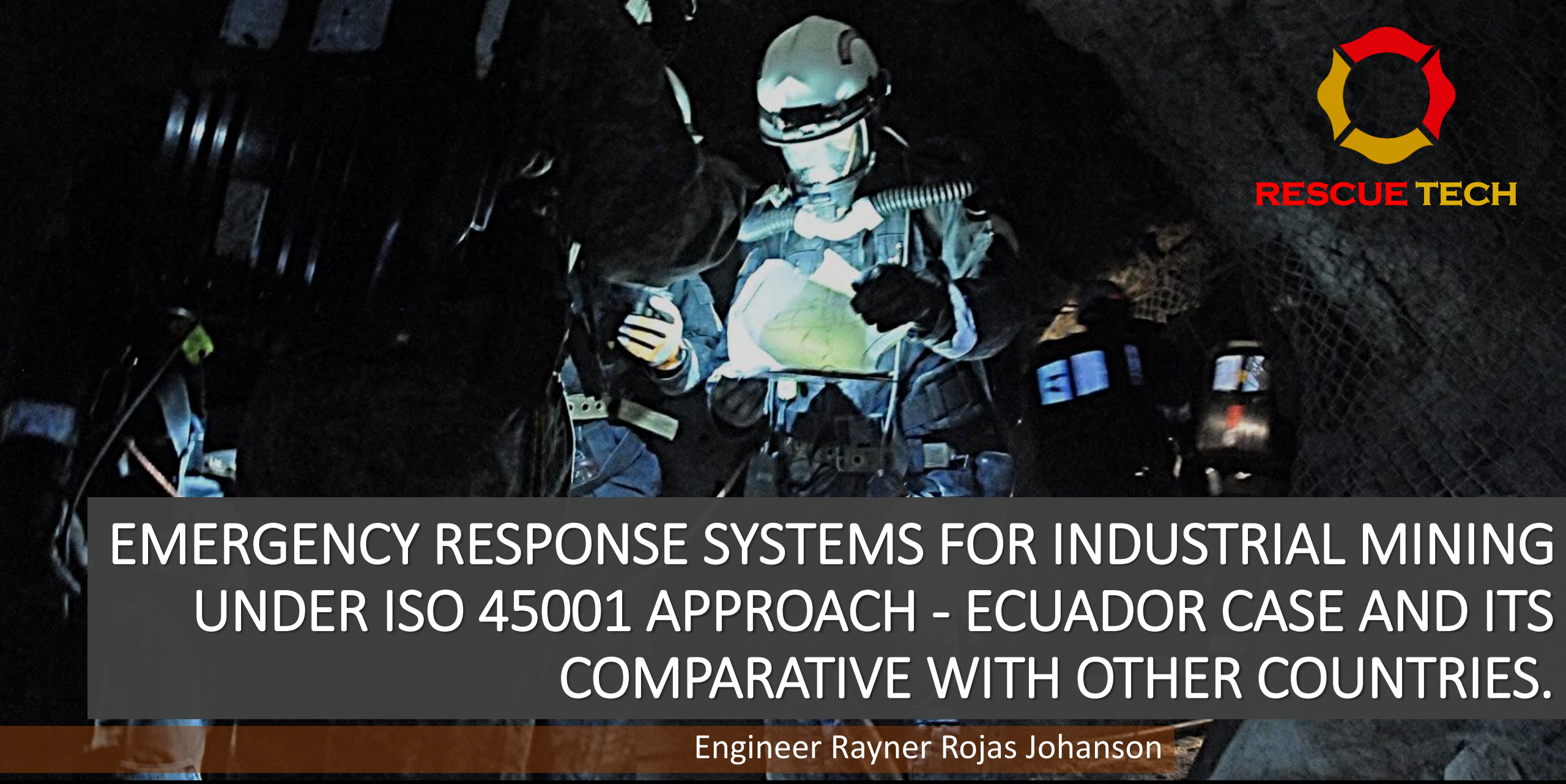


RESCUE TECH

EMERGENCY RESPONSE SYSTEMS FOR INDUSTRIAL MINING UNDER ISO 45001 APPROACH - ECUADOR CASE AND ITS COMPARATIVE WITH OTHER COUNTRIES.

Engineer Rayner Rojas Johanson

ECUADOR AND INDUSTRIAL MINING

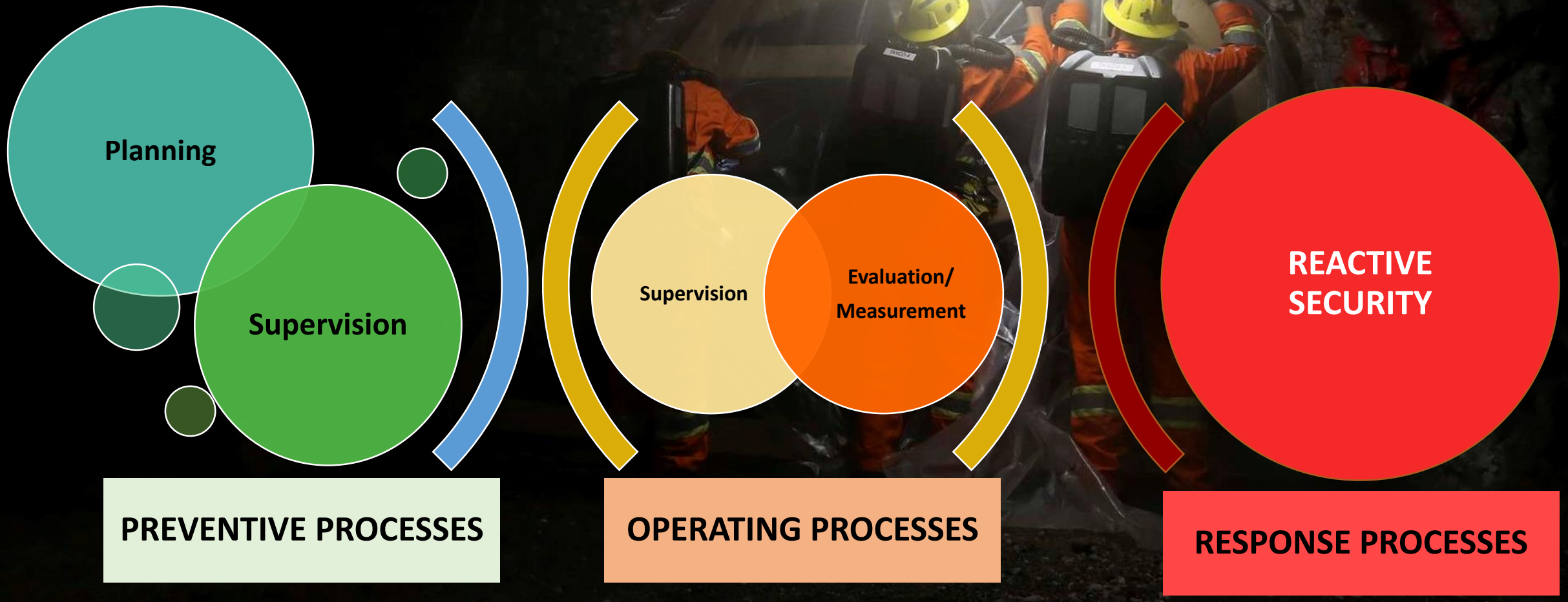
- In 2019 Ecuador begins the stage of large-scale mining production.
- Extractive methods: surface / underground
- USD 2 252 MM will be invested between 2019 - 2021
- Cascabel (one of the largest copper projects in the world)

COUNTRIES AND STANDARDS ANALYZED

PERU	CHILE	ECUADOR
General Mining Law DS Nº 014-92-EM	MINING CODE Law 18248	Mining Law
Law that creates SUNAFIL LAW 29981	STANDARDS ON WORK ACCIDENTS AND DISEASES Law 16744	D.E. 2393 OCCUPATIONAL HEALTH AND SAFETY STANDARD, AND IMPROVEMENT OF THE WORKING ENVIRONMENT
Occupational Health and Safety standard in Mining DS-024-2016-EM	STANDARD ON PREVENTION OF PROFESSIONAL RISKS	STANDARD OF OCCUPATIONAL SAFETY AND HEALTH IN THE MINING INDUSTRY
DS 023 2017 EM: Modifications to DS-024-2016-EM	MINING SECURITY STANDARD Decree 132	Health and Safety Regulations for Construction and Public Works
Resolution Nº 039-2017-OS / CD Typification Table of infractions and sanctions in mining safety.		General Regulations to the Mining Law
		ARCOM: GUIDE FOR VERIFICATION OF SSO COMPLIANCE
		RESOLUTION No 007-DIR-ARCOM-2016- Technical Guidelines

ISO 45001: OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS

SECURITY PROCESSES



DEFINITIONS

EMERGENCY:

- Event that can cause personal injury and that could lead to social conflicts and property damage if not intervened immediately (UNEP).
- MINING EMERGENCY: *“unwanted event that should be expected”* and is generated by the development of mining activity or by natural causes. It requires the organization to respond in a planned and organized manner to protect life, the environment and property, while assessing risks and establishing controls to maintain the safety of people responding to the emergency (R. Rojas).

COMPLIANCE WITH NATIONAL STANDARDS AND ISO 45001 REQUIREMENTS - EMERGENCY RESPONSE PROCESSES

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
5	Leadership and worker participation	YES	P	P
6	Planning	P	P	P
7	Support	P	P	NO
8	Operation	P	P	P
9	Performance evaluation	NO	NO	NO
10	Improvement	P	P	NO

YES: IT COMPLIES

P: PARTIALLY COMPLIES

NO: DOES NOT COMPLY

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
5	**Leadership and worker participation**	YES	P	P
5.3	Roles, responsibilities and authority in the organization	YES	YES	P

ISO 45001/5 Leadership and Participation VS. Compliance with national Standards

The Standards analyzed in each country contain requirements that are not clear regarding the roles, functions and responsibilities of the organization when preparing for or responding to an emergency. With the exception of Peru that has included requirements with a higher level of specificity.

ISO 45001 6 PLANNING – Compliance with national Standards

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
6	**Planning**	P	P	P
6.1	*Actions to address risks and opportunities*	P	P	P
6.1.2	Hazards identification and evaluation of risks and opportunities	P	P	NO
6.1.3	Determination of legal requirements and other requirements	NO	NO	NO
6.1.4	Action Planning	YES	YES	P
6.2	*OSH objectives and planning to achieve them*	P	P	P
6.2.1	OSH Objectives	P	P	P
6.2.2	Planning to achieve OSH objectives	P	P	P

- The Standards analyzed do not establish specific requirements for the planning of response activities for mining rescue teams, which require carrying out risk assessments and determining objectives associated with the safety of the members of these teams and of the mining workers during the response activities.

ISO 45001 7 SUPPORT - Compliance with national Standards

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
7	Support	P	P	NO
7.1	Resources	P	p	NO
7.2	Competence	P	p	NO
7.3	Awareness	NO	NO	NO
7.4	Communication	YES	YES	P
7.4.2	Internal communication	YES	YES	P
7.4.3	External communication	YES	YES	P
7.5	Documented information	P	P	NO
7.5.2	Creation and Update	P	P	NO
7.5.3	Control of documented information	P	P	NO

- Ecuador: general Standard on the support requirements for Emergency Response processes.
- A challenge for these countries is to work on these criteria.
- Matrix of: Resources (equipment, etc.) / Professional Competences / Medical requirements

ISO 45001/ 8 OPERATION - Compliance with national standards

- We observed that the countries studied have a level of requirements that allow planning rescue operations. However, in the case of Ecuador, these requirements are scarce..
- The big challenge for the industry is to carry out a process of Emergency Response in a safe way, according to the OSH Policy

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
8	Operation	P	P	P
8.1	Planning and operational control	P	P	P
8.1.2	Eliminate hazards and reduce risks for OSH	P	NO	NO
8.1.3	Change management	NO	NO	NO
8.1.4	Purchases	NO	NO	NO
8.2	Preparation and response to emergencies	P	P	P

ISO 45001 9 PERFORMANCE EