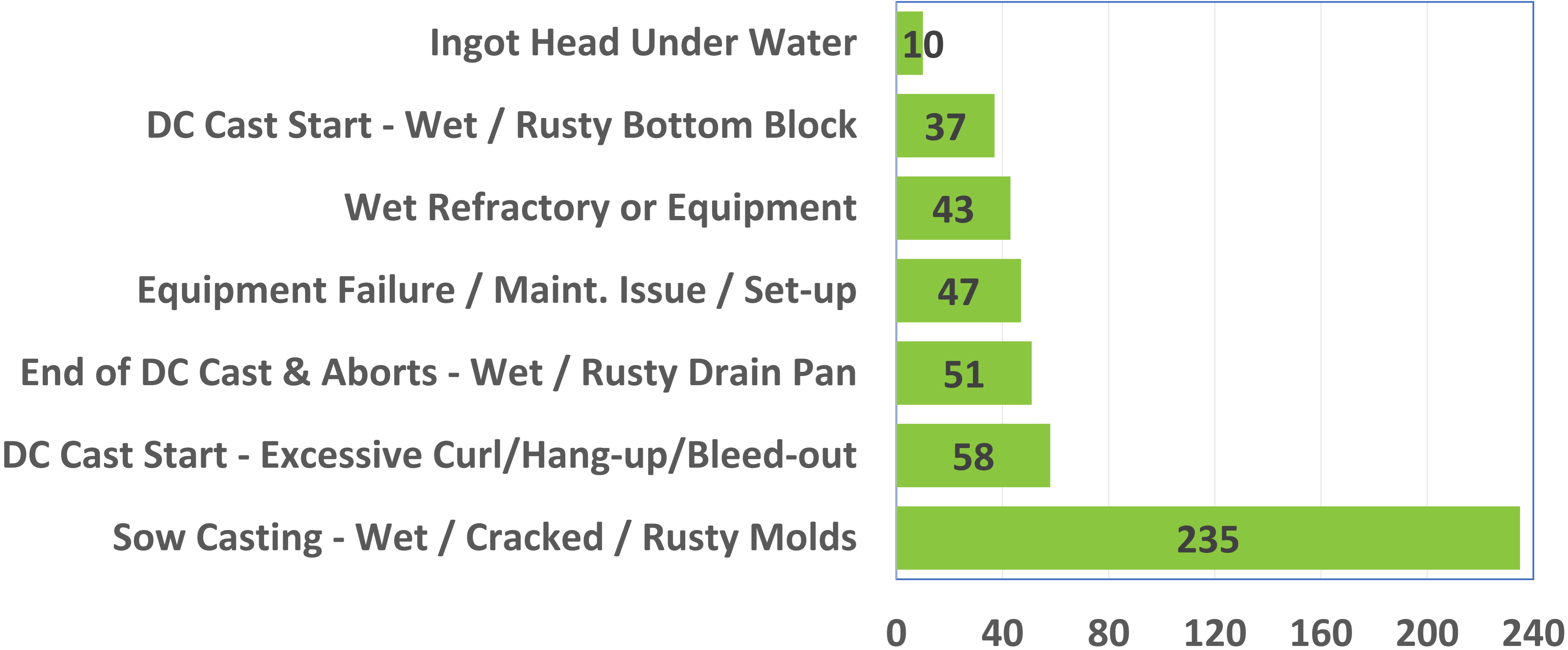


FIGURE 27. Casting Explosions by Major Causes 2015 – 2023 Sep. 2024 ²⁹



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

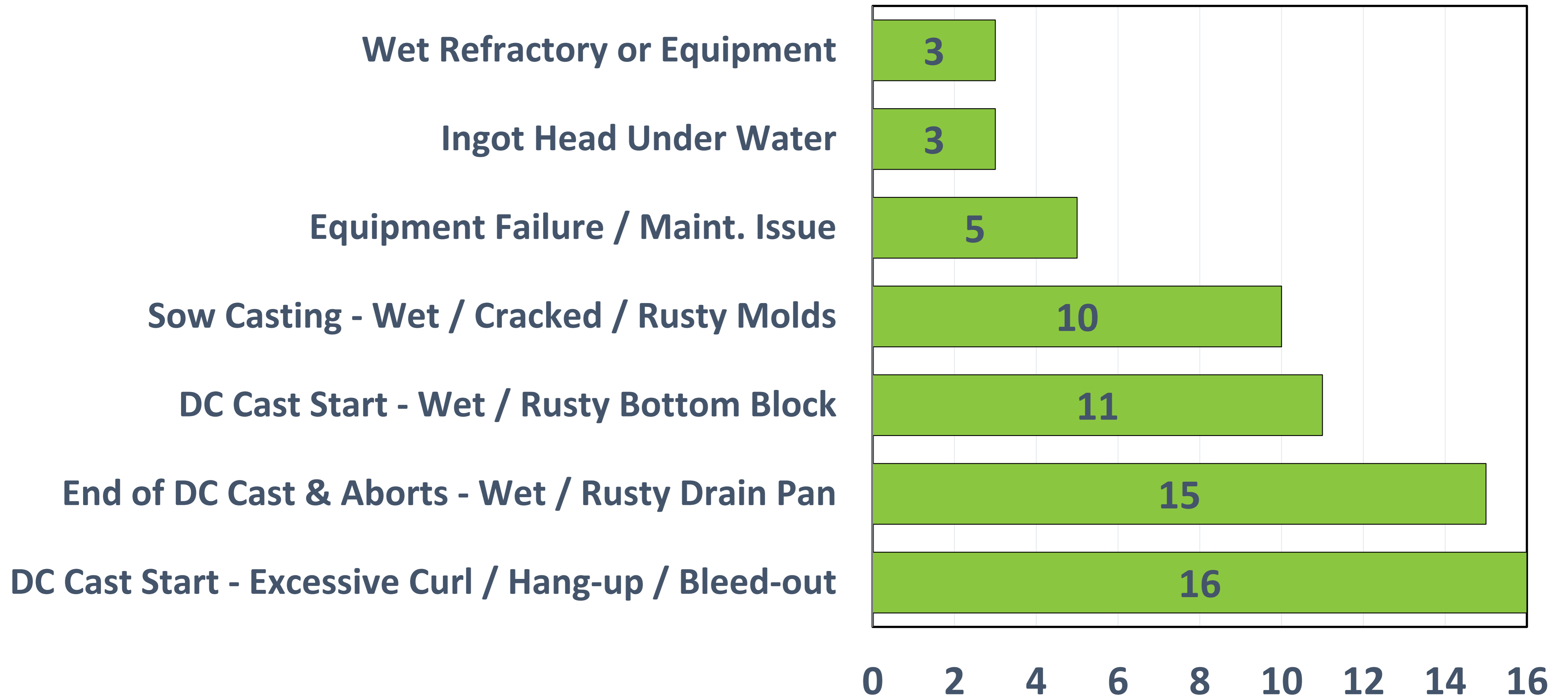


FIGURE 28. Casting Explosions by Major Causes 2015 – 2023

Sep. 2024 ³⁰



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)

Transfer Explosions by Equipment 1980 – 2023 (Total 927)

