



mineaware

CONSULTING

Using data to solve problems

OUR FOOTPRINT

Barrick Gold
North Mara
Tanzania



Barrick Gold
North Mara
Tanzania

Barrick Gold Kibali
DRC



Caledonia Mining
Zimbabwe



Harmony Gold
Sibanye-Stillwater
Gold Fields
Northam Platinum
Anglo Platinum
Village Main Reef
Samancor Chrome
Impala Platinum
PAR
Petra Diamonds
Ekapa



OUR FOOTPRINT



Harmony Gold



OUR FOOTPRINT



Teck Resources



OUR FOOTPRINT

Teck Resources



Barrick Gold
North Mara
Tanzania



Barrick Gold
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PAR
Petra Diamonds
Ekapa



Harmony Gold





Daily Users

6236

Projects

89

Team Members

108

Countries

6

and counting...



syncromine **CORE**



CLIENTS



syncromine CORE

Risk Management

Incident Management

Safety Inspections

OCR Solution

Mobile Solution

GeoTech Module

Production Management

E-Shift Boss Logbook

Ventilation Module

Survey & Sampling

Bonus Module

Ore Accounting

INT. LAYER

3rd Party Reporting

Data Interface to and from External Sources

Dashboard and Reporting Services

Syncromine Action Manager & Workflow Manager Services





RISK
MANAGEMENT
MODULE



Where are our current Hazard Risk Registers?



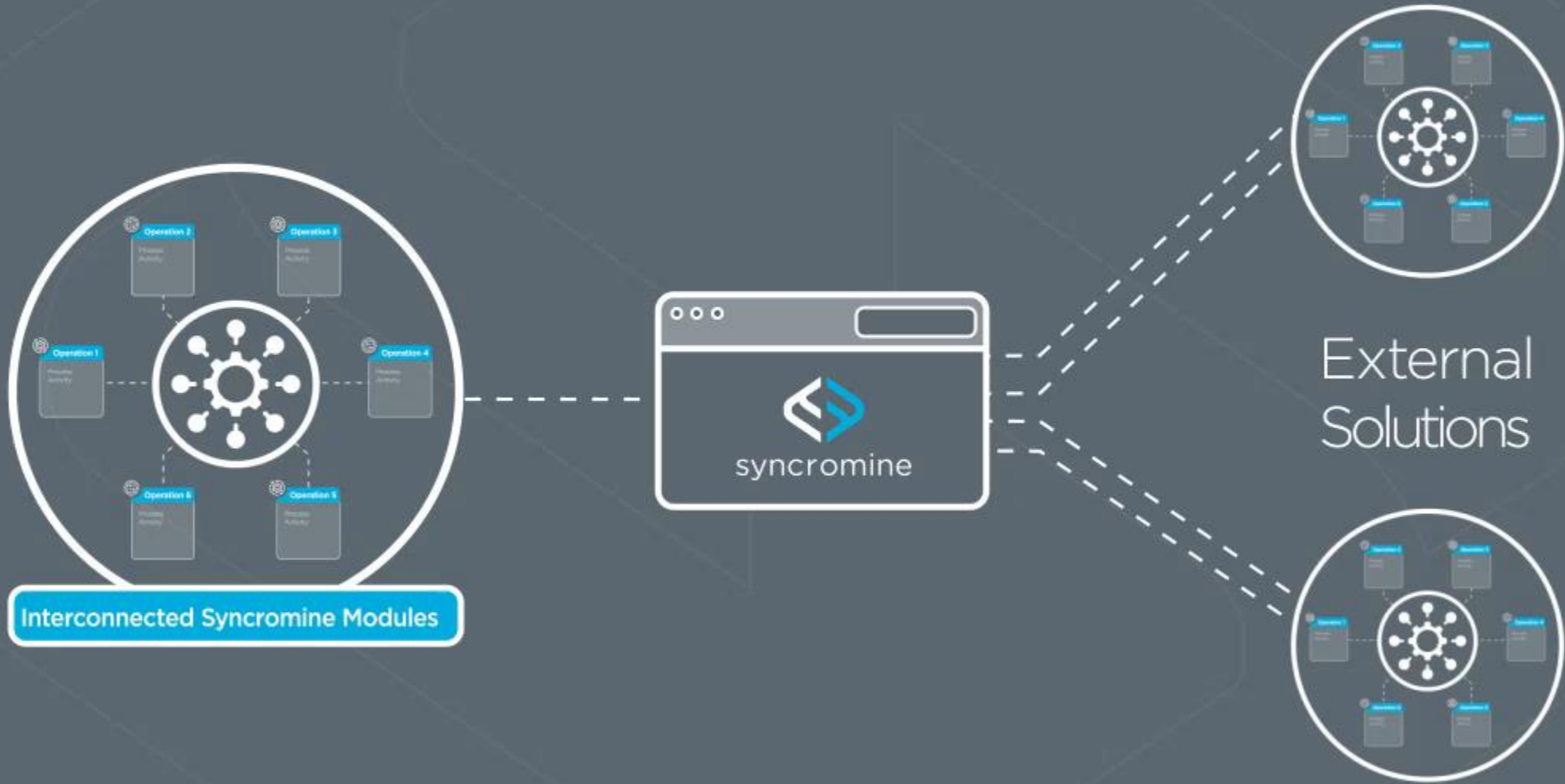
De-centrally Associated

Where are our current Hazard Risk Registers?

