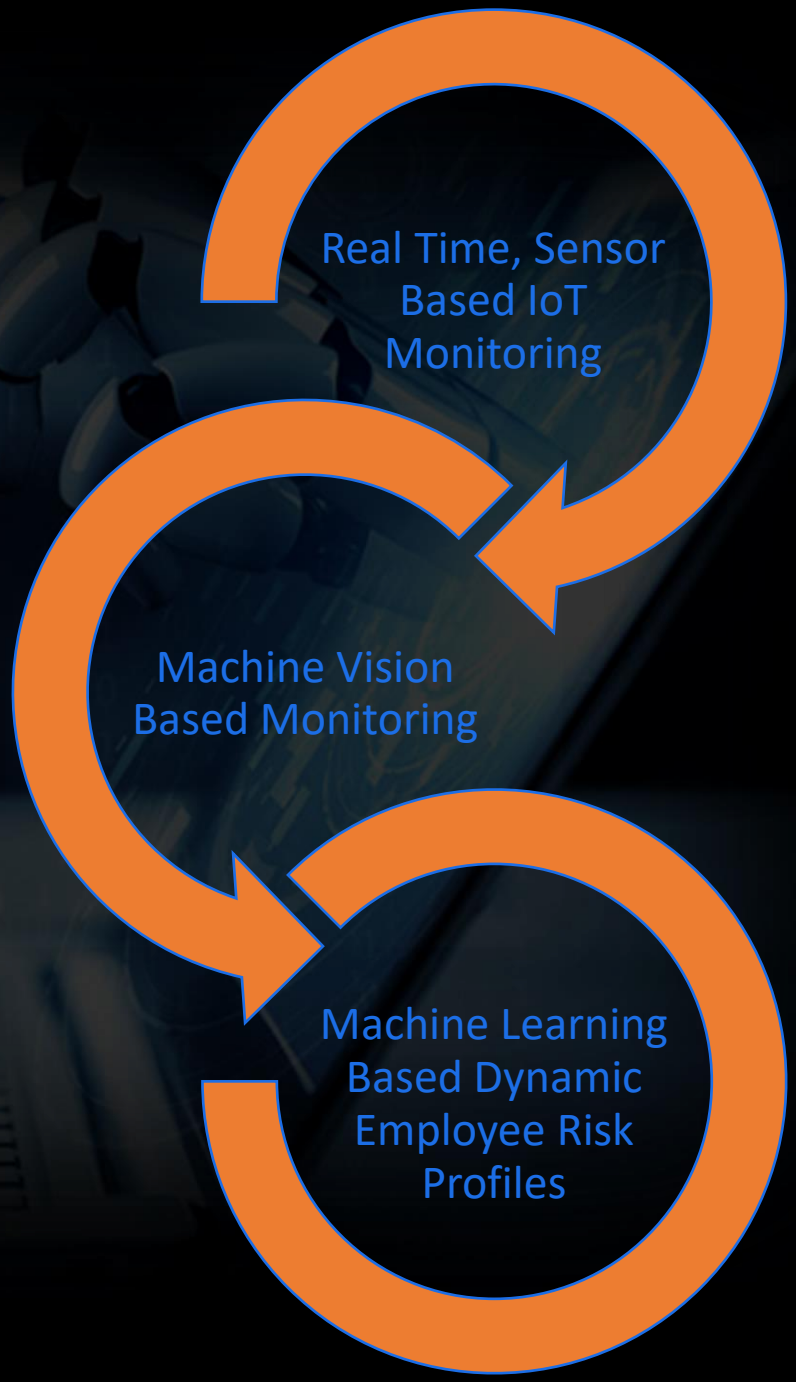
Predict & Prevent OH&S Incidents using Machine Learning, Machine Vision, IoT & Digital Twins

CONSULTING
GROUP

AI & ML Based, Safety, & Risk Minimisation

- **MONITOR** - Monitor Real-time IoT and Machine Vision based alerts (incl. personal protective equipment, hazards and mobile equipment risk) to ensure safety compliance today. Use Digital Twins for real-time visualisation and scenario modelling.
- **PREDICT** – Predict OH&S incidents by creating forward-looking machine learning-based 'Dynamic Employee Risk Profiles' to calculate an employee's chances of being involved in an incident on any upcoming day.
- **INTERVENE & PREVENT** – Prevent incidents by retraining, proactively removing employees from potentially dangerous situations and send live compliance alerts to employees to immediately eliminate dangerous working conditions.