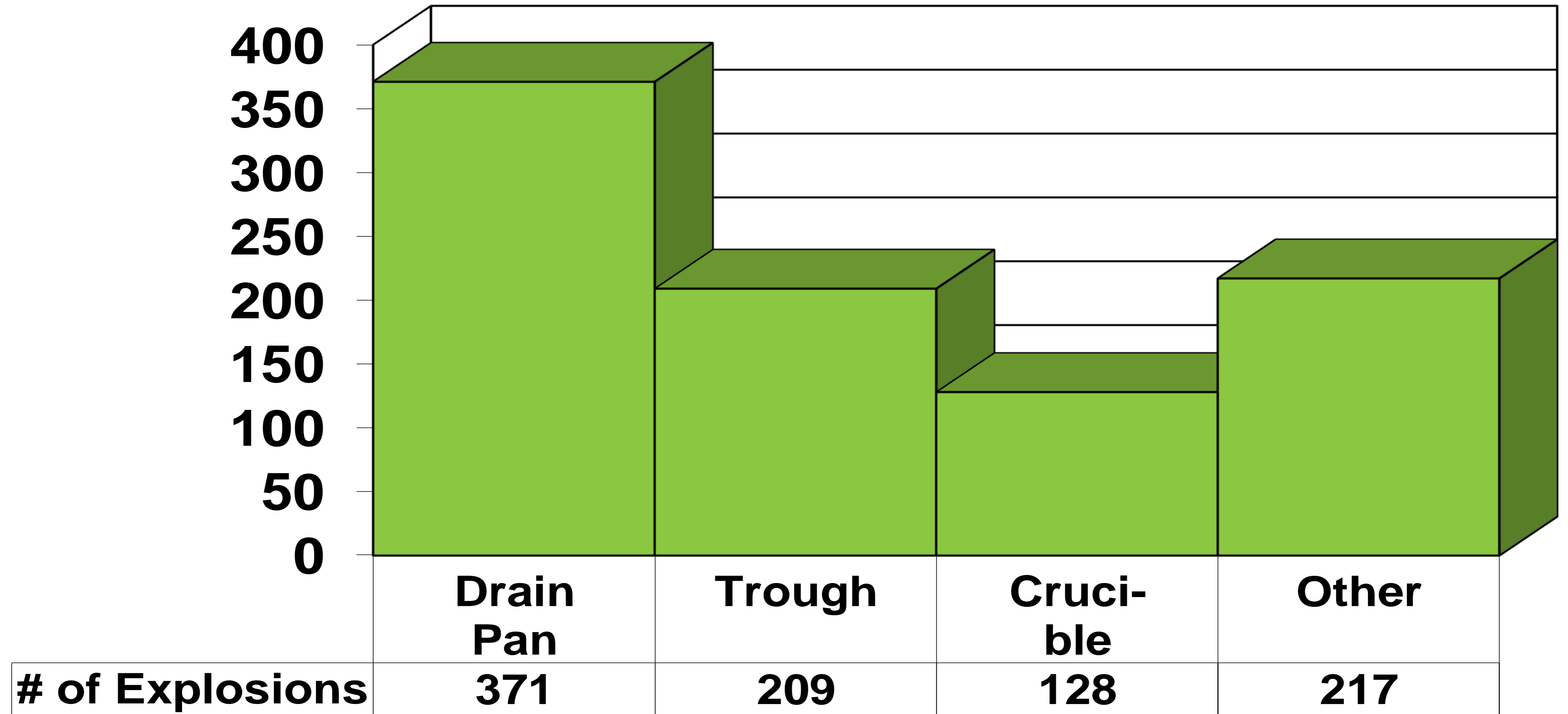


FIGURE 30. Transfer Explosions by Equipment 1980 – 2023

Sep. 2024



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

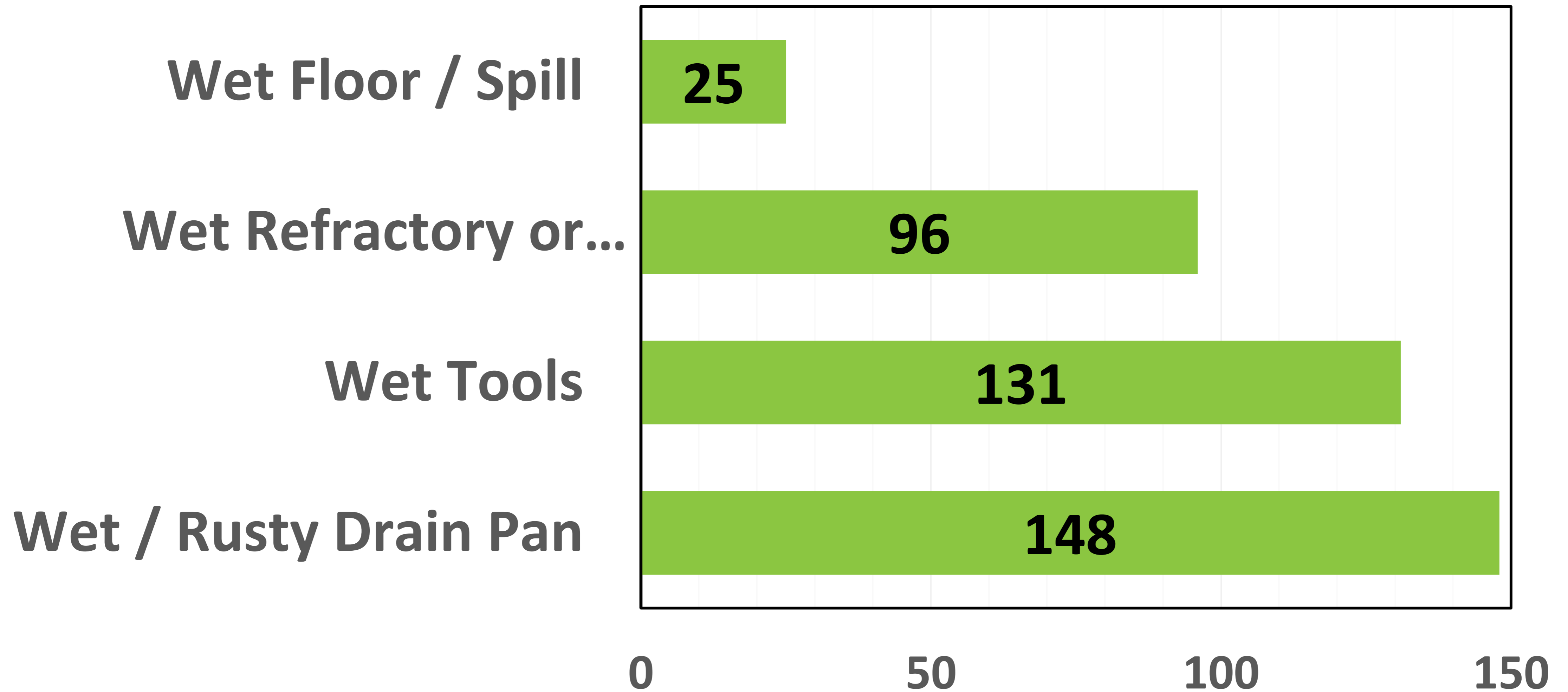


FIGURE 31. Transfer Explosions – Major Causes 2008 – 2023

Sep. 2024₃₃



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

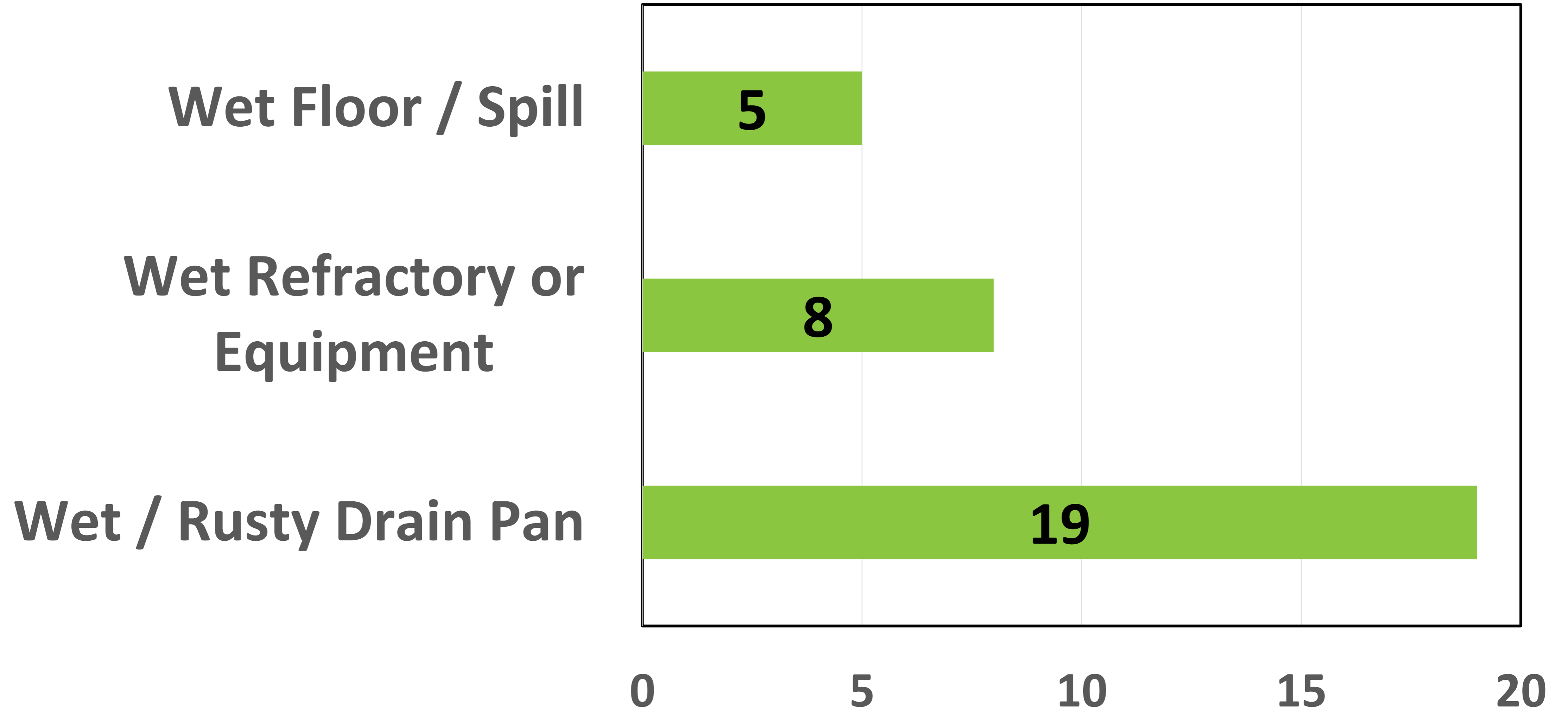


FIGURE 32. Transfer Explosions – Major Causes 2008 – 2023



17 Injuries by Operation – 2023