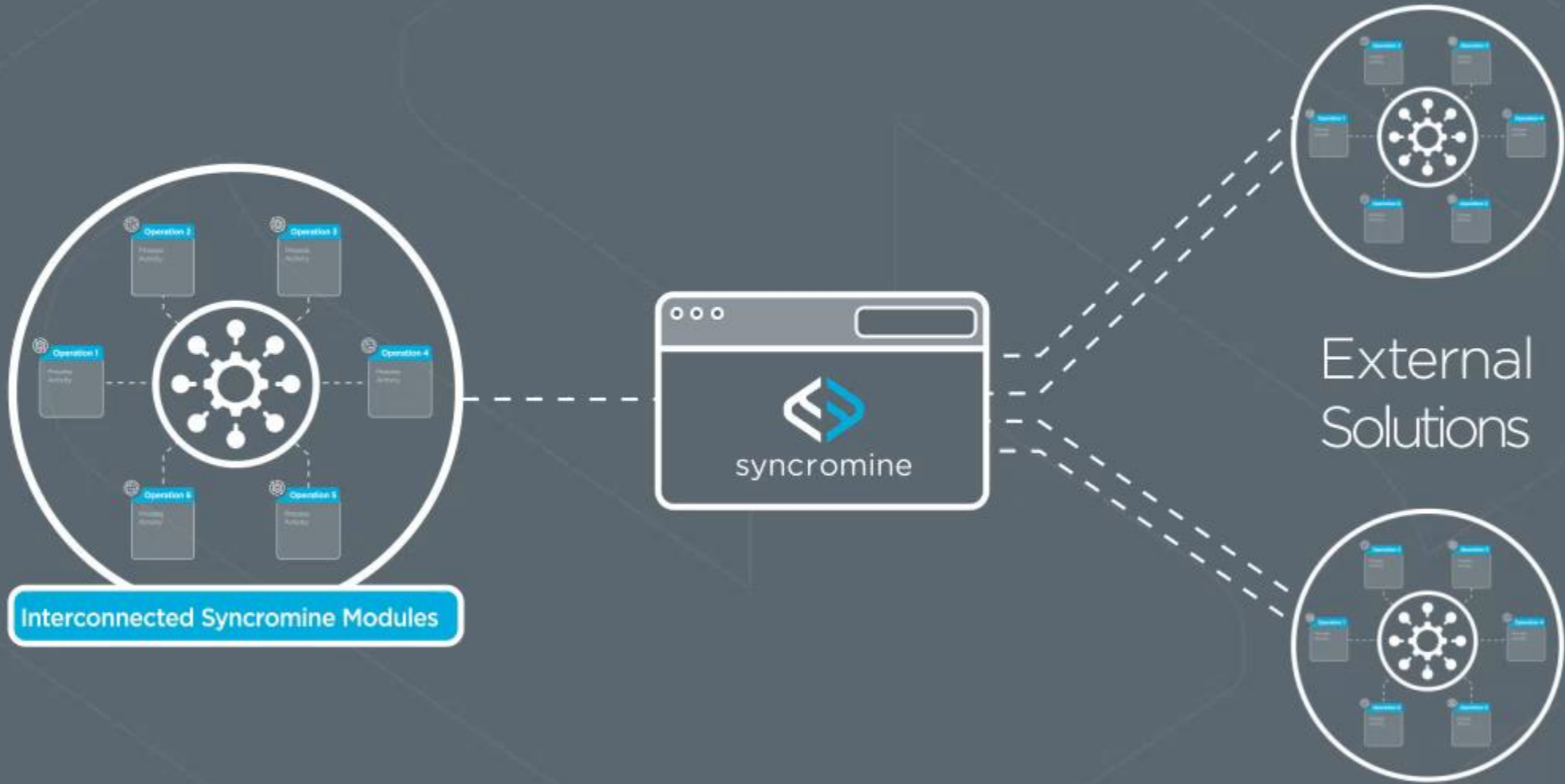


De-centrally Associated

HAZARD MANAGEMENT



HAZARD MANAGEMENT



HAZARD & RISK FRAGMENTATION STRUCTURE



HAZARD & RISK FRAGMENTATION STRUCTURE



HAZARD & RISK FRAGMENTATION STRUCTURE

Hazard Overview Risk Details Risk Details AI Recommended Risks

Risks

Add New Risk

Risk Name	Description	Risk Rating	Major Risk	S.U.E	Edit Risk
Production delays	Fall of ground may cause production delays, impacting operational efficiency and output.	Medium M12		✓	
Injury due to falling rocks	Workers or equipment may be struck by falling rocks, leading to serious injury or fatalities.	High H24	⚠	✓	
Collapse of underground workings due to ground instability	Underground workings may collapse due to ground instability, leading to structural damage.	High H19	⚠	✓	
Inadequate support systems	Support systems in the mine not providing sufficient protection against falls of ground	High H25	⚠	✓	
Damage to equipment from falling rocks	Mining equipment may be damaged by falling rocks during excavation or blasting activities.	Low L3			

AI Recommended Risks

Probability

Actions

U Unstable ground conditions	Unstable ground conditions leading to a higher risk of falls of ground	Almost Certain	✓
N Neglect of maintenance procedures	Failure to properly maintain and inspect support systems, leading to increased risk of falls of ground		✓
I Inadequate ground support	Inadequate ground support systems leading to a higher likelihood of falls of ground	Likely	✓
I Injury to personnel from falling rocks	Personnel may be injured by falling rocks during excavation or blasting activities.	Almost Certain	✓
L Lack of employee training	Employees not adequately trained in identifying and addressing potential ground fall hazards		✓

Generate Risks using AI

Risk
Review
Event

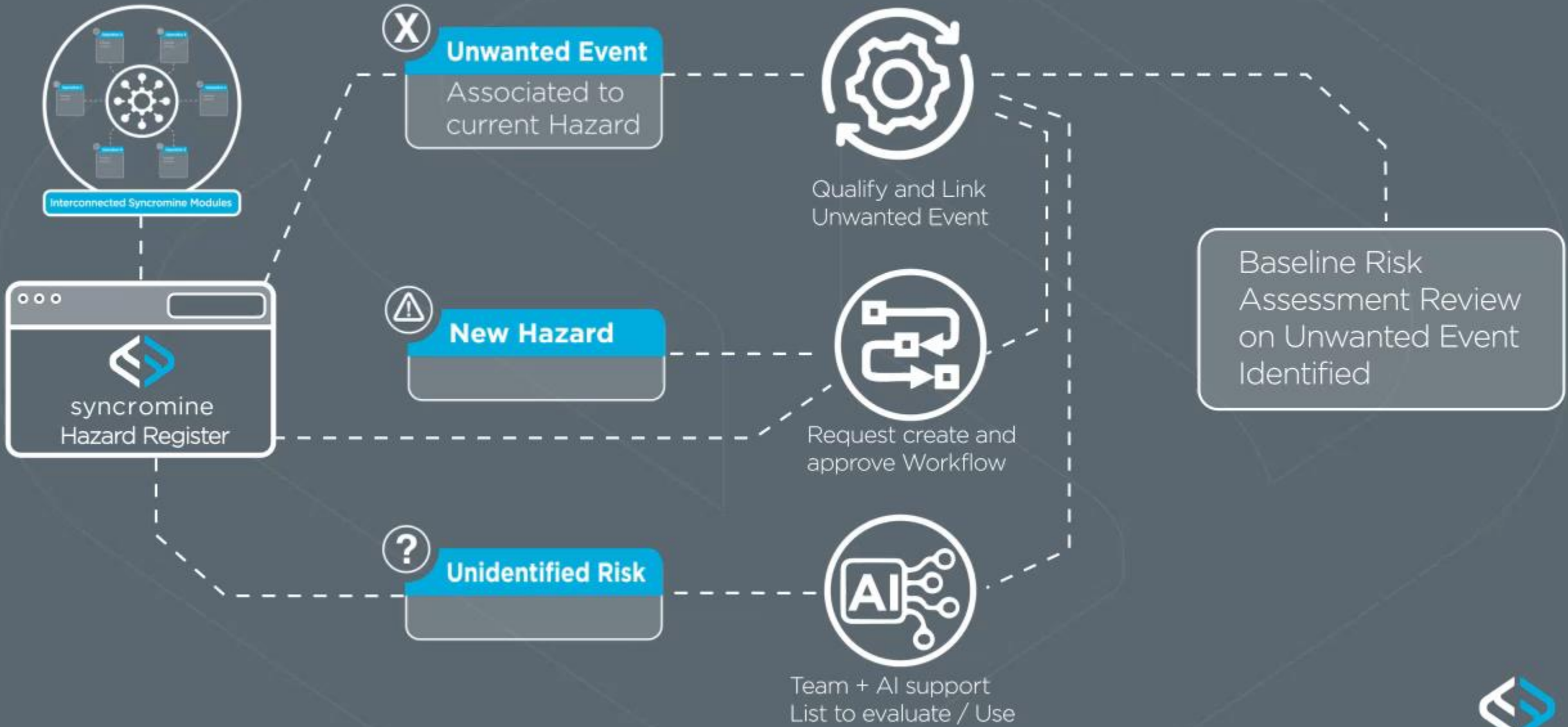
List to evaluate / Use



HAZARD & RISK FRAGMENTATION STRUCTURE



HAZARD & RISK FRAGMENTATION STRUCTURE



BASELINE RISK ASSESSMENT

Edit Baseline

Operational Geo Location:

Harmony > South Africa > Corporate > Corporate GL > Harmony Group > Group

Process:

Mining > All Areas > Drilling

Baseline Details

Description:

Fall of ground may cause production delays, impacting operational efficiency and output.

Energy:

When an object can move on its own accord because of its own weight or because of a gravitational incline or force.

Probability:

Rare

HML

Medium x

Legal and Regulatory Aligned?