Dynamic Risk Profiles

PREDICT – Create forward-looking AI/ML-based 'Dynamic Employee Risk Profiles' using role type, role risk, experience, age, recent overtime, recent sick leave, near misses, recent incidents, weather, risk culture, recency of training, and many other features to accurately predict the chances of an employee being involved in an OHS incident. Simplified example below:

Rain	1
Heat	0

	Age	Rain Dependency	Heat Dependency	Role Risk Index	Years of Experience	Hours Worked LW	Calculated Overtime Worked LW	Sick Leave Taken LW
Edie Power	32	1	1	5	15	20	0	2
Larissa Wyatt	25	1	1	3	7	30	0	1
Sumaya Gilliam	52	0	1	6	11	69	31	0
Max Koch	20	1	1	9	3	69	31	4
Ned Christensen	35	0	0	2	6	38	0	0
Nina Conrad	26	1	1	9	9	55	17	0
Shoaib Beck	43	1	1	8	6	38	0	3
Viola Connelly	37	1	1	6	17	55	17	0
Margie Mac	48	1	1	7	23	20	0	3
Tegan Johnston	36	0	0	5	20	69	31	0
Ricky Lowery	30	0	0	7	14	47	9	5
Alya Horner	41	0	0	7	6	56	18	0
Danielle Gardner	39	0	1	6	11	21	0	2
Allana Franco	40	1	1	8	10	48	10	1
Andrew Dowling	25	1	1	8	3	70	32	3
Colby Lewis	21	0	0	6	2	26	0	1
Anwar Valdez	52	0	0	2	16	26	0	0
Macie Goddard	19	0	1	9	3	70	32	4
Liberty Heath	32	0	1	8	10	28	0	0
Damien Bull	22	0	0	4	2	64	26	0
Quentin Ewing	32	0	0	4	3	45	7	0
Jevan Leach	35	1	1	5	7	34	0	0
Dafydd Lester	37	1	1	10	6	62	24	0
Angel Hibbert	52	1	0	9	15	62	24	0
Nusaybah Ponce	56	1	1	6	19	35	0	2
Aya Weir	31	1	1	7	3	37	0	1
Elisabeth Molina	58	0	0	2	20	64	26	4
Maxime Bartlett	64	1	1	1	24	43	5	0
Kaden Tanner	31	1	0	7	14	70	32	5
Anderson Vo	48	1	0	4	5	65	27	2

Rain	1
Heat	0

	Age	Rain Dependency	Heat Dependency	Role Risk Index	Years of Experience	Hours Worked LW	Calculated Overtime Worked LW	Sick Leave Taken LW	Dynamic Risk Rank
Max Koch	20	1	1	9	3	69	31	4	1
Kaden Tanner	31	1	0	7	14	70	32	5	2
Andrew Dowling	25	1	1	8	3	70	32	3	3
Angel Hibbert	52	1	0	9	15	62	24	0	4
Macie Goddard	19	0	1	9	3	70	32	4	5
Anderson Vo	48	1	0	4	5	65	27	2	6
Margie Mac	48	1	1	7	23	20	0	3	7
Nusaybah Ponce	56	1	1	6	19	35	0	2	8
Elisabeth Molina	58	0	0	2	20	64	26	4	9
Nina Conrad	26	1	1	9	9	55	17	0	10
Dafydd Lester	37	1	1	10	6	62	24	0	11
Shoaib Beck	43	1	1	8	6	38	0	3	12
Allana Franco	40	1	1	8	10	48	10	1	13
Maxime Bartlett	64	1	1	1	24	43	5	0	14
Viola Connelly	37	1	1	6	17	55	17	0	15
Ricky Lowery	30	0	0	7	14	47	9	5	16
Sumaya Gilliam	52	0	1	6	11	69	31	0	17
Edie Power	32	1	1	5	15	20	0	2	18
Aya Weir	31	1	1	7	3	37	0	1	19
Larissa Wyatt	25	1	1	3	7	30	0	1	20
Tegan Johnston	36	0	0	5	20	69	31	0	21
Damien Bull	22	0	0	4	2	64	26	0	22
Alya Horner	41	0	0	7	6	56	18	0	23
Jevan Leach	35	1	1	5	7	34	0	0	24
Danielle Gardner	39	0	1	6	11	21	0	2	25
Colby Lewis	21	0	0	6	2	26	0	1	26
Anwar Valdez	52	0	0	2	16	26	0	0	27
Liberty Heath	32	0	1	8	10	28	0	0	28
Quentin Ewing	32	0	0	4	3	45	7	0	29
Ned Christensen	35	0	0	2	6	38	0	0	30