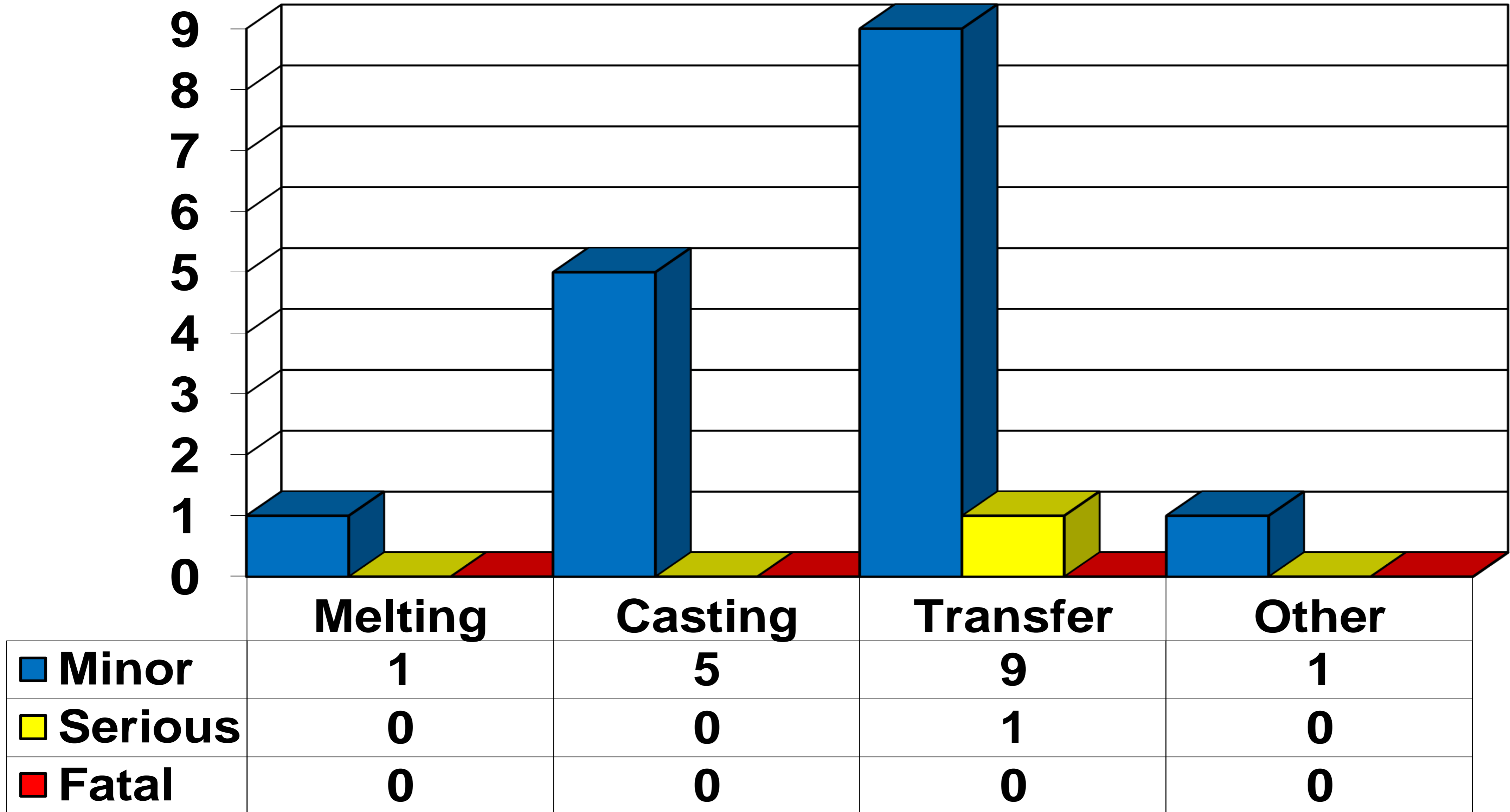


FIGURE 33. Injuries By Operation For 2023

Sep. 2024



1652 Injuries by Operation: 1980 – 2023

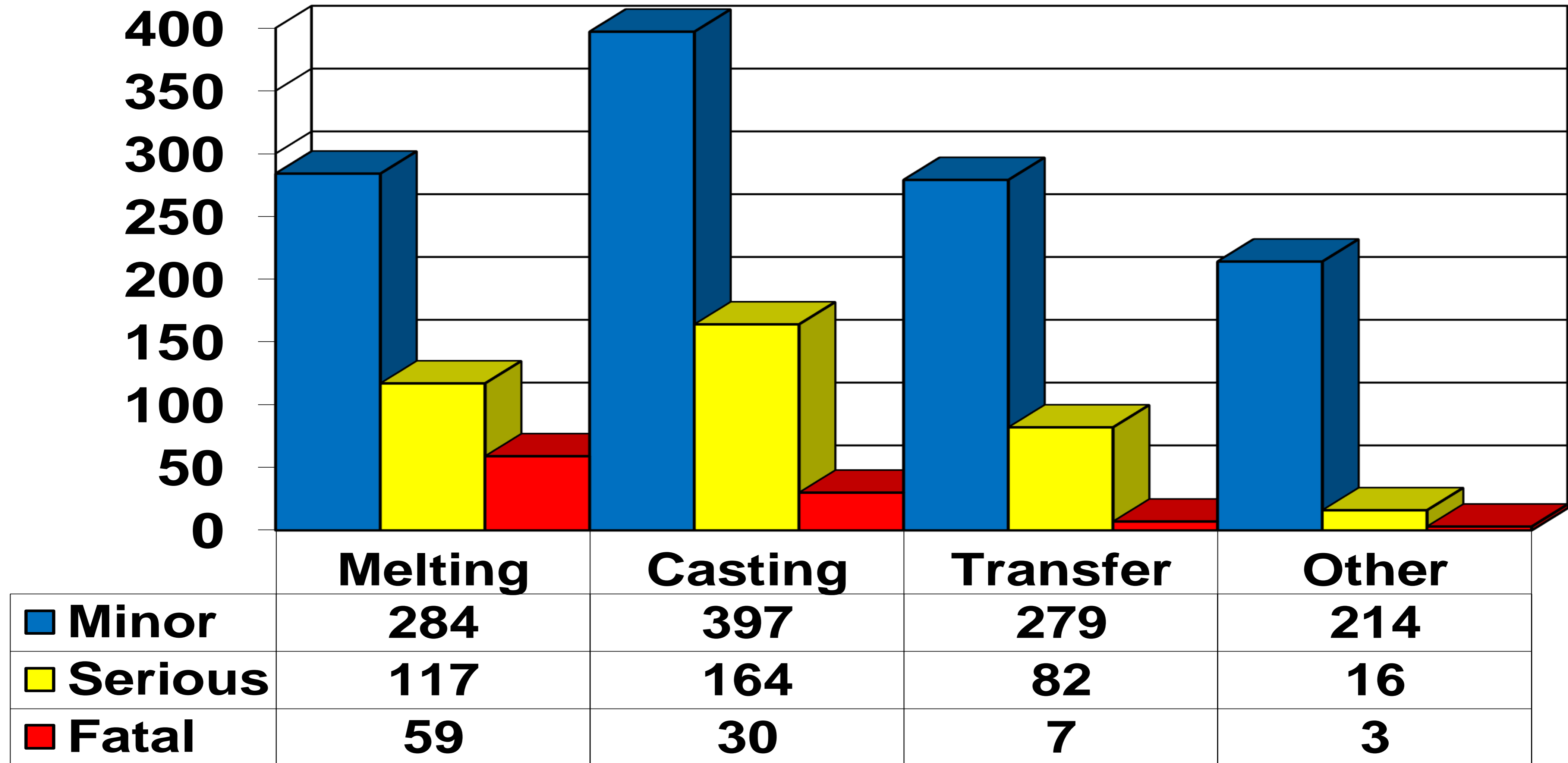


FIGURE 34. Injuries By Operation For 1980 – 2023 Sep. 2024



Melting Explosions By Month 2017 – 2023

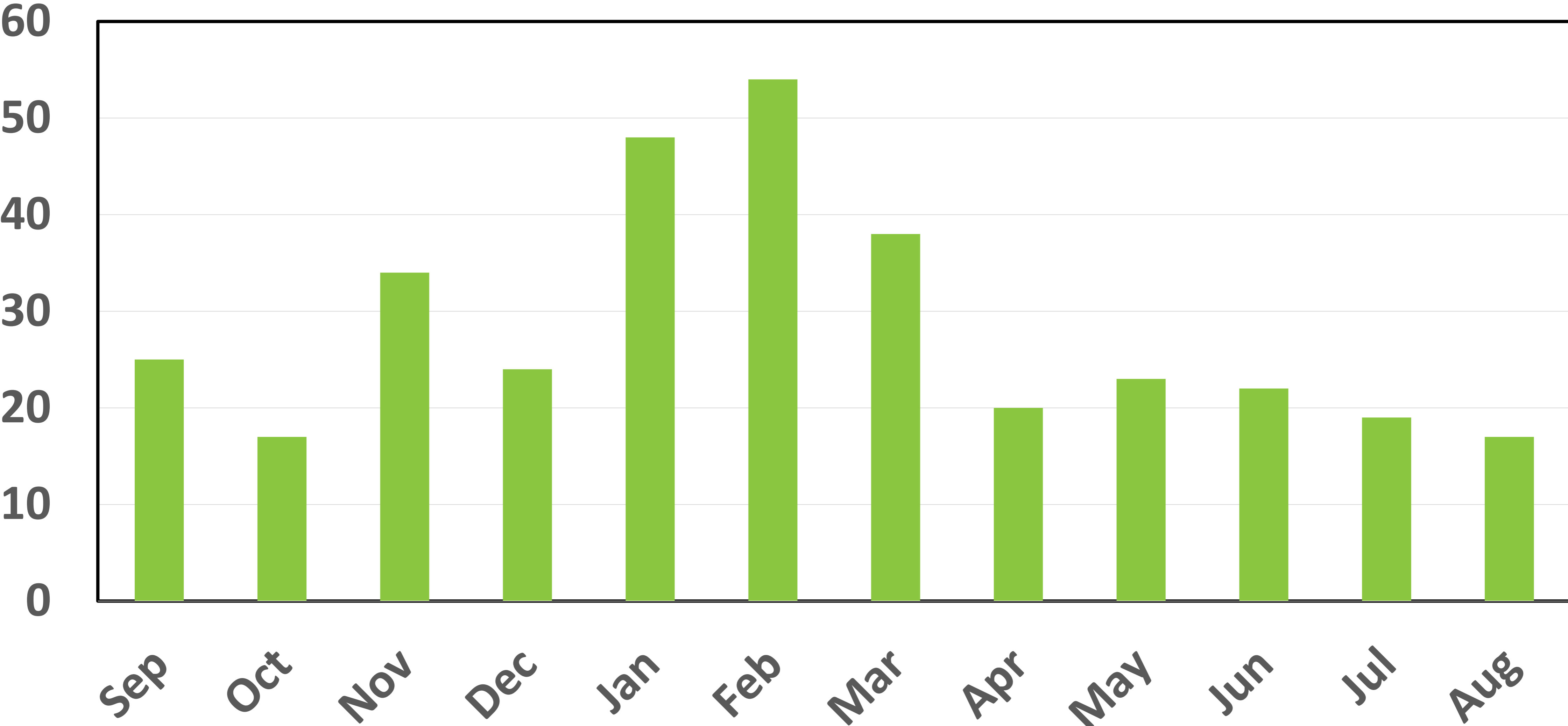


FIGURE 35. Melting Explosions By Month 2017 – 2023

Sep. 2024



Casting Explosions By Month 2017 – 2023

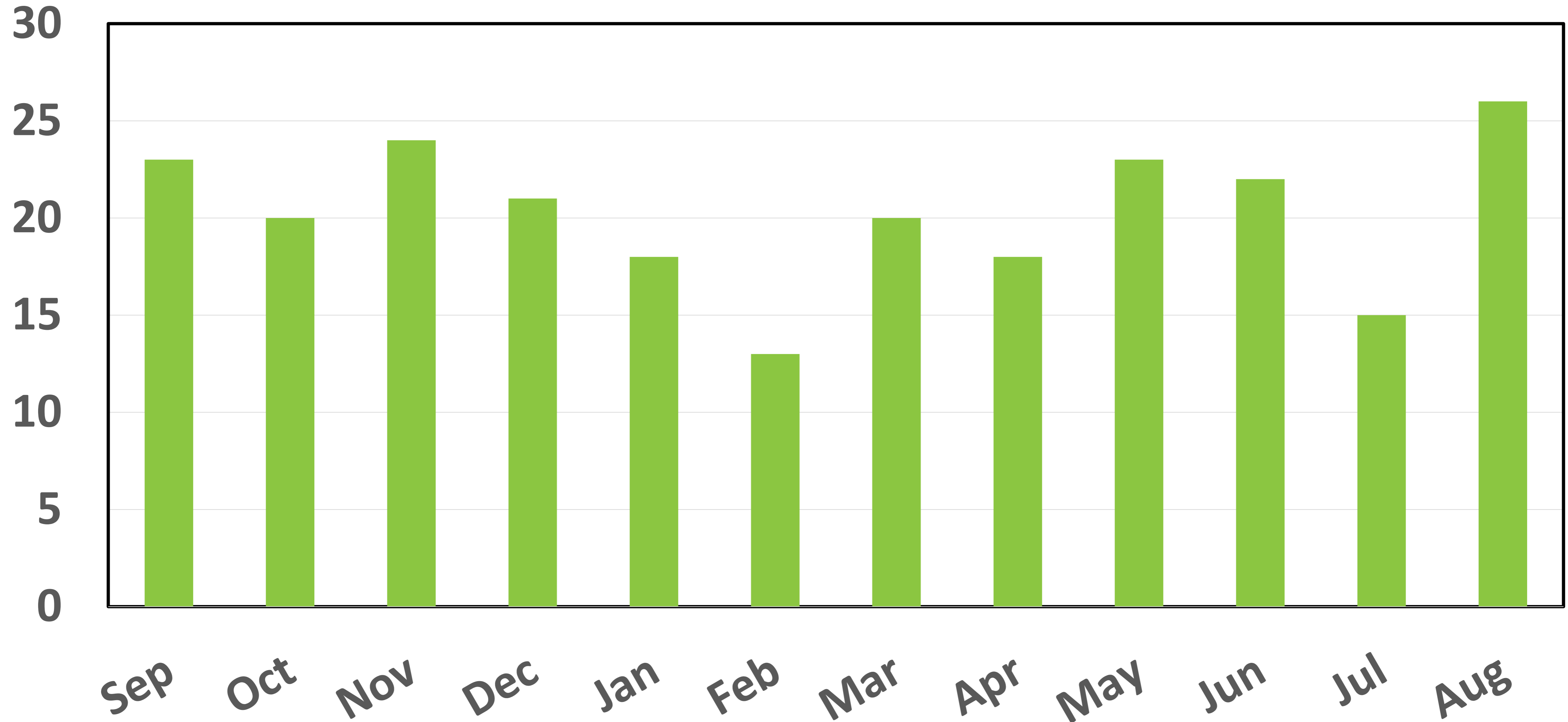