No Yes

Functional Department

Contractor Foreman x Fire Marshall x

Impact

Environmental Impact Material Losses Damage Business Interruption Occupational Health Harm To People Safety Harm To People Legal And Regulatory Reputation Community Social Impact

Insignificant Insignificant Moderate Minor Moderate Major Moderate

Impact \ Probability	Rare	Unlikely	Possible	Likely	Almost Certain
Catastrophe	High H15	High H19	High H22	High H24	High H25
Major	Medium M12	High H14	High H18	High H21	High H23
Moderate	Medium M8	Medium M11	Medium M13	High H17	High H20
Minor	Low L3	Low L5	Medium M2	Medium M10	High H16
Insignificant	Low L1	Low L2	Low L4	Low L6	Medium M7

Major Risk

No

S.U.E

Yes



BASELINE RISK ASSESSMENT

Edit Baseline

Likelihood	Rating	Description
Almost certain	5	Unwanted event is almost certain to happen in the next year (a 90% or greater chance of occurrence)
Very likely	4	High probability for unwanted event to occur next year (a 50% – 90% chance of occurrence)
Likely	3	It is possible for unwanted event to occur next year (between 20% - 50% chance of occurrence)
Unlikely	2	Low probability for unwanted event to occur next year (between 5% - 20% chance of occurrence)
Rare	1	Very low probability for unwanted event to occur next year (a less than 5% chance of occurrence)

Likelihood versus consequence	Low consequence (rating: 1)	Minor consequence (rating: 2)	Moderate consequence (rating: 3)	Major consequence (rating: 4)	Extreme consequence (rating: 5)
Almost certain (rating: 5)	Moderate 5	Moderate 10	High 15	Critical 20	Critical 25
Very likely (rating: 4)	Low 4	Moderate 8	High 12	High 16	Critical 20
Likely (rating: 3)	Low 3	Moderate 6	Moderate 9	High 12	High 15
Unlikely (rating: 2)	Low 2	Low 4	Moderate 6	Moderate 8	Moderate 10
Rare (rating: 1)	Low 1	Low 2	Low 3	Low 4	Moderate 5



BASELINE RISK ASSESSMENT

Edit Baseline

Operational Geo Location

Harmony > South

Process

Mining > All Areas

Baseline Details

Description

Fall of ground may occur

Energy

When an object can

Probability

Rare

H&M

Unlikely

Legal and Regulatory

No Yes

Functional Department

Contractor Foreman

Impact

Environmental Impact

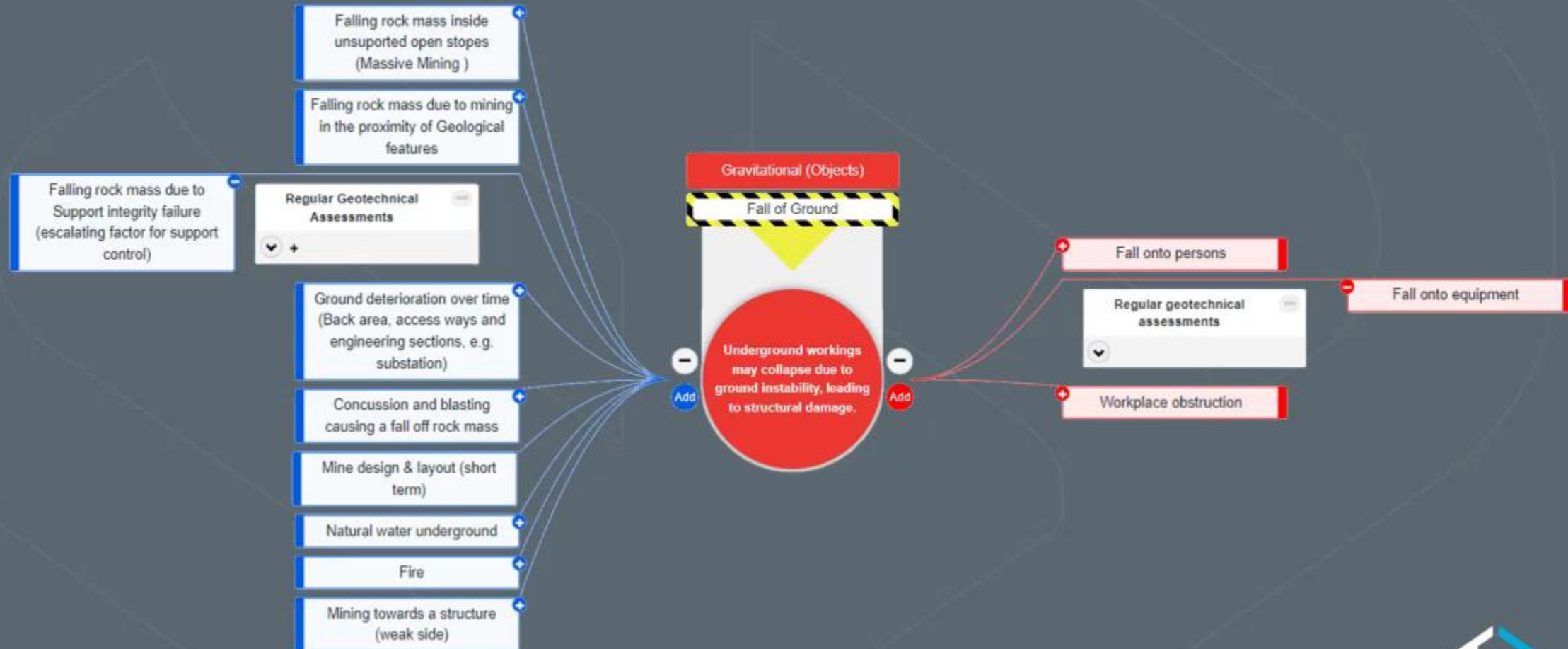
Insignificant Insigni

Risk Matrix for Operational Risk Assessments

Severity / Category		Severity (Where an event has more than one 'impact'. Choose the 'severity' with the highest rating)				
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
(H&S) Injury or harm to people		First Aid Injury, Nuisance value	Medical Treatment Injury, or Restricted Work Injury	Single Lost Time Injury	Multiple Lost Time Injuries, Admission to intensive care unit. Serious, chronic, long term effects	Single fatality or loss of quality of life / Irreversible impact on health
(E) Environmental Impact		Minimal environmental impact Level 1 incident	Limited environmental impact Level 2 incident Remediable short term	Significant environmental impact Level 3 incident Remediable within short to medium term	Major environmental impact Level 4 incident Remediable short, medium or long term	Catastrophic environmental impact Level 5 incident Remediable short, medium or long term
(D) Damage / Revenue Loss / business interruption		No disruption to operation <R75k / < US\$10k	Brief disruption to operation R75k - R1m / US\$10k - US\$100k	Partial shutdown R1m - R10m US\$100k - US\$1m	Partial loss of operation R10m - R500m US\$1m - US\$50m	Substantial or total loss of operation >R500m / >US\$50m
(R) Reputation – Community / Gov / Media		Slight impact – public awareness may exist but no public concern	Limited impact – local public concern	Considerable impact – regional public concern	National impact – national public concern	International impact – international public attention
Probability		Risk Rating				
5 Almost Certain	Daily	11 (M)	16 (M)	20 (H)	24 (H)	25 (H)
4 Likely	Weekly	7 (L)	12 (M)	17 (M)	22 (H)	23 (H)
3 Possible	Quarterly	4 (L)	8 (M)	13 (M)	18 (M)	21 (H)
2 Unlikely	6 monthly	2 (L)	5 (L)	9 (M)	14 (M)	19 (H)
1 Rare	Yearly	1 (L)	3 (L)	6 (L)	10 (M)	15 (M)
RISK RATING	RISK LEVEL	TOLERANCE LEVELS FOR OPERATIONAL RISK ASSESSMENTS				
19 to 25	(H) – High	Escalate to a higher level and implement specific action plans				
8 to 18	(M) – Medium	Proactively manage via appropriate management system				
1 to 7	(L) – Low	Monitor and manage as appropriate via management system				



BOWTIE ANALYSIS



BOWTIE ANALYSIS

Add Threat

Loaded Threats

Search...

- Track Integrity Failure:
- Power Supply Interruption:
- Human Error:
- Sudden release of energy in the Earth's crust causing ground instability:
- Fractures in the Earth's crust causing potential ground movement:
- Control System Malfunction:
- External Hazards:
- Vehicle Failure:

Confirm Selection **Show Add Threats**

+ Add Threats

Add New Threat | AI - Threats

AI - Generate Threats

Rock Burst

Critical	
M	
Hierarchy of C	
Control Cate	
Control Type	
Survivable: High	▼
Available: High	▼
Relative: High	▼

- + Fall onto persons
- + Fall onto equipment
- + Workplace obstruction



BOWTIE ANALYSIS

Add Threat

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- Vehicle Failure:

[Confirm Selection](#) [Show Add Threats](#)

Add Threats

[Add New Threat](#) [AI - Threats](#)

Search...