Machine Vision, Monitoring & Alerts

Real Time, Sensor Based IoT Monitoring

- Noise, Vibration, Movement, Lighting, Hydration
- Hydration, Fatigue, Inattention
- Temperature, Machine Speed, RPM, Torque, Coolant Temperature
- Chemical Detection, Air Quality, C02
- Real-time data on Recent Hours Worked, Overtime/Sick Leave, Role Risk Rating, Years of Experience

Real-time analytics from IoT sensors in the environment are used for alerts and also stored for advanced analytics.

Machine Vision Based Monitoring

- Safety Equipment, PPE (Hard Hats, High Visibility Vests, Eye Protection etc), Hazardous Material Security (Locks, Unauthorised Access, Appropriate Safety Equipment), Dust, Liquid Spills, Trip Hazards, Proximity Detection, Location Awareness, Poor Mobile Equipment Practices.
- Understanding complex video events in real time (e.g. traffic flow, people movements, weather events, accidents, incidents, threats, inspections, defect reduction, tracking, environmental assessments, drone footage assessment and much more.

This is one of our consultants on CCTV being assessed for appropriate PPE, in real time, with alerts and monitoring!

Predictive Analytics & Optimisation

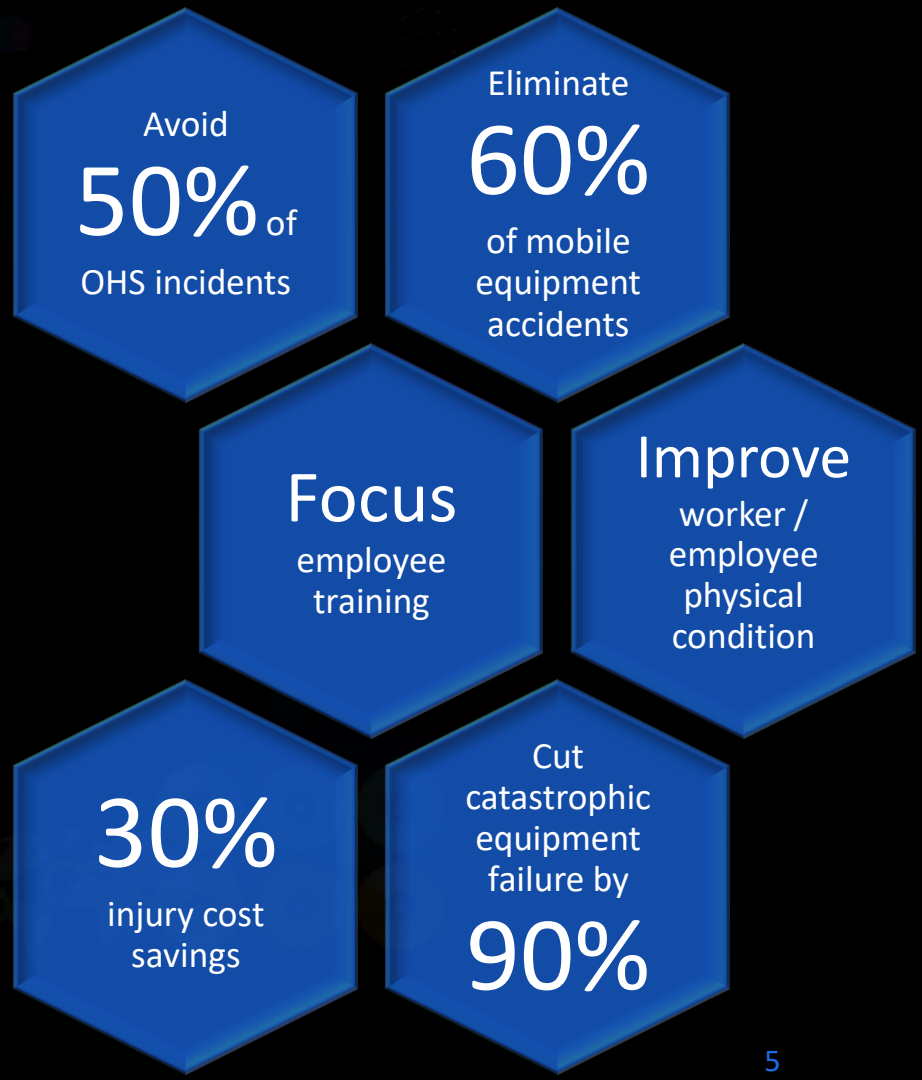
Predict Events Using Machine Learning & Artificial Intelligence