FIGURE 36. Casting Explosions By Month 2017 – 2023

Sep. 2024



Transfer Explosions By Month 2017 – 2023

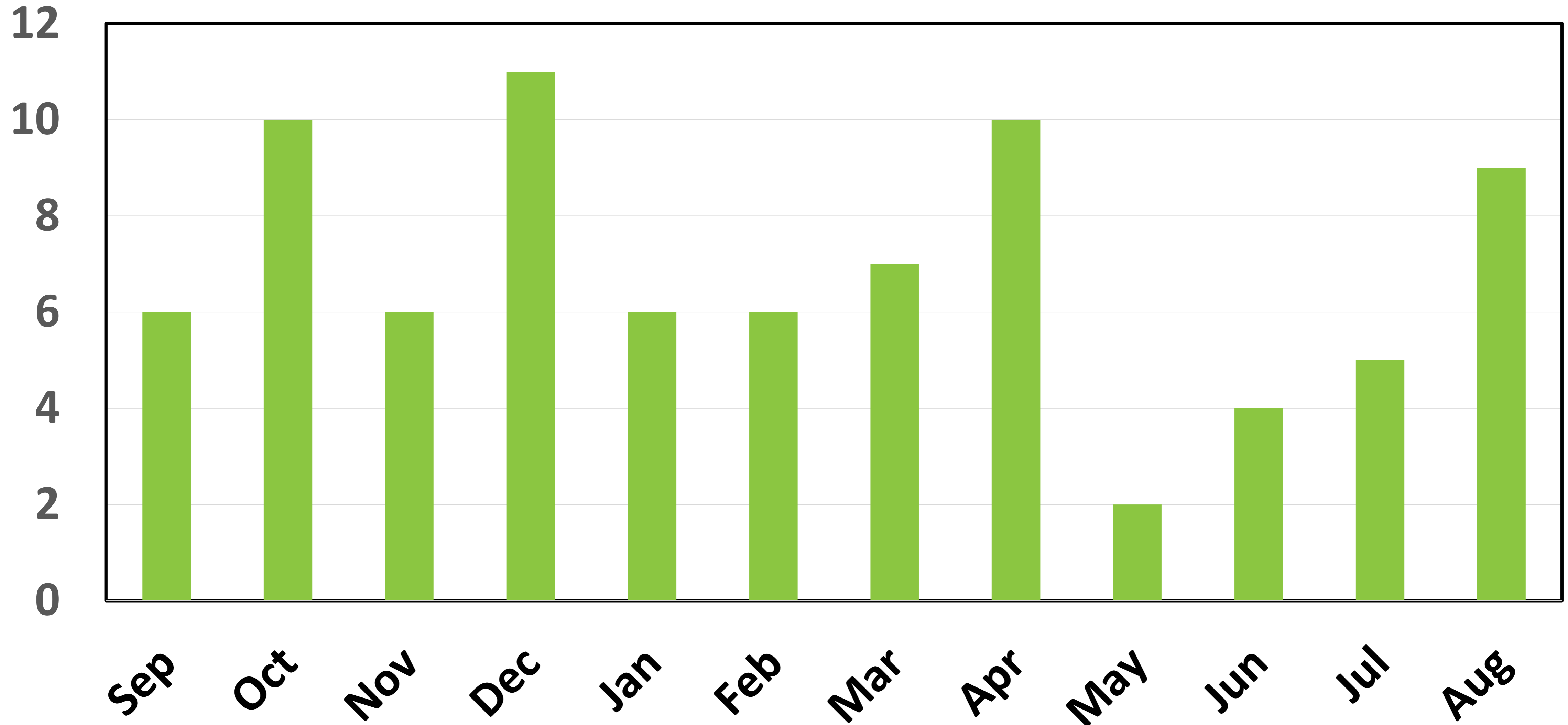


FIGURE 37. Transfer Explosions By Month 2017 – 2023

Sep. 2024



Force Level By Process Plant – 2023

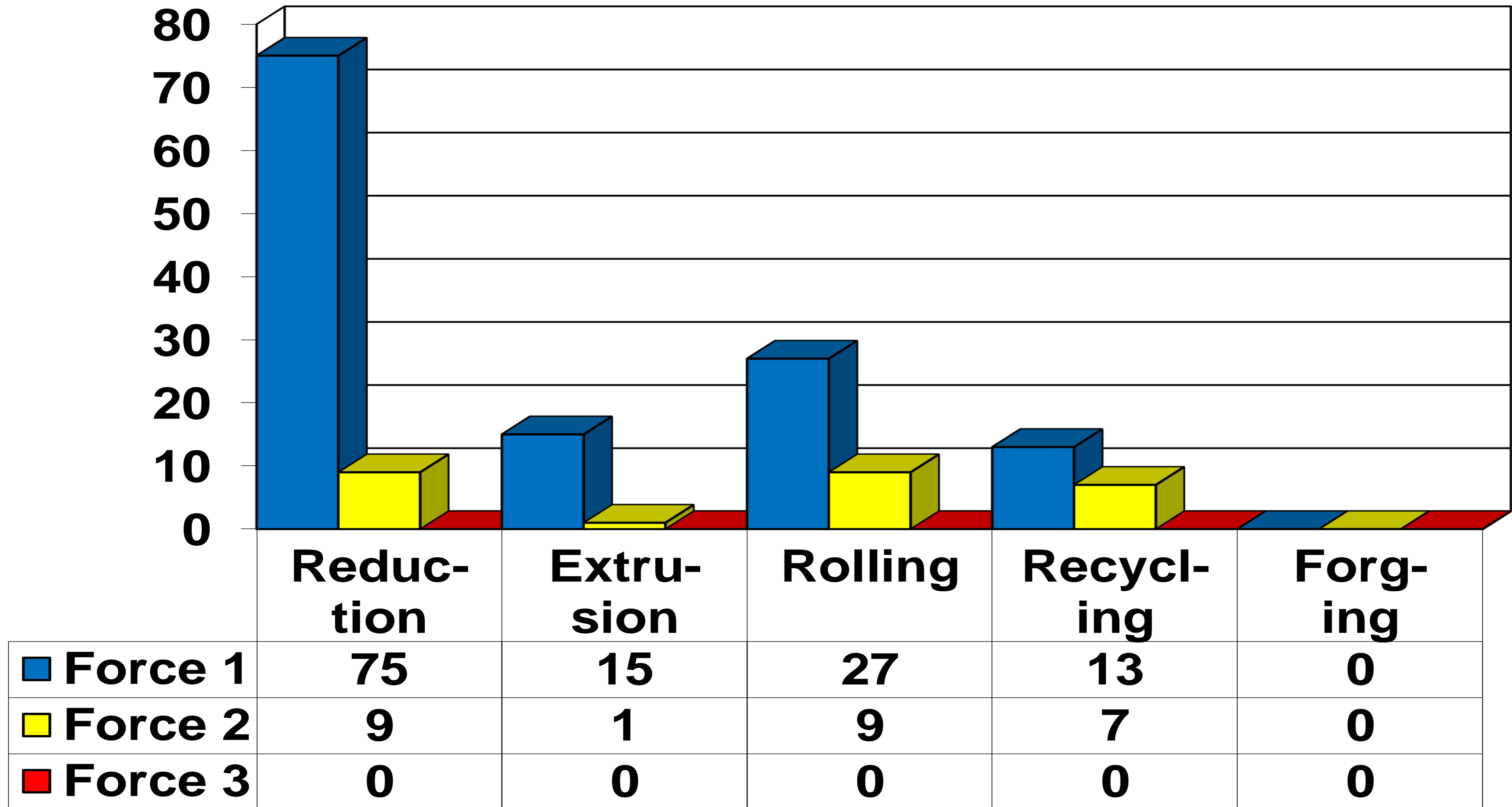


FIGURE 38. Force Level By Process Plant Reported For 2023

Sep. 2024



Force Level By Process Plant 1980 – 2023

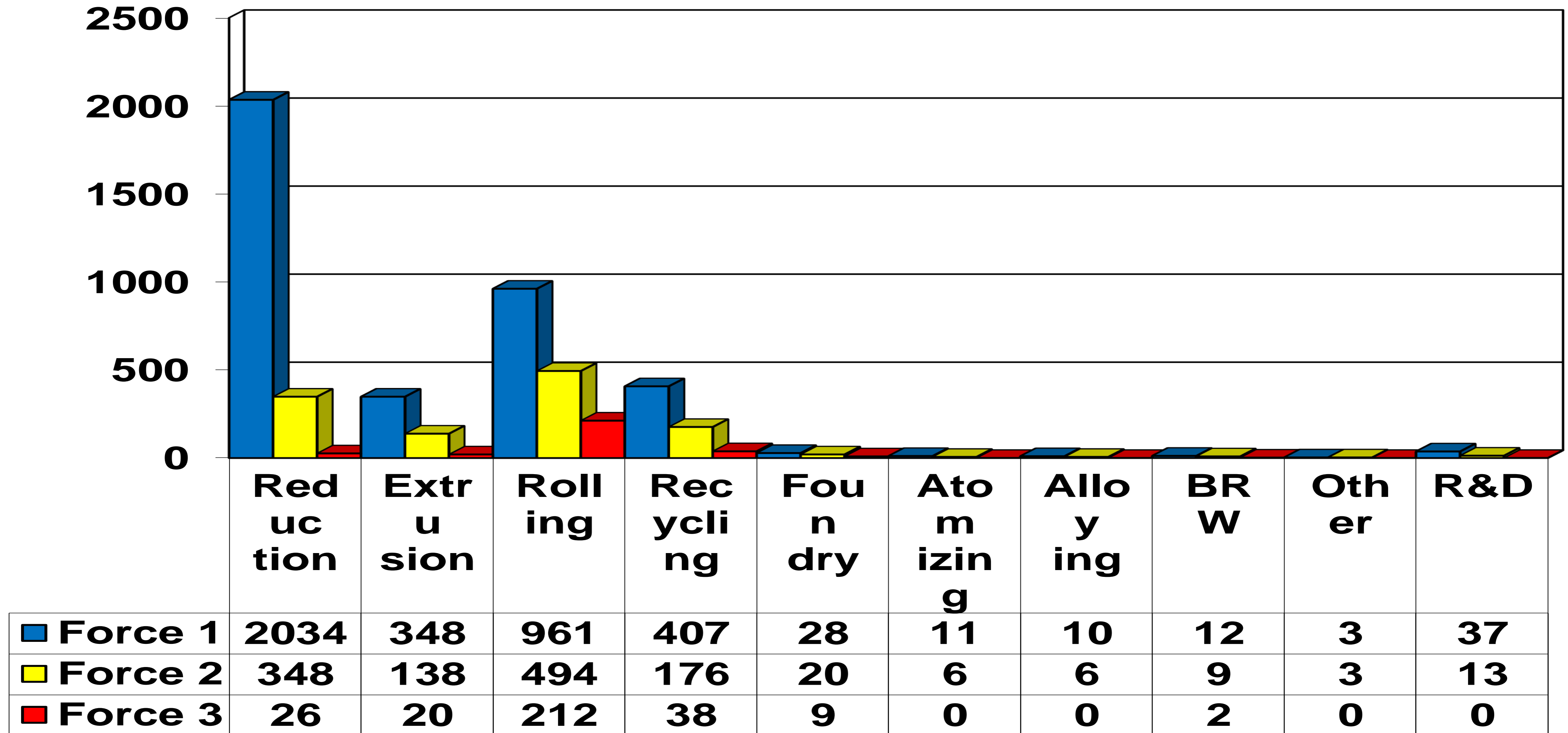


FIGURE 39. Force Level By Process Plant Reported For 1980 – 2023 Sep. 2024