- Seismic activity:** Sudden release of energy in the earth's crust leading to ground instability
- Rock burst:** Sudden release of built-up stress in the rock mass leading to ground instability
- Water ingress:** Inflow of water into underground workings leading to ground instability
- Excessive blasting:** Uncontrolled and excessive use of explosives leading to ground instability
- Poor ground support:** Inadequate support of underground excavations leading to ground instability

[Create Threat\(s\)](#)

Rock Burst

Critical

Hierarchy of C

Control Cate

Control Type

Survivable: High

Available: High

Relative: High

- + Fall onto persons
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BOWTIE ANALYSIS

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Loaded Threats

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Add Threats

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- Poor ground support:** Inadequate support of underground excavations leading to ground instability

[Create Threat\(s\)](#)

Controls

- Rock reinforcement:** Implement rock reinforcement measures to stabilize the ground and prevent collapse.
- Seismic monitoring:** Implement seismic monitoring systems to detect and assess seismic activity in real-time.
- Ground support design:** Develop and implement ground support design to withstand seismic activity and prevent collapse.
- Emergency response training:** Provide extensive emergency response training for personnel to handle situations involving seismic activity.
- Geotechnical assessments:** Regular geotechnical assessments to identify and address potential ground instability and mitigate collapse risks.

Rock Bur

Survivable High

Available High

Relative High



BOWTIE ANALYSIS

Critical **High**

Mesh Netting ⋮

Hierarchy of Control: ▼

Control Category: ▼

Control Type: ▼

Survivable: ▼

Available: ▼

Reliable: ▼

⬆️ + ? ⚙️

Hierarchy of Control

- Elimination, Substitution or Reduction
- Engineering controls
- Work practices
- Industrial hygiene practices
- Administrative controls
- Personal protective equipment

Rate **Control Effectiveness** (Secondary Matrix)