Predict Incidents

- Predict OHS Incidents by combining incident history with environmental variables and staff activities.
- Machine-Learning-Based Dynamic Employee Risk Profiles.
- Hazard Identification.

Asset Monitoring and Safety Optimisation

- Predict catastrophic equipment failure that could lead to injury or fatality.
- Defective equipment identification.
- Determine safe asset use via statistical analysis and optimise asset safety.



Digital Twins

Real Time Visualisation & Scenario Modelling using Digital Twins

Digital Twin Maturity

- Centralise and Collect Data (SSOT).
- Reporting and Dashboards.

- Visualise Over Maps and Building Models (2D, 3D, Model).

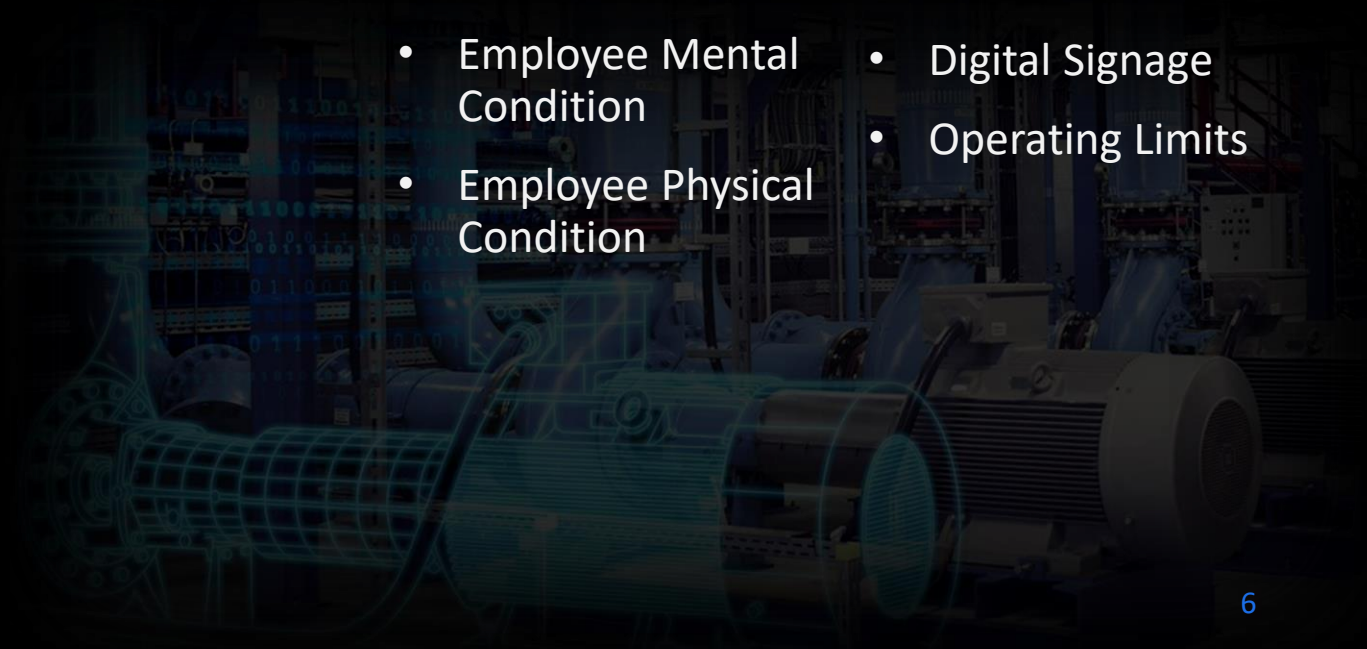
- Real-time, 4D model to include real-time data from systems and telemetry (i.e. APIs and IoT).

- Feedback to/from systems and telemetry for decision support around operational safety and risk.

- Complete Autonomous Operations and Risk Minimisation.

Collect Data and Model Relationships between:

- Personal Protective Equipment
- Environmental Factors
- People Data
- Employee Mental Condition
- Employee Physical Condition
- Environmental Telemetry, Sensors
  - Temperature
  - Input Speed
  - Power Input
  - Vibration
- Digital Signage
- Operating Limits



Case Studies

Risk Reduction and Safety

We can expedite the delivery of your outcomes using IP and accelerators…

Predict, Intervene & Prevent OHS Incidents

Reduced incident frequency by identifying predictors of OH&S incidents and building a predictive model. The model combined incident history, weather, annual leave, overtime, role types and more to automatically alert employees who had that had a high risk of being involved in an incident that day. Intervention and prevention included reminders, re-training and duty changes.

Monitor and Alert for PPE Compliance

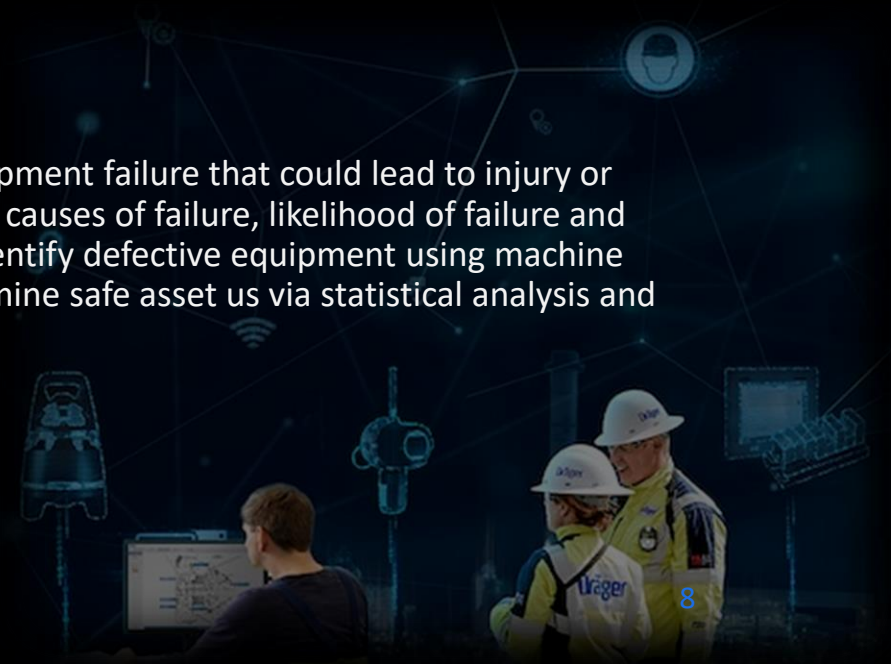
Improve PPE (Personal Protective Equipment) use and compliance by monitoring real-time CCTV feeds of high risk, PPE environments. Artificial Intelligence and Machine Learning based models were trained to be able to identify hard hats, goggles and vests, but could easily be extended to identify gloves, boots, badges and any other PPE measure. Monitoring over months showed a decline in non-compliance.

Risk Culture, Safety Culture and Psychological Wellbeing Surveys

Various surveys across various industries to identify areas of risk or concern based on questions around Risk Culture, Safety Culture/Compliance, and Phycological Health. Results allow drilling to problem departments, locations and site to focus training and remediation activates.

Asset Safety

Predict catastrophic equipment failure that could lead to injury or fatality by understanding causes of failure, likelihood of failure and predict failure events. Identify defective equipment using machine vision and IoT and determine safe asset us via statistical analysis and optimise asset safety.