Reduction Plant

Main Causes of 84 Incidents – 2023

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

FIGURE 40. Reduction Plant Incidents Summary 2023



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



Recycling Plant

Main Causes of 21 Incidents – 2023

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

FIGURE 42. Recycling Plant Incidents Summary 2023



Reduction Plant Injuries & Incident Causes – 2023

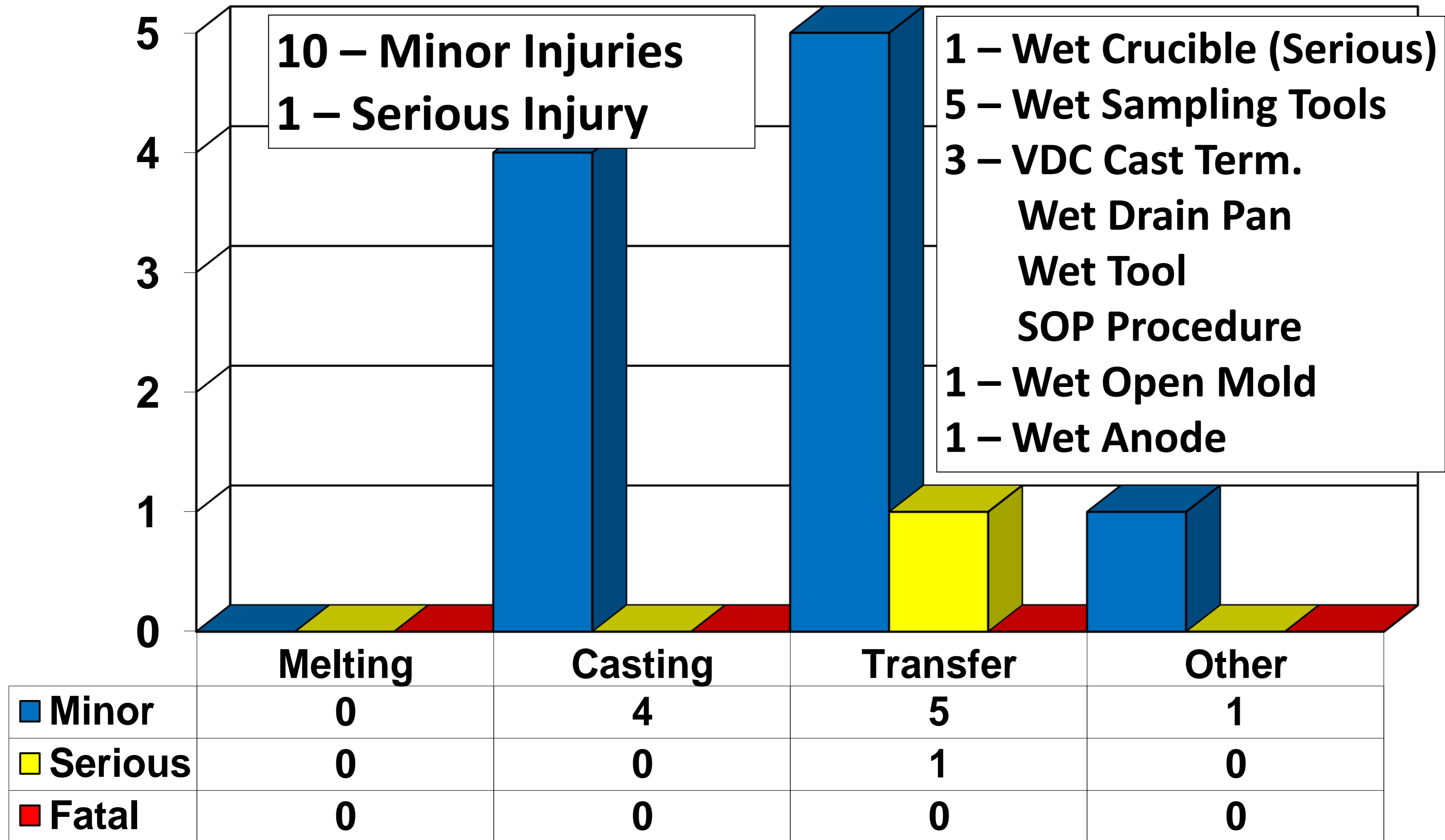