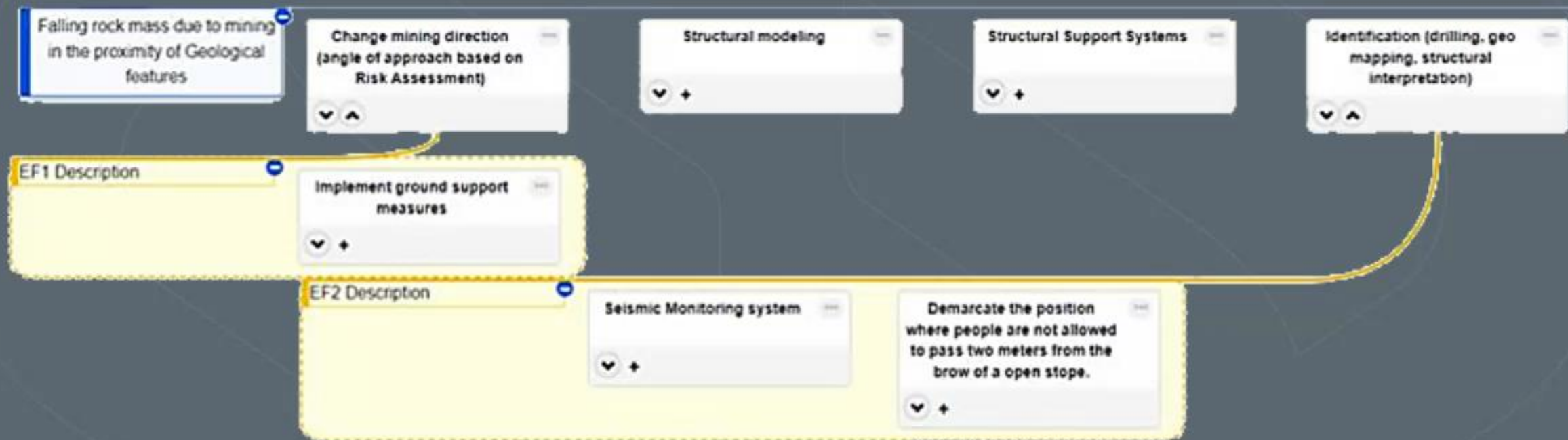
- Reliable
- Available
- Survivable

Control Management

- Monitoring Controls
- Verification Actions
- Improvement Plans



BOWTIE ANALYSIS



Task Based Risk Assessment



Baseline

Controls

Bowtie Analysis

Task

Sub-Task

Steps

Checklist



Task Based Risk Assessment



Baseline

Controls

Bowtie Analysis

Task

Sub-Task

Steps

Checklist





Integrated Data



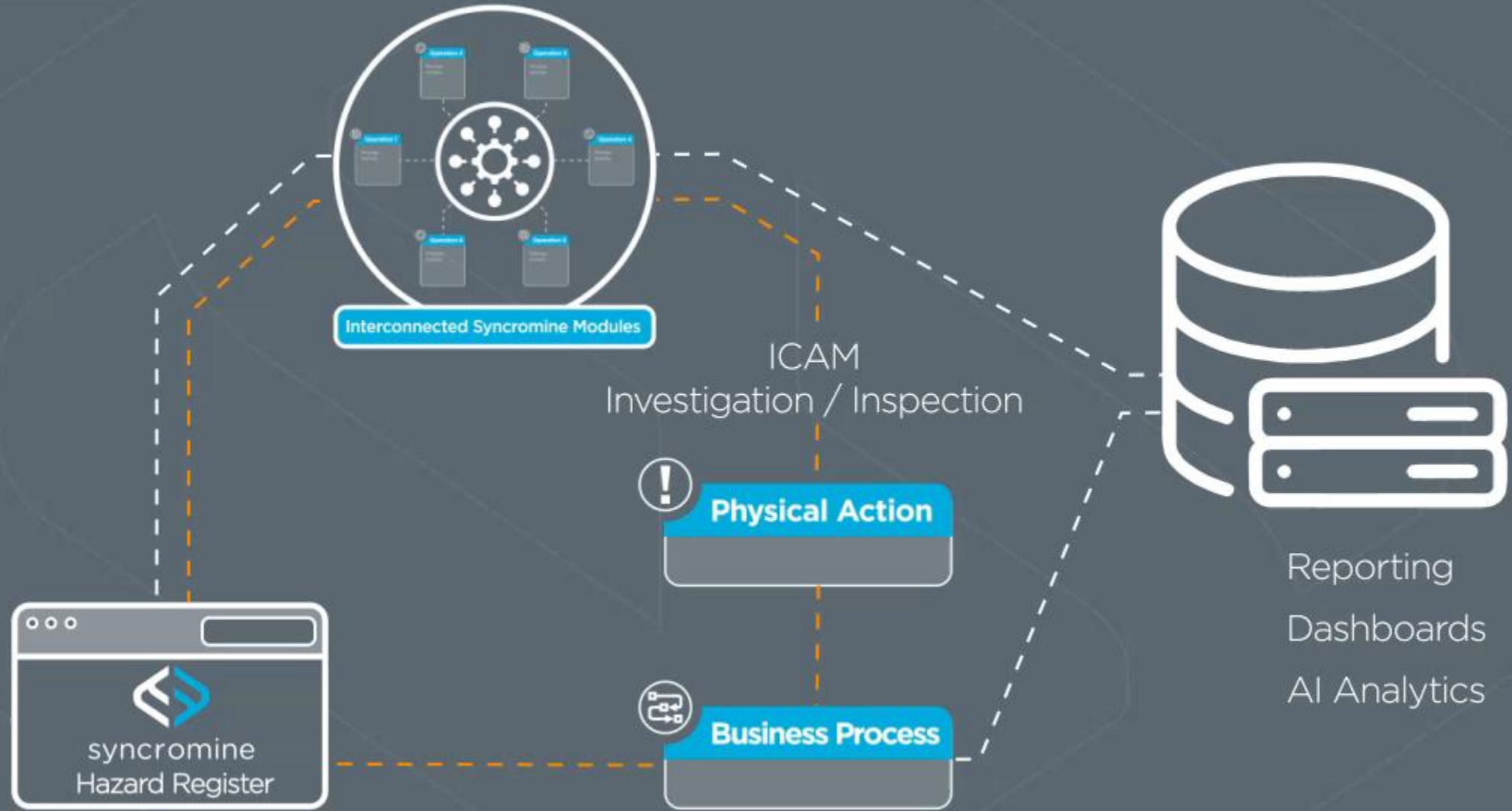


 **Integrated Data**

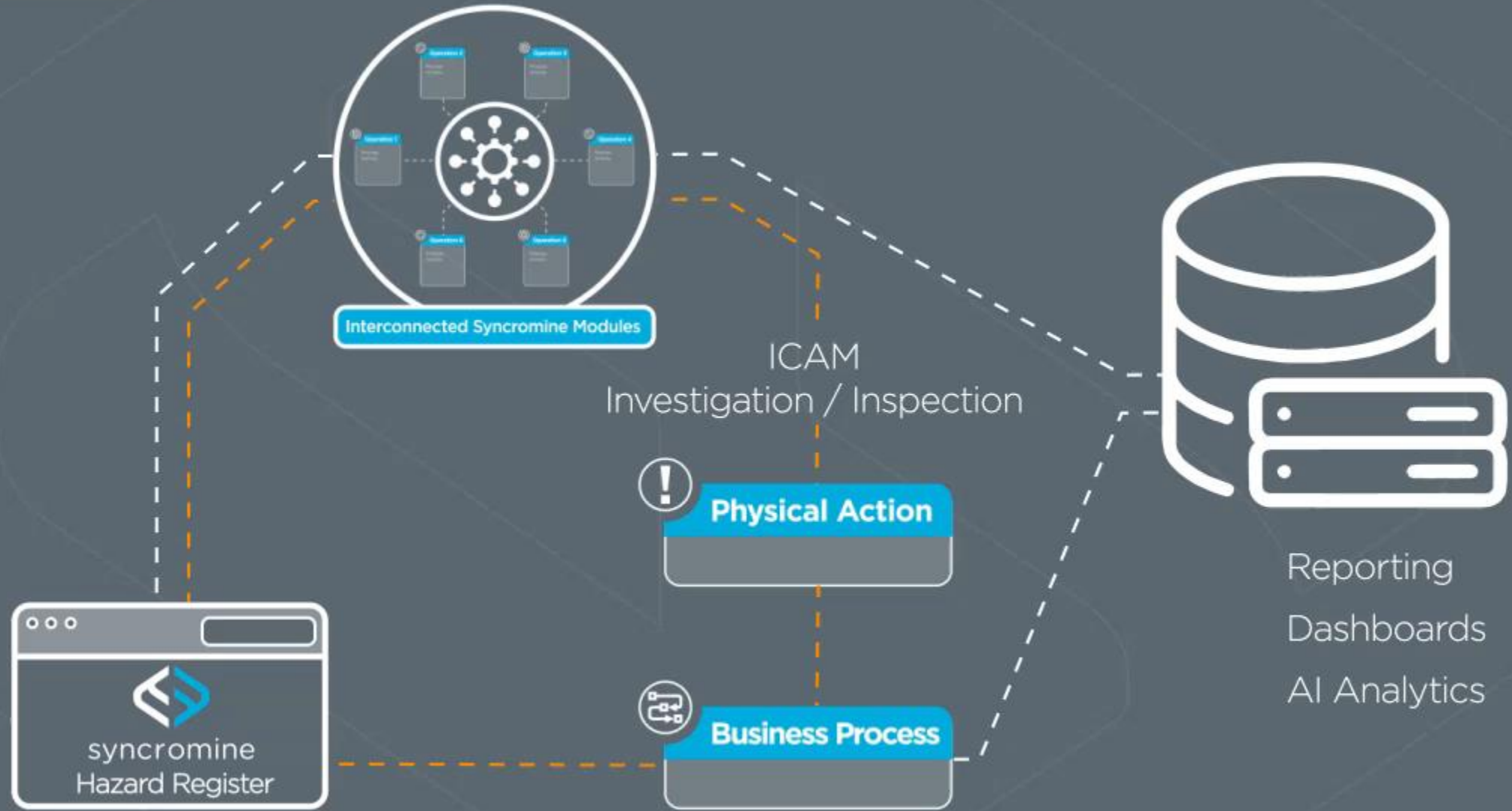
 **Integrated Systems & Processes**



HAZARD MANAGEMENT



HAZARD MANAGEMENT



INTEGRATED SYSTEMS & PROCESSES

11:22

← 92 H 105A VRF PAN P3

General Information

Crew Name: S11 Buffalo

Current Sesimic Rating: 6 SEISMIC CHECKLIST

Outstanding Actions: A 0 B 0 C 0

Pre-Planning Recommendations

Adhere to the breast panel standard and support practices.

- Pin top aburnent with 1.5m perma bolts installed 1.5m apart in staggered pattern along with welded mesh
- Pay attention to barring and slope support practices
- Ensure top and bottom access is open and supported
- Panel face length excessive, do not blast half faces and man the panel sufficiently.
- Adhere to steep slope standards, ensure rolling rock barricades are installed on the face and carry an underhand face shape.
- Support faulting 0.5m on both sides to mine standard. Monitor wedges in the

Departmental Inspections

RE Walkabout	2024-02-20
Strata Control Officer	2024-02-15
Safety Officers Inspection	2024-02-07
Vent Officers Inspection	

Additional Notes

Sesimic Ratings Timeline

Overview Actions Planning

11:22

← 92 H 105A VRF PAN P3

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Vent Officers Inspection	

Additional Notes

Sesimic Ratings Timeline

Overview Actions Planning

11:24

← 70 AE 52 VRF PAN 2

Actions

A Is all tendon support installed to mine standard?

Corrective Action: Install all tendon support installed to mine standard?

Reported By: Christopher Weighell

BL-22012024-9719 92a Reported On: 1/22/2024 12:00:00 AM Open

A Is all elongate support installed to mine standard?

Corrective Action: Install all elongate support installed to mine standard?

Reported By: Christopher Weighell

BL-22012024-9719 92b Reported On: 1/22/2024 12:00:00 AM Open

A Is net/mesh support in stope to mine standard?

Corrective Action: Install net/mesh support in stope to mine standard?

Reported By: Christopher Weighell

BL-22012024-9719 92c Reported On: 1/22/2024 12:00:00 AM Open

A Is all tendon support installed to mine standard?

Corrective Action: Install all tendon support installed to mine standard?

Reported By: Christopher Weighell

Overview Actions Planning



INTEGRATED SYSTEMS & PROCESSES



The screenshot shows a software interface for 'Inspections Capture'. The top navigation bar includes 'Cancel', 'Forms', 'Save', 'Actions', and 'General Comments'. The main content area is divided into several sections:

- Header Information:** Includes a dropdown for 'Auditor' and a 'Responsible Person' field.
- Selected Forms:** A list of forms under the heading 'WA-SOI'. The first form is 'WA-SOI-Stoping'.
- General Section:** A table with columns 'Tags' and 'Step'. It lists various inspection items with status indicators (red 'A', yellow 'S', green 'GC').
- Table:** A table with columns 'YES', 'NO', 'Stop a...', and 'NA'. It contains rows of data with radio buttons for selection.

A large red octagonal stop sign with a white hand icon is overlaid on the center of the screenshot, indicating a stop or warning.





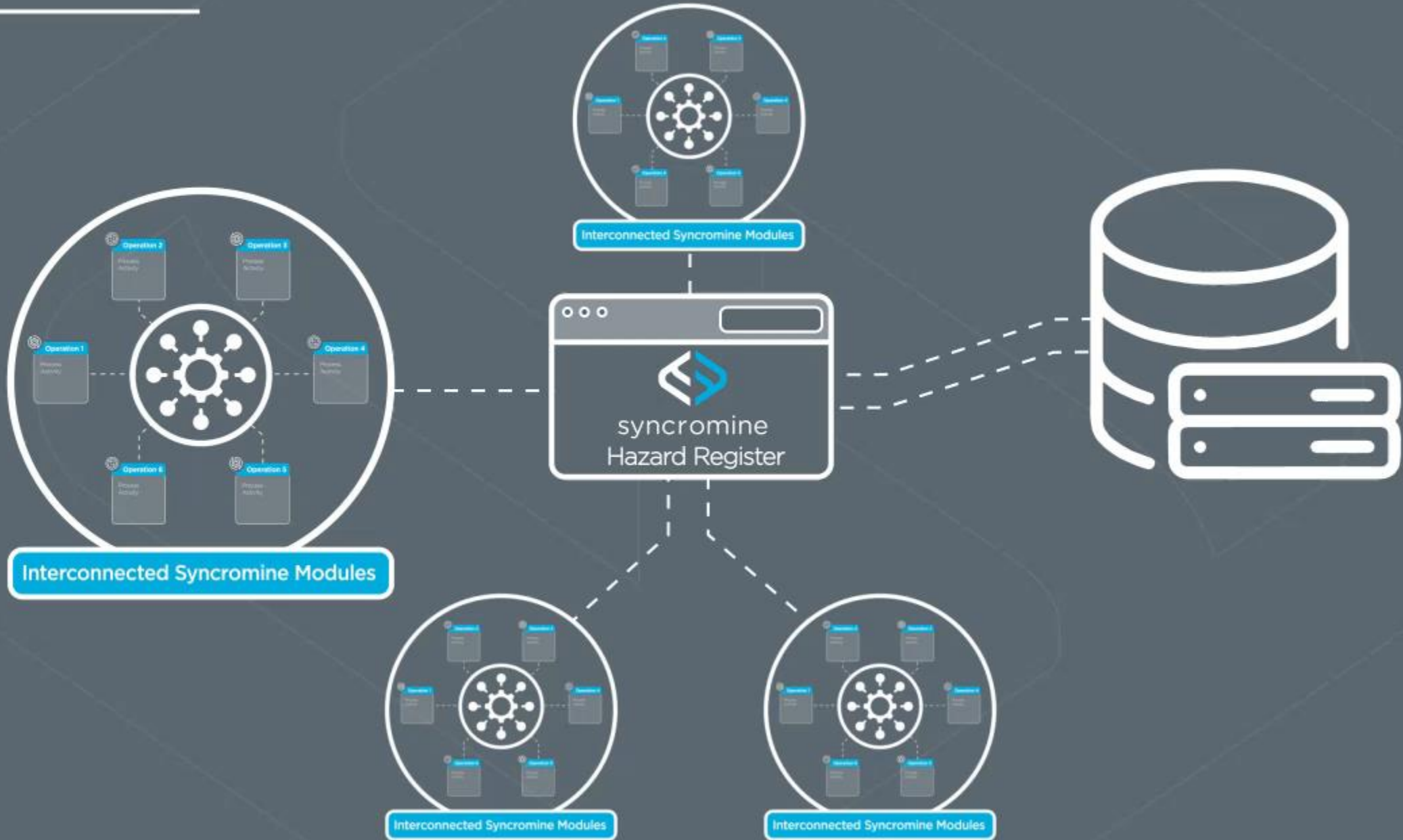
 **Integrated Data**

 **Integrated Systems & Processes**

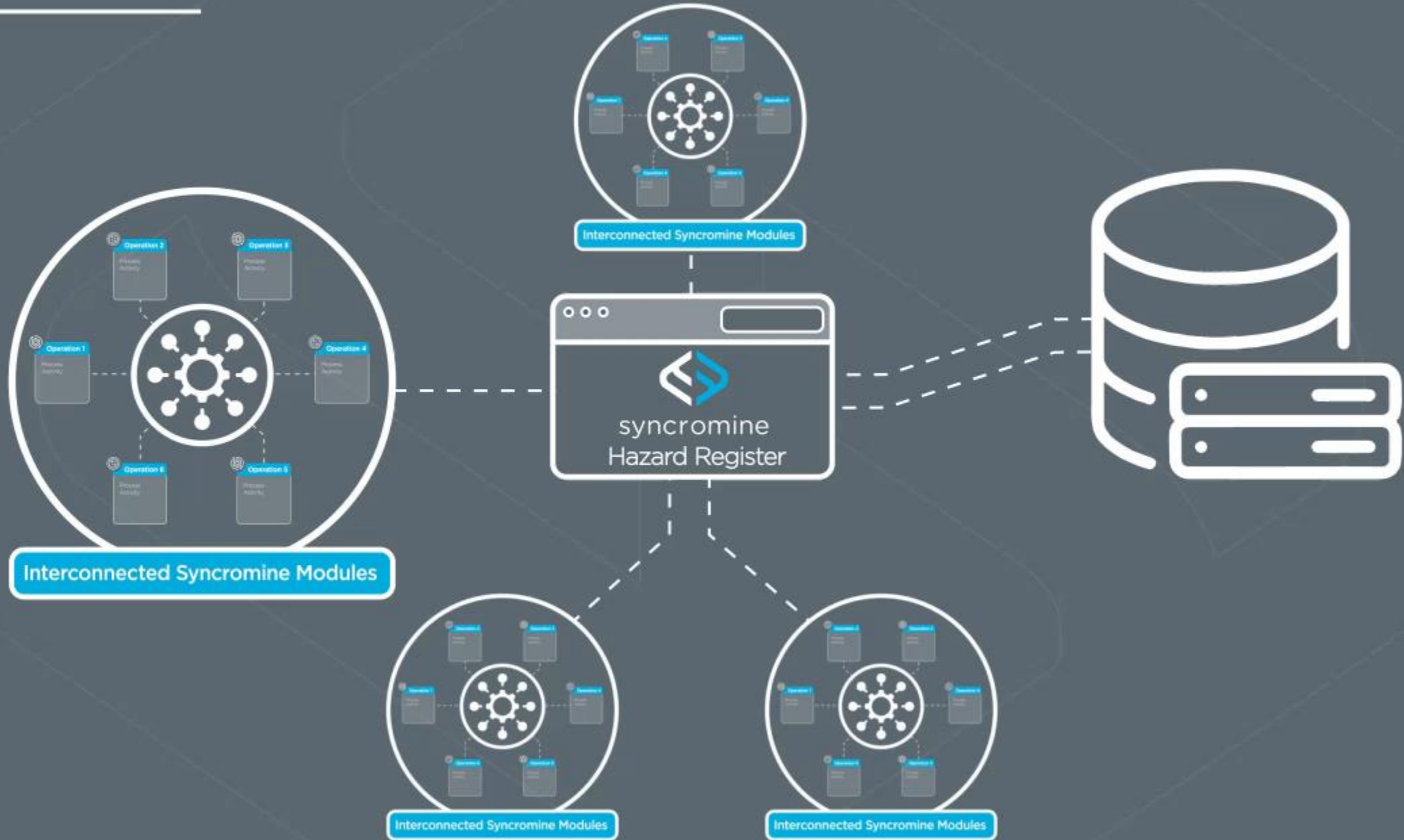
 **Master Data Management**



HAZARD MANAGEMENT



HAZARD MANAGEMENT





 **Integrated Data**

 **Integrated Systems & Processes**

 **Master Data Management**

 **Reporting and Business Intelligence**



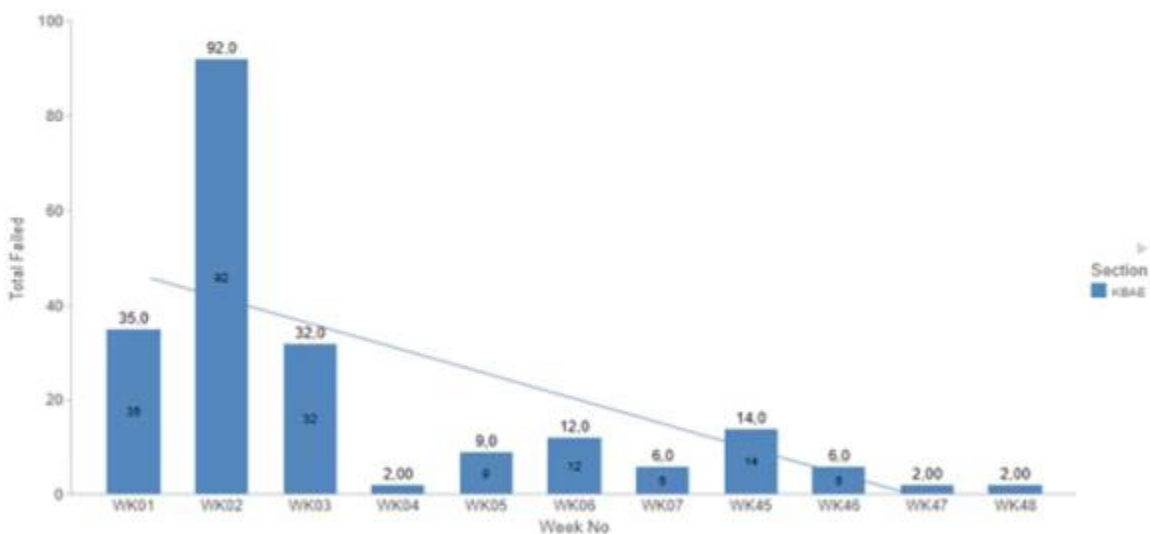
EASE OF REPORTING & DASHBOARD INTEGRATION

Gravitational (Objects)

Unwanted Event	Control	Week No	WK01	WK02	WK03	WK04	WK05	WK06	WK07	WK44	WK45	WK46	WK47	WK48	WK49	WK50	WK51
Exposure to fall of ground	Support installation		99.37	98.77	95.01	99.43	98.39	98.33	97.06	100.00	97.89	88.89	99.72	99.63	99.70	98.96	95.19

Failures per Section

SUE	Control	Week No Section	WK01	WK02	WK03	WK04	WK05	WK06	WK07	WK45	WK46	WK47	WK48	WK49	WK50	WK51	
Exposure to fall of ground	Support installation	KBAC	11	13	-	-	-	-	-	-	-	-	-	-	-	-	
		KBAE	35	92	32	2	9	12	6	14	6	2	2	-	-	-	
		KBBB	23	11	2	1	-	-	-	-	-	-	-	-	2	6	5
		KBBD	10	53	-	3	-	-	-	-	-	-	-	-	-	-	-
Total		79	169	34	6	9	12	6	14	6	2	2	2	6	5		



Failures per Workplace

SUE	Control	Workplace	Week No	WK01	WK02	WK03	WK04	WK05	WK06	WK07	WK45	WK46	WK47	WK48	WK49	WK50	WK51
Exposure to fall of ground	Support installation	102 16 PAN E 2		-	6	-	-	-	-	-	-	-	-	-	-	-	-
		102 16 PAN E 3		8	17	-	-	-	-	-	-	-	-	-	-	-	-
		102 16 PAN E 7		-	4	-	-	-	-	-	-	-	-	-	-	-	-
		102 17 PAN E 7 VCR		1	-	-	-	-	-	-	-	-	-	-	-	-	-
		102 17 PAN E 8		-	5	-	-	-	-	-	-	-	-	-	-	-	-



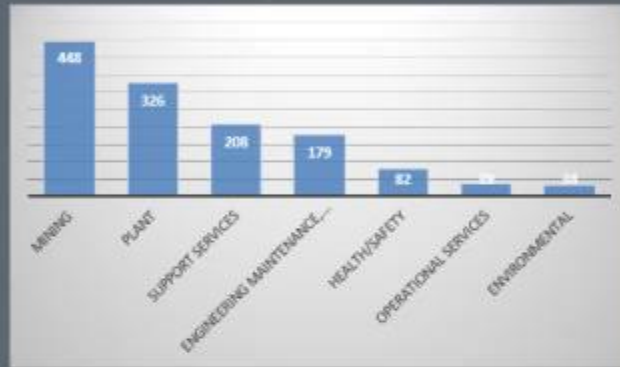
EASE OF REPORTING & DASHBOARD INTEGRATION

ORGANISATION

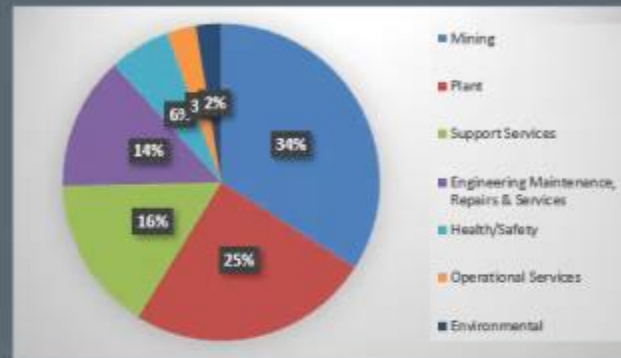
Organisational Function...

- Engineering Maintenance...
- Environmental
- Health/Safety
- Mining
- Operational Services
- Plant
- Support Services
- (Blank)

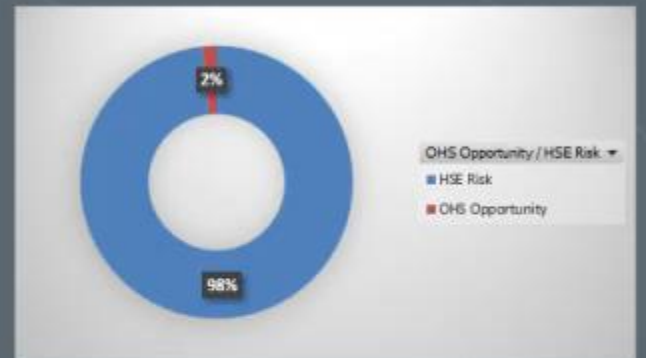
ORGANISATIONAL FUNCTION / PROCESS



% ORGANISATIONAL FUNCTION / PROCESS

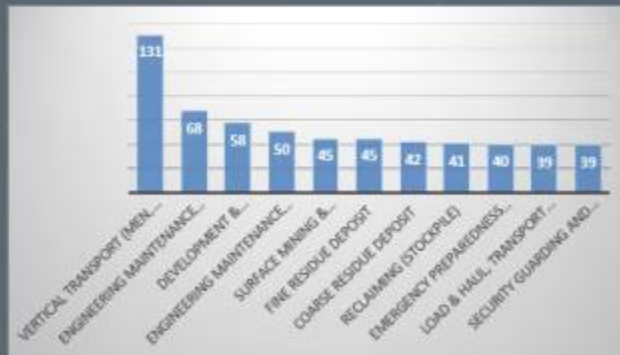


OPPORTUNITY VS RISK

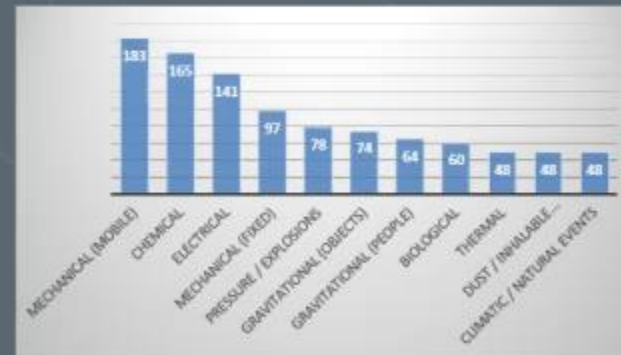


TOP 10

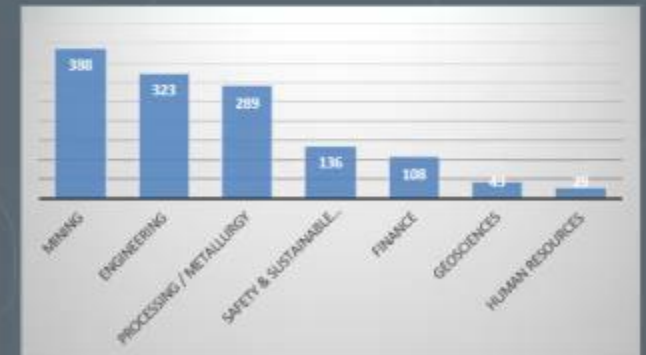
TOP 10 SUB PROCESS / ACTIVITY



TOP 10 HAZARD CLASSIFICATION



RISK OWNER





 **Integrated Data**

 **Integrated Systems & Processes**

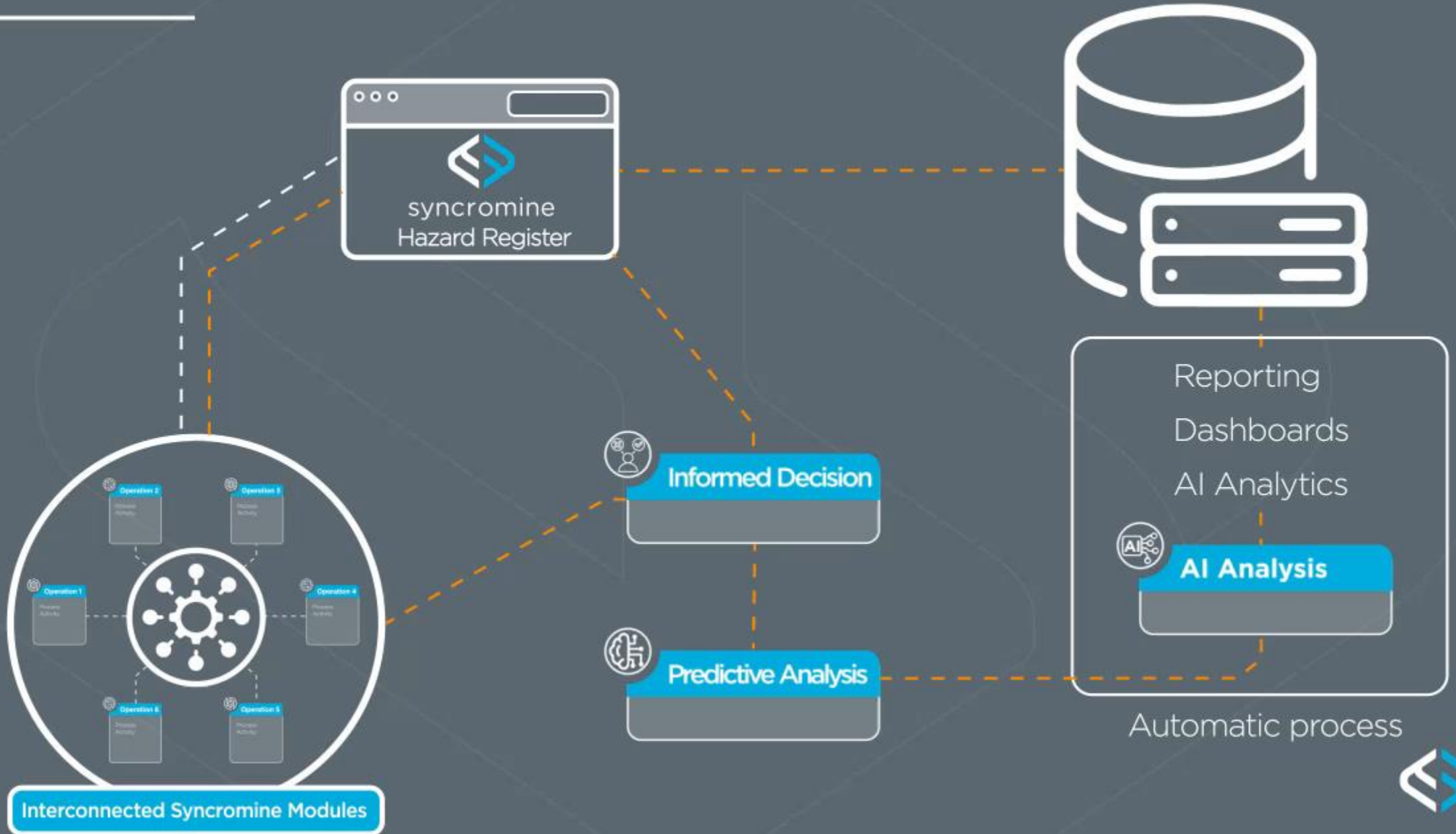
 **Master Data Management**

 **Reporting and Business Intelligence**

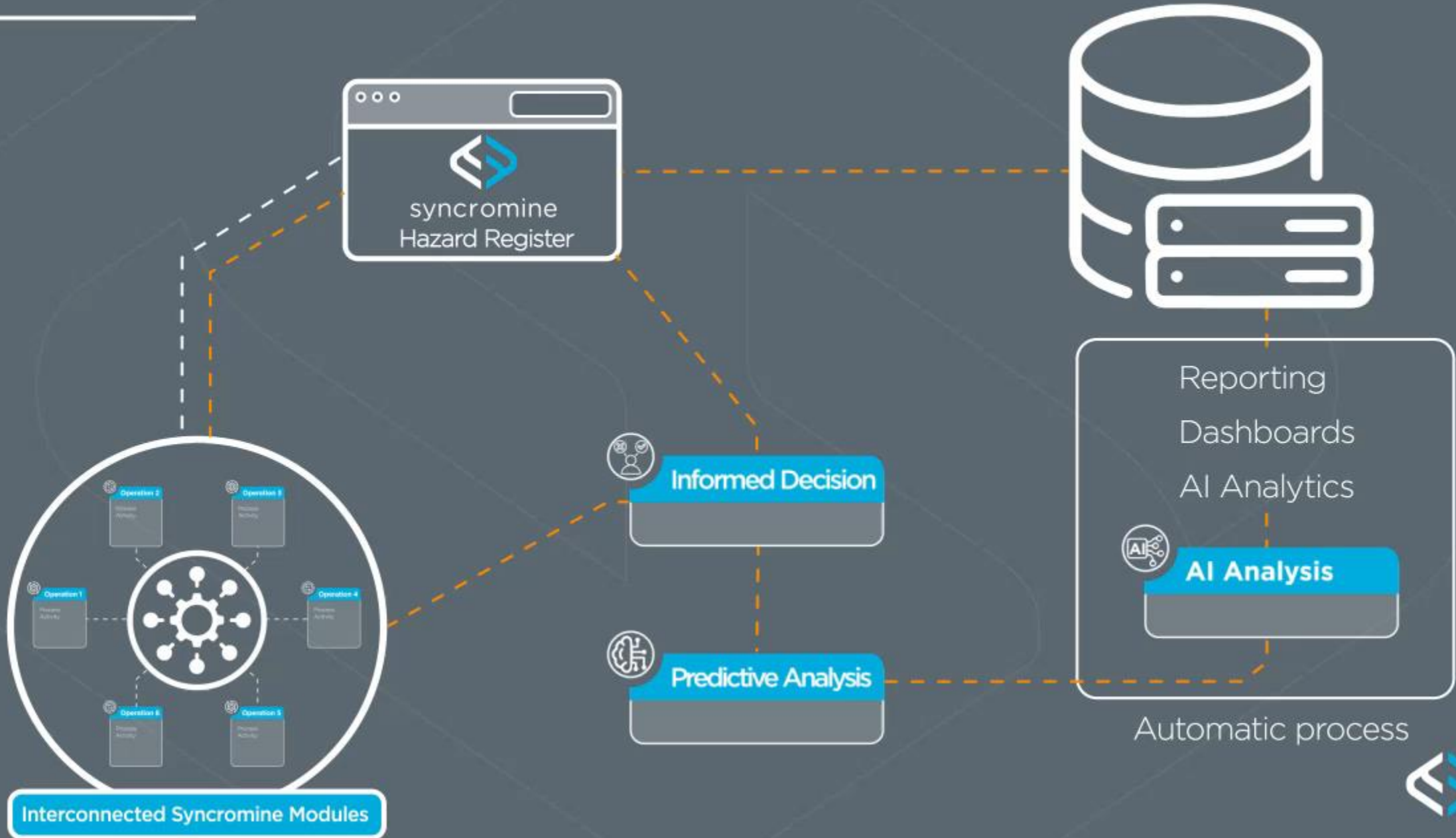
 **Data Science**
AI, Deep Learning, Machine Learning



HAZARD MANAGEMENT



HAZARD MANAGEMENT



ACTUAL RESULTS ACHIEVED

Over the last 3 years with implementing and growing the process with Harmony Gold in South Africa the following was achieved:

- ↔ Across 19 operations they now have 9 million monitoring points on Critical controls
- ↔ 12% YOY increase on points monitored.
- ↔ 4% YOY reduction in Lost time injury frequency rate.
- ↔ 6% YOY reduction in Fall of Ground incident rate.

Reducing turnaround time on Mine safety closures from averages of 3 Days to 8 hours.

