

COURT-EVIDENTIARY STYLE REPORT · RULE 702, FEDERAL RULES OF EVIDENCE

# Foreseeable Injury Mechanisms in a U.S. Private-Sector Water Utility

*A Temporal Stability Analysis · OSHA Severe Injury Reports, 2015–2025*

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*Illustrative report based on hypothetical circumstances; not commissioned.*

## 01 · KEY TERMS & CENTRAL QUESTION

# The vocabulary before the statistics

<b>OSHA SIR</b>	Severe Injury Reports
<b>NAICS 22</b>	the U.S. utilities sector
<b>Event</b>	how the contact occurred
<b>Source</b>	the object or agent involved
<b>Event–source</b>	event × source = mechanism
<b>Temporal stability</b>	stable pattern across periods
<b>Foreseeability</b>	a recurring, plannable pattern

## CENTRAL QUESTION

*Are severe injuries in water-utility work random events — or do they recur in stable, foreseeable patterns?*

## 02 · WHY FORESEEABILITY MATTERS

# Foreseeability is anticipation, not hindsight



*Structured data reveals recurring injury mechanisms before the next serious incident.*

Recurrent hazards can be planned for

Stable patterns set prevention priorities

Data separates isolated events from embedded risks

## 03 · DATA SOURCE

# Public, reproducible OSHA injury data

## OSHA Severe Injury Reports, 2015–2025

2015

2025

### **In-patient**

Overnight hospital admission

### **Amputation**

Traumatic loss of a body part

### **Loss of an eye**

Serious, reportable eye injury

*Employer-reported, structured, and reproducible — a defensible evidentiary basis.*

## 04 · UNIT OF ANALYSIS

# Event × Source = the injury mechanism

### EVENT

How contact occurred —  
struck by, caught in, fall to a  
lower level

×

### SOURCE

The object or agent —  
powered machinery,  
weather, structures

=

### MECHANISM

The event–source pair at  
the point of exposure

*Example — struck by × powered machinery = the struck-by powered-machinery mechanism*

*Binding what happened to what caused it supports actionable hazard anticipation.*

## 05 · OPERATIONAL STRESS TEST

# COVID-19 as an operational stress test

**Pre-COVID**

2015–2020

**COVID-era**

2020–2023

**Post-COVID**

2023–2025

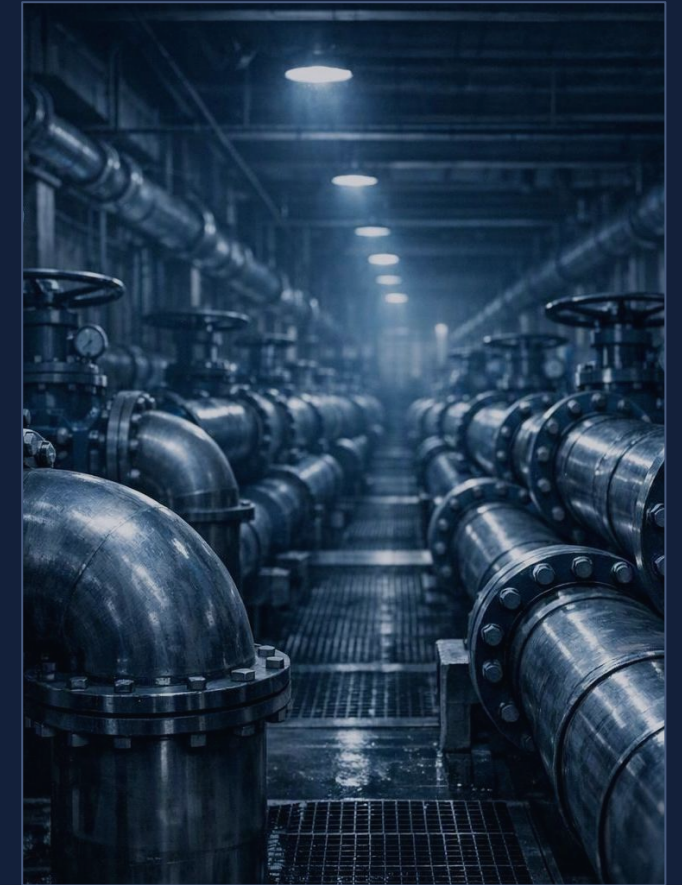
*If the same mechanisms persist before, during, and after disruption, they are structurally embedded.*

**Workforce disruption**

**Task reassignment**

**Maintenance pressure**

**Operational continuity**



# A transparent, repeatable method



**Chi-square**

homogeneity tests

**Cramér's V**

effect size

**$\alpha = .05$**

significance threshold

*The method evaluates whether the distribution of mechanisms changed across periods.*

## 07 · MAIN FINDING

# No significant redistribution of mechanisms

The pattern of severe injury mechanisms remained stable across pre-COVID, COVID-era, and post-COVID periods.

**p = .62**

No significant redistribution  
Pre-COVID vs COVID

**p = .44**

No significant redistribution  
Pre-COVID vs Post-COVID

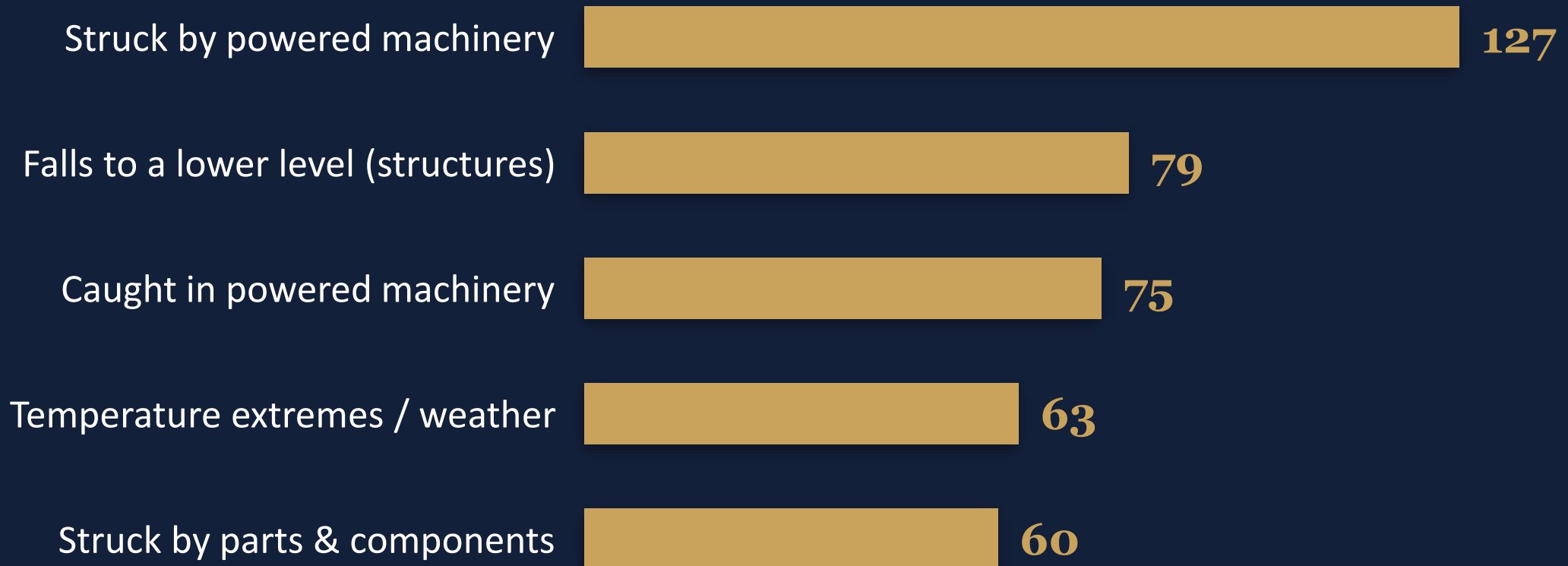
**p = .36**

No significant redistribution  
COVID vs Post-COVID

All p-values exceed the .05 threshold; effect sizes were modest (Cramér's  $V \approx .48-.53$ ).

## 08 · RECURRING INJURY MECHANISMS

# The mechanisms that recur over time



*Top five event–source mechanisms in U.S. water utilities, 2015–2025 (counts, not rates).*

## 09 · NATIONAL ALIGNMENT

# Aligned with the national water sector

≈ **0.94**

Cosine similarity (structural match)

**$\rho = .79$**

Rank alignment (p = .006)

- Strong structural similarity to the national profile
- No material divergence across all three periods
- Supports benchmarking to inform prevention planning

# Water is not a surrogate for oil & gas

## WATER UTILITIES

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- Electrical exposure via parts & components
- Same-level slips and trips
- Weather-driven temperature extremes

## OIL & GAS

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- Caught-in incidents with machinery
- Struck-by heavy equipment
- Concentrated mechanical hazards

***Cosine  $\approx 0.39$  · rank  $\rho = -0.14$***

*Risk structures are sector-specific; controls must be tailored.*

## 11 · STABLE DOES NOT MEAN SAFE

# Stable does not mean safe



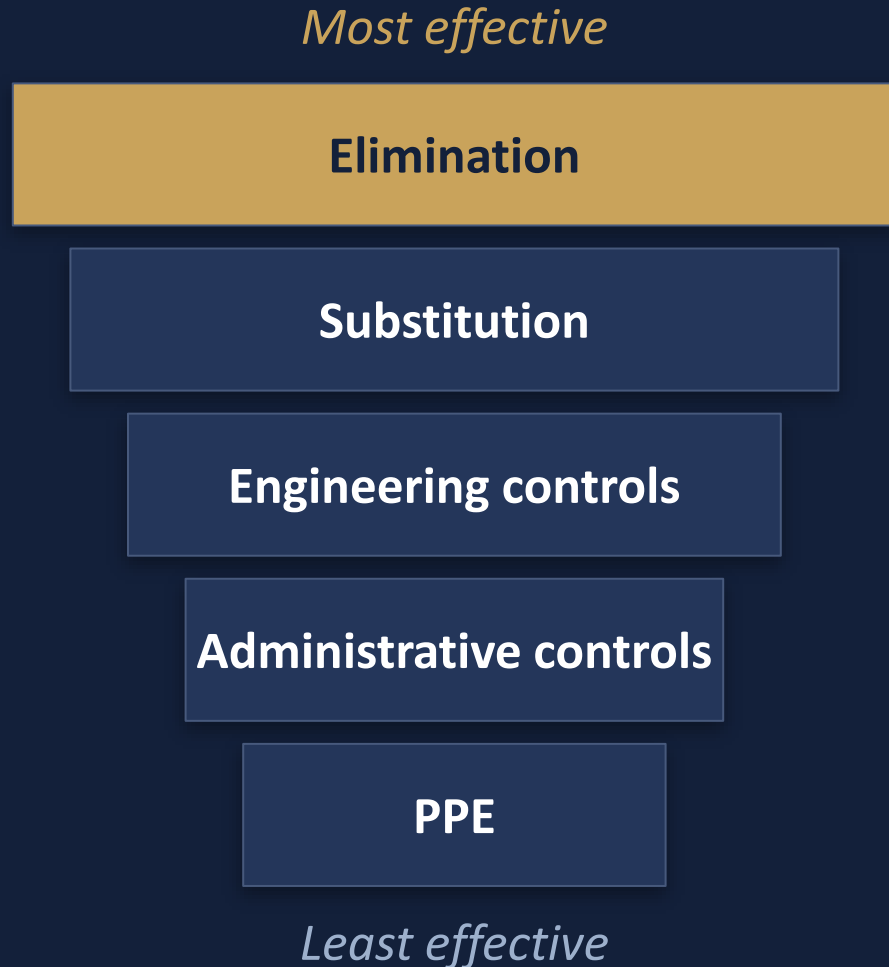
*Stability means the risk is persistent — not acceptable.*

- Persistent mechanisms deserve planned controls
- Recurrent hazards are not surprises
- Stability supports proactive risk management



## 12 · PREVENTION IMPLICATIONS

# Prioritize upstream controls



- Engineering controls & equipment safeguards
- Task design and work planning
- Supervision and focused training
- PPE as a supporting control — not the only one

# Built for reliability review

✓ Public data source

✓ Defined classification rules

✓ Transparent comparison periods

✓ Reproducible statistical methods

*Structured to support Rule 702 / Daubert-style reliability review.*

## REFERENCES & FRAMEWORK

- OSHA Severe Injury Reports
- NAICS Sector 22
- OIICS event/source framework
- Chi-square homogeneity
- Cramér's V effect size
- Rule 702 / Daubert

## 14 · STRATEGIC TAKEAWAYS

# Five takeaways for prevention planning

- 1 Severe injury mechanisms in water-utility work recur.
- 2 COVID-era disruption did not materially redistribute the pattern.
- 3 The analyzed profile aligns with national water-sector data.
- 4 The risk structure differs from oil & gas.
- 5 Stable mechanisms support reasonable foreseeability and prevention planning.

*Persistent injury patterns should guide durable controls, focused training, and forward-looking safety planning.*