FIGURE 43. Reduction Plant Injuries By Operation 2023

Sep. 2024



Rolling Plant Injuries – 2023

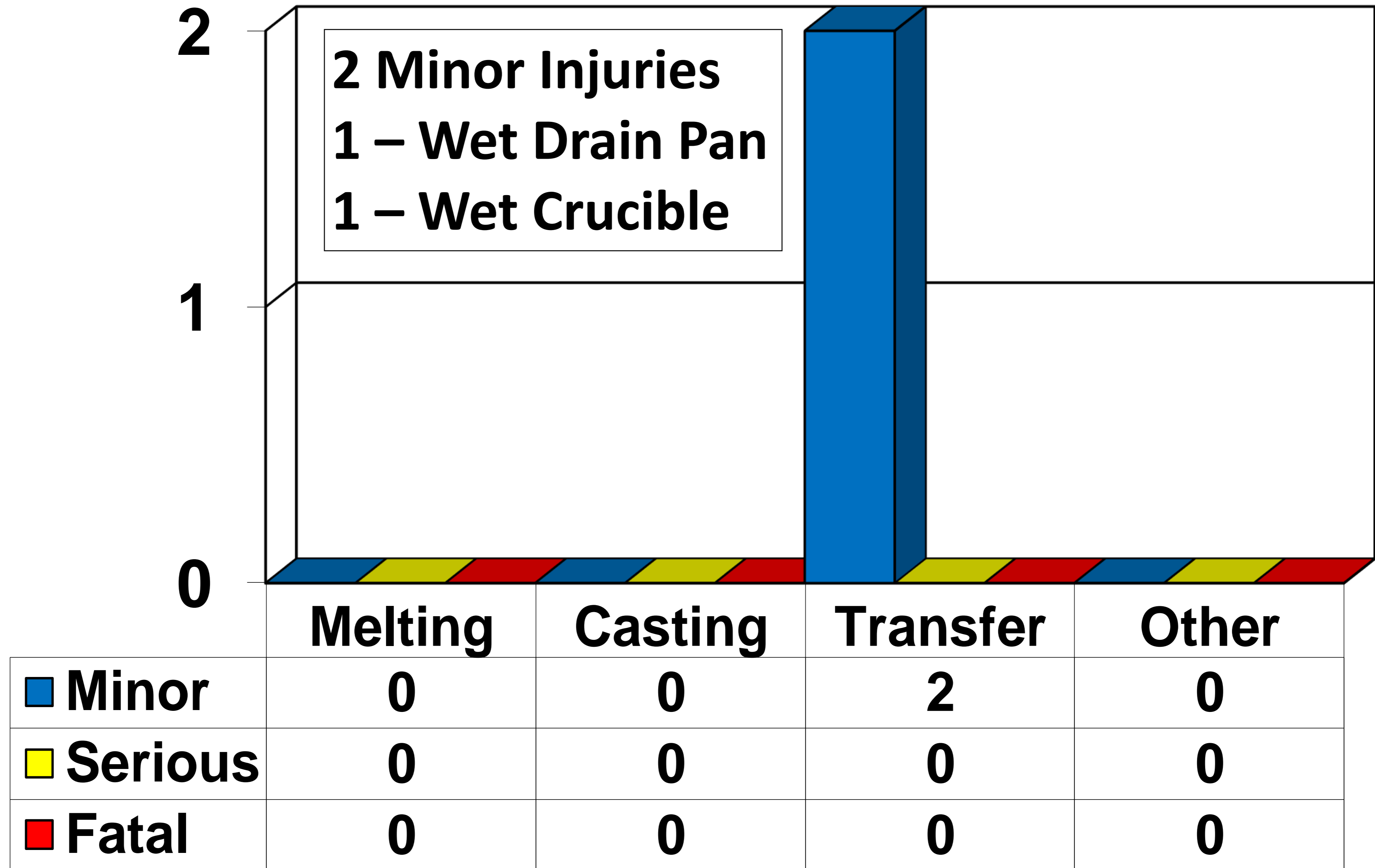


FIGURE 44. Rolling Plant Injuries By Operation 2023 Sep. 2024



Extrusion Plant Injuries – 2023

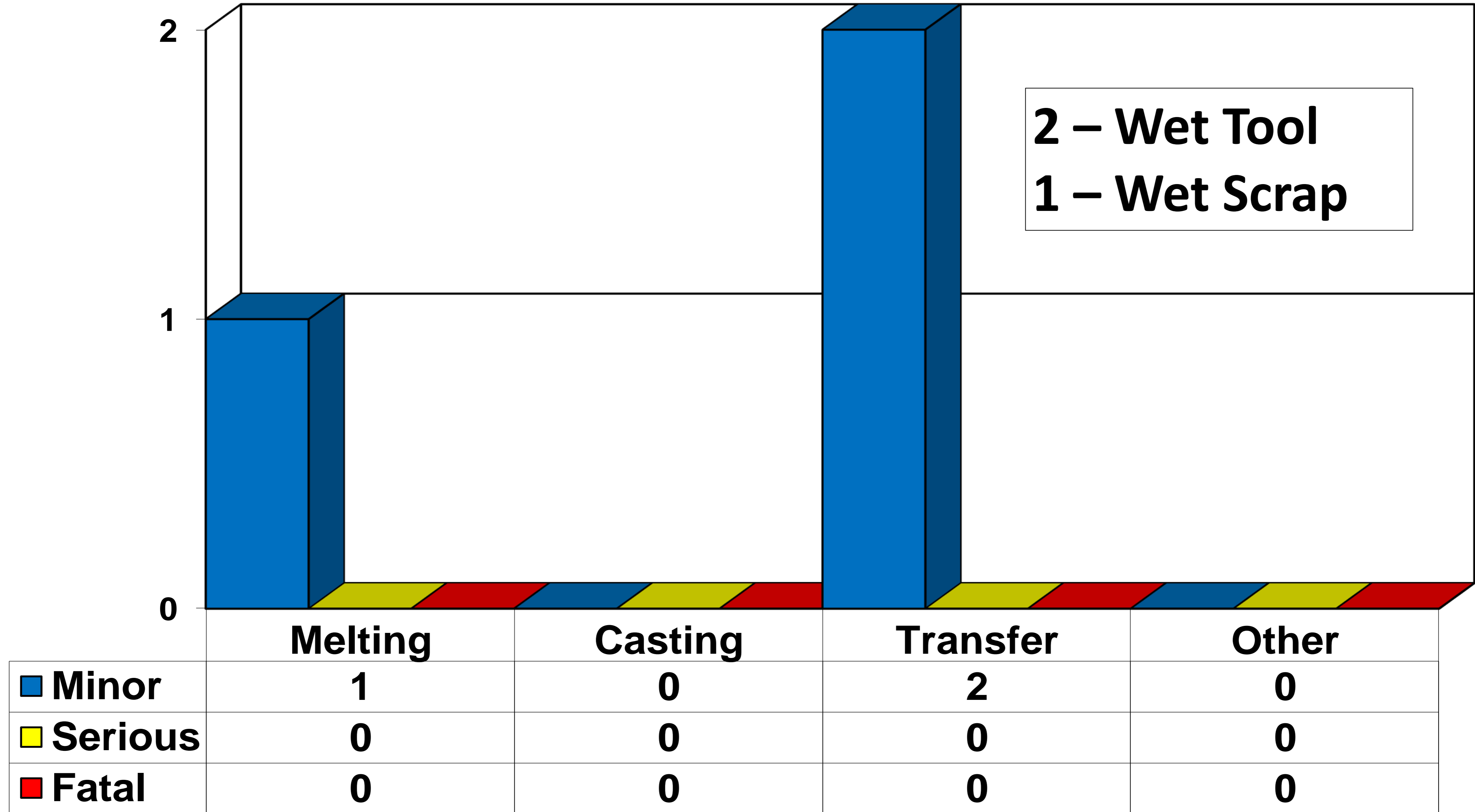


FIGURE 45. Extrusion Plant Injuries By Operation 2023

Sep. 2024



Recycling Plant Injuries – 2023

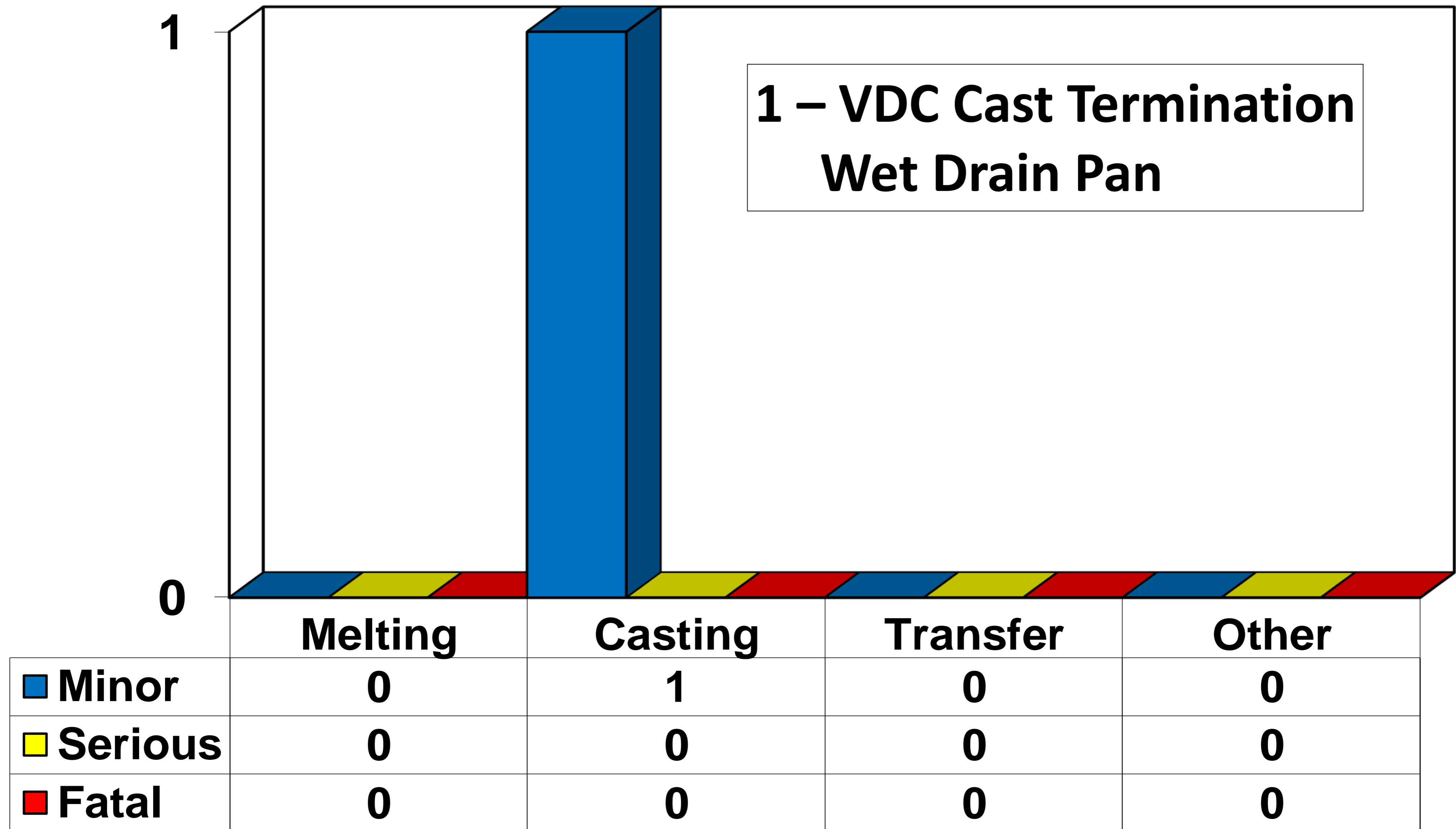


FIGURE 46. Recycling Plant Injuries By Operation 2023