Appendix

OHS Risk & Drivers

Personal and Operation Risk Examples

Personal

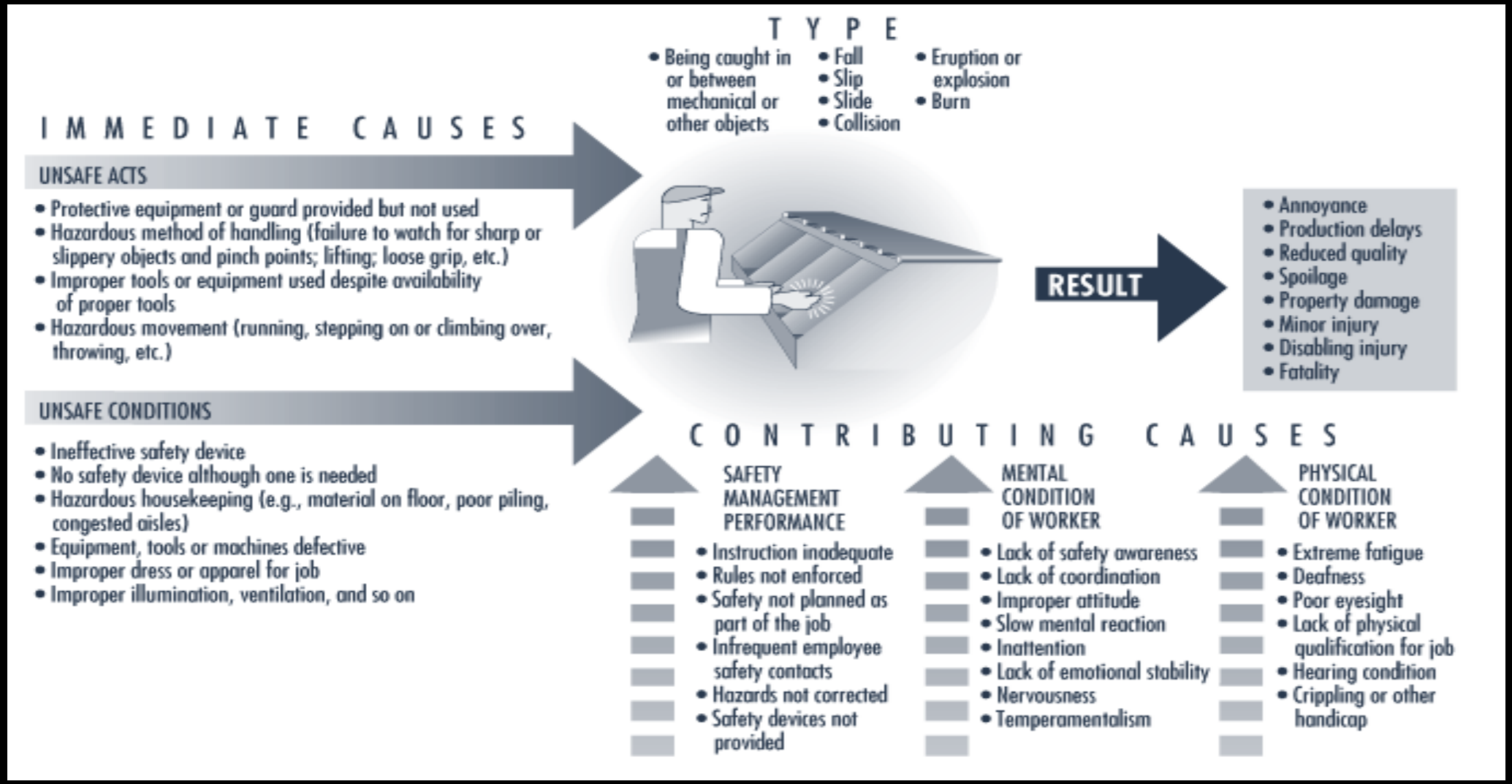
- Long term health
- Weight and habit management
- Food quality
- Sleep quality
- Sedentary work
- Drug and alcohol
- Relationship stress
- Boredom
- Fatigue
- Early starts and/or late finishes (particularly after dark)
- PPE compliance
- Training

Operational

- Road conditions
- Wildlife on roads
- Chemical exposure
- Air quality
- Unplanned detonation and explosives
- Loading facilities
- Heights
- Confined spaces
- Remote work (and access to health services)
- Heavy vehicle operation
- Visibility
- Ground and structure stability

Risk Identification

Example of immediate causes and contributing risk factors for a manufacturing line worker…



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