Sep. 2024



Injury Severity by Process Plant – 2023

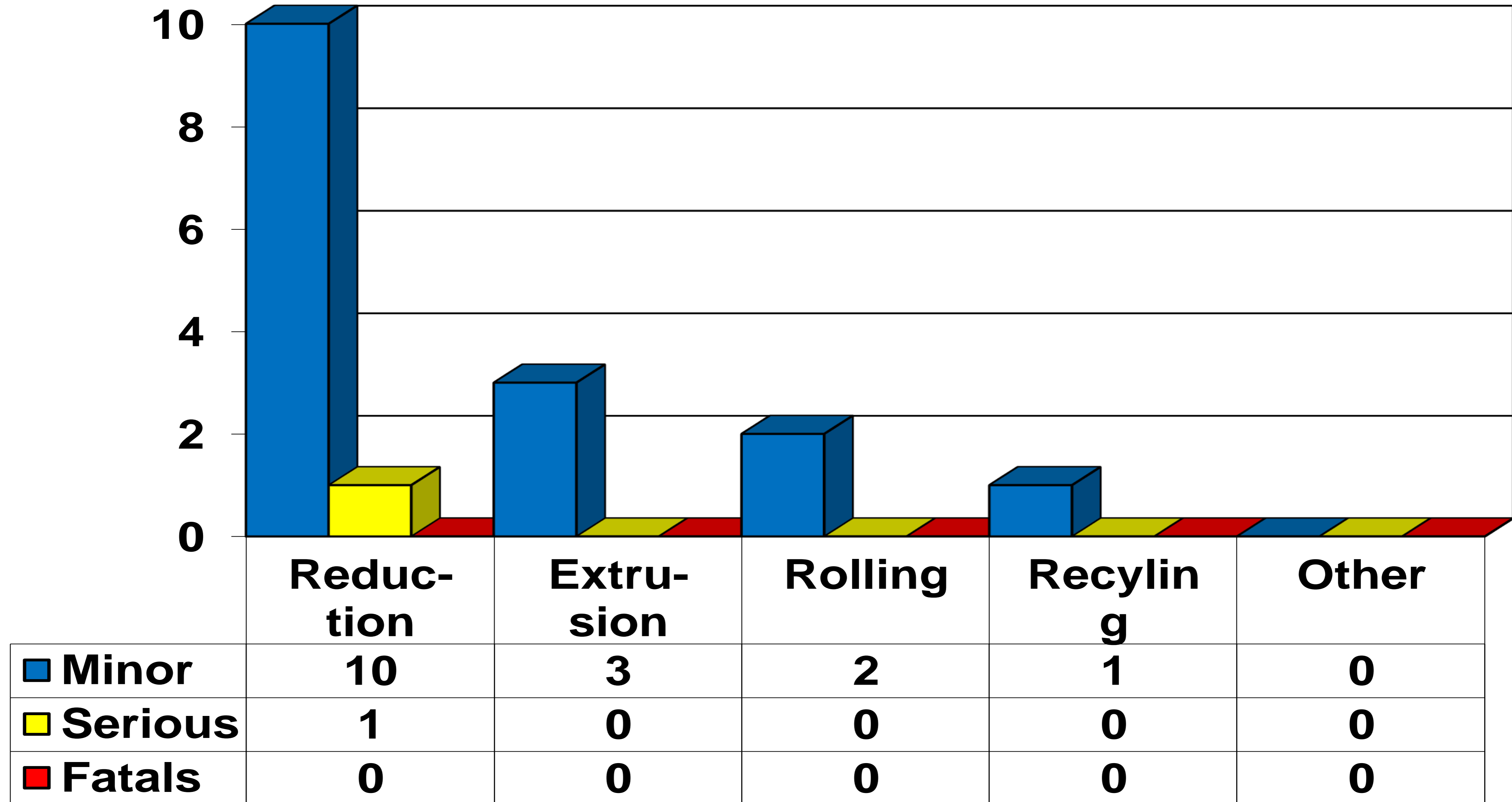


FIGURE 47. Injury Severity By Process Plant – 2023

Sep. 2024



Injury Severity by Process Plant 1980 – 2023

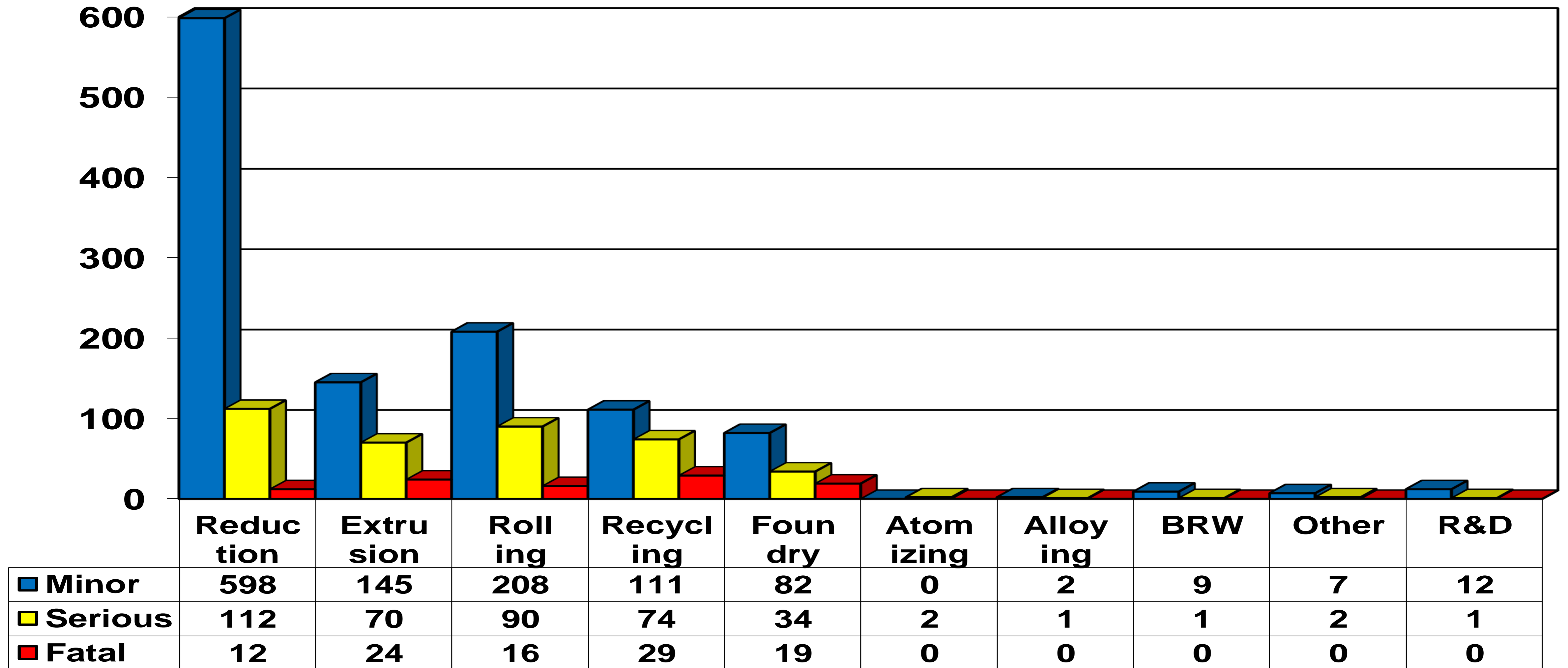


FIGURE 48. Injuries Severity By Plant Reported For 1980 – 2023 Sep. 2024



Reduction & Recycling Plant Incidents, Injuries / Incident Rate 2012 – 2023

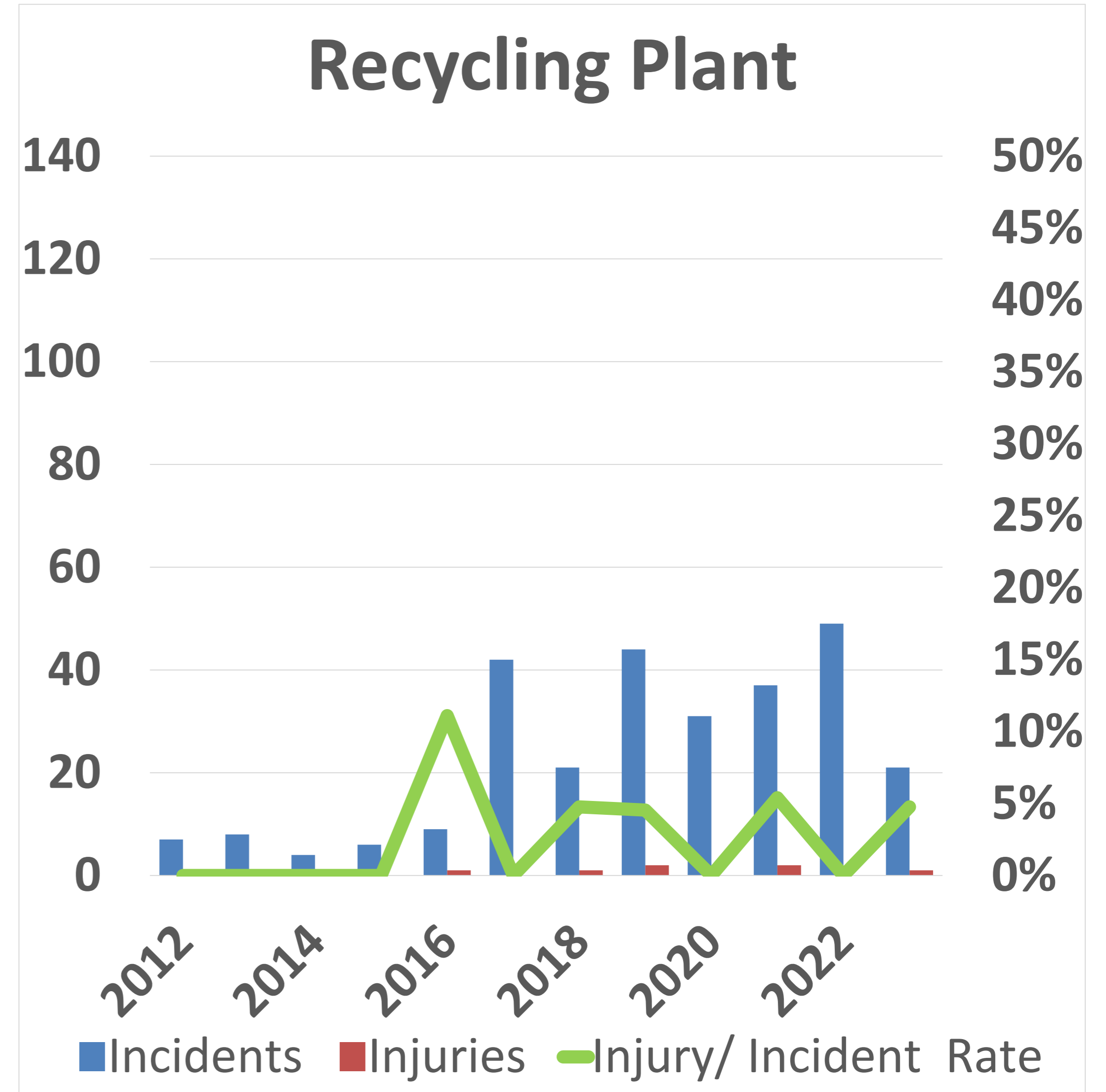
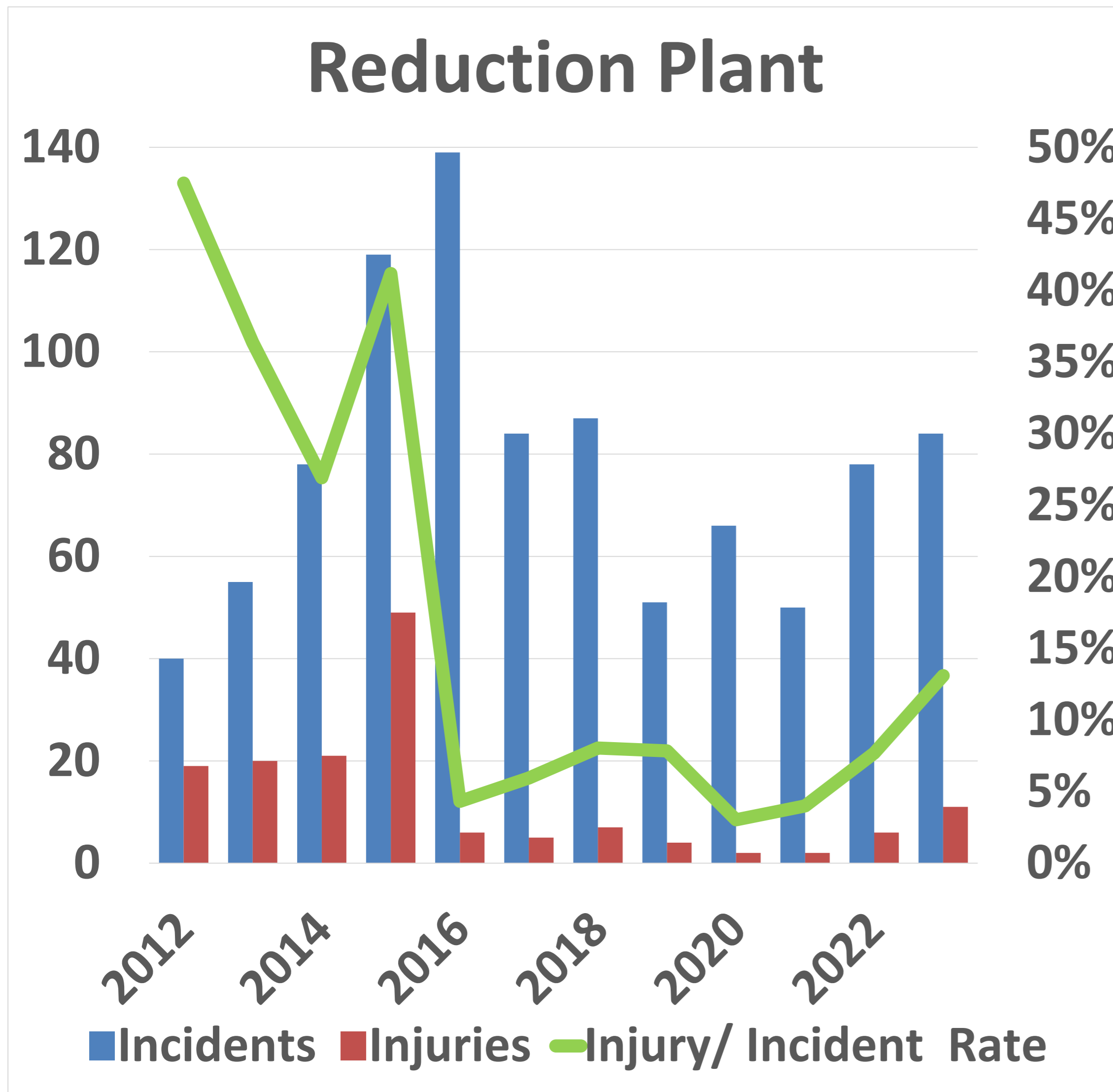


FIGURE 49. Reduction & Recycling Incident, Injury & Injury Rate 2012-2023 Sept. 2024



Rolling & Extrusion Plant Incidents, Injuries / Incident Rate 2012 – 2023

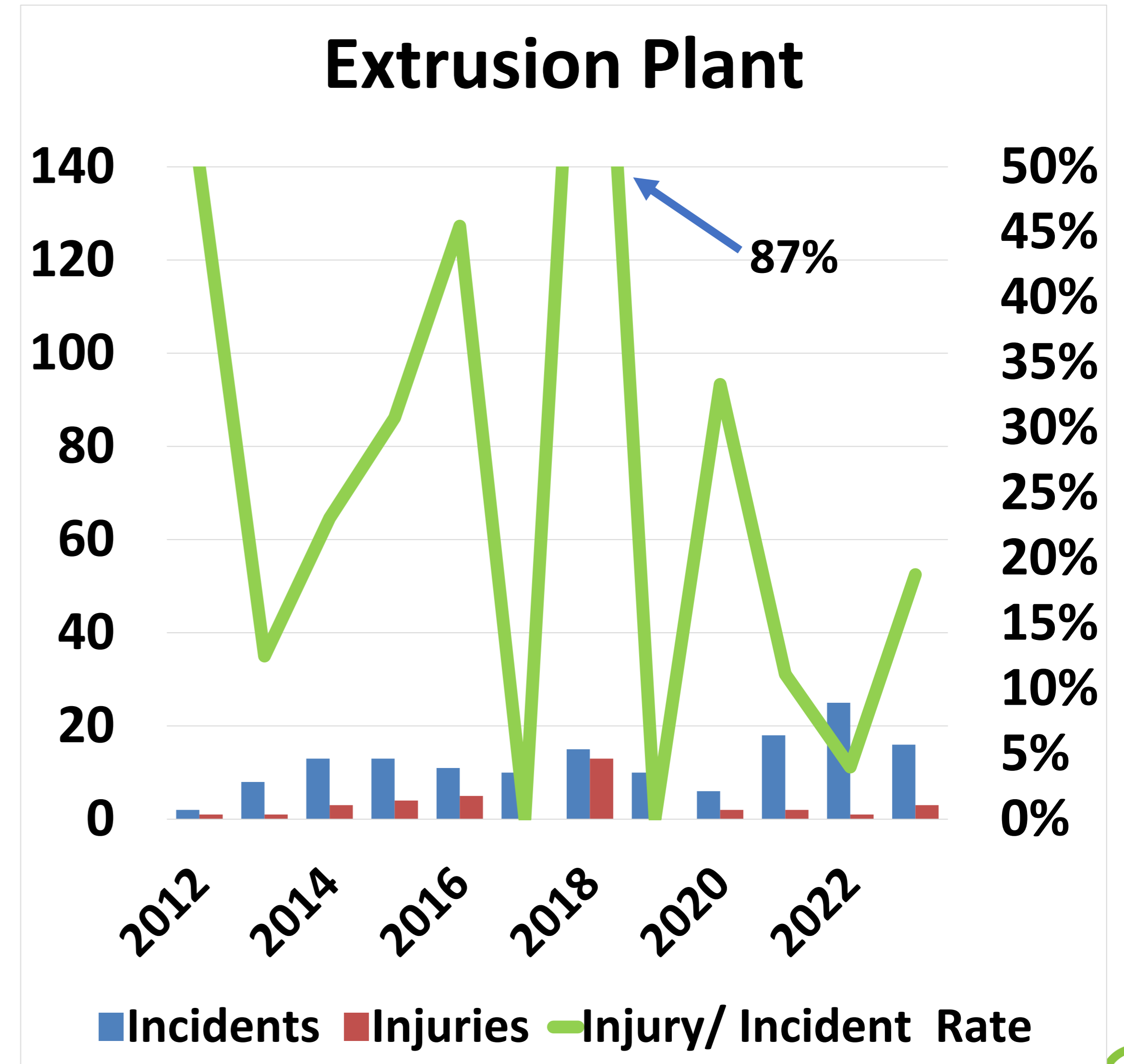
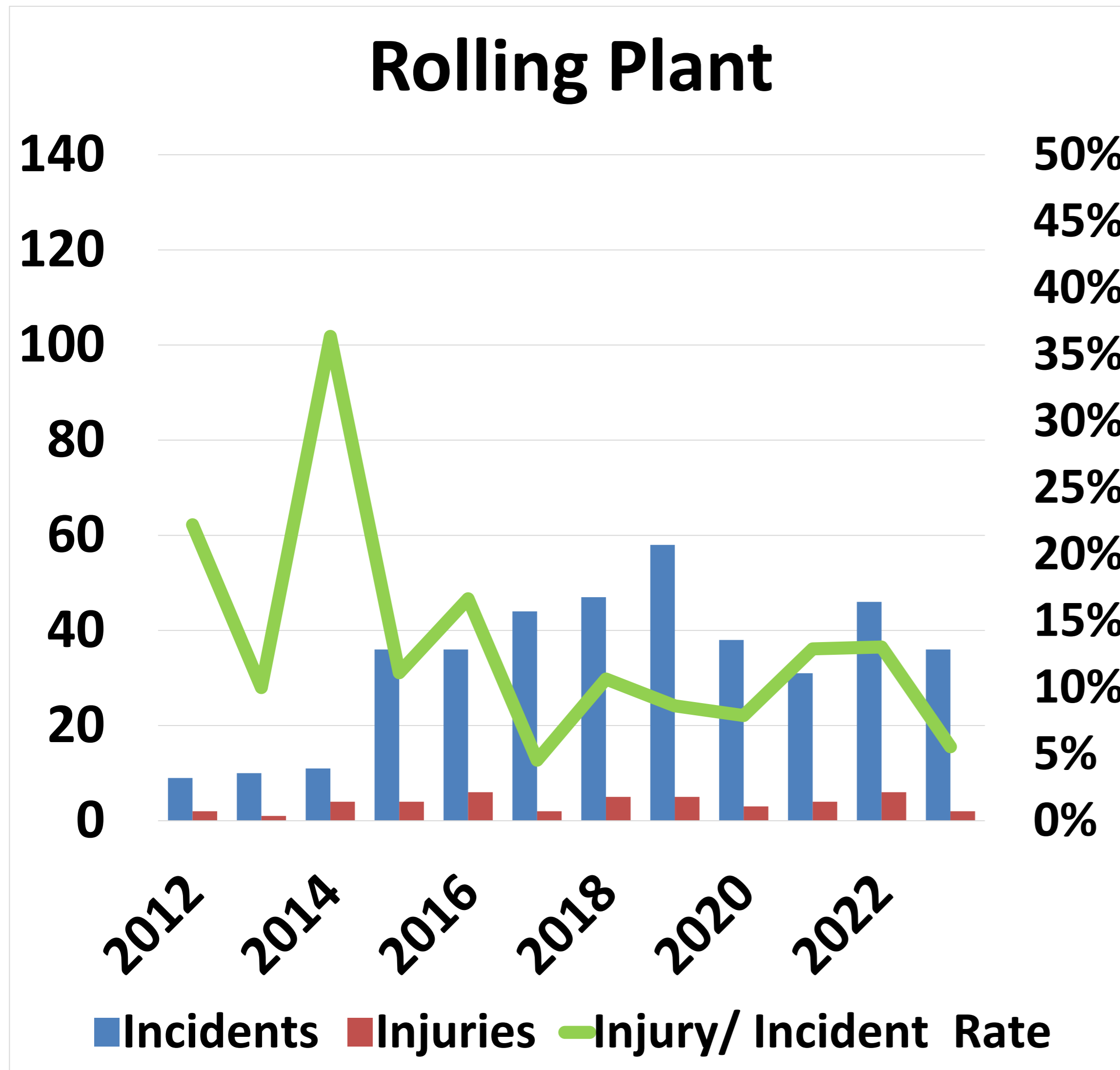


FIGURE 50. Rolling & Extrusion Incident, Injury & Injury Rate 2012-2023 Sept. 2024



Thank you!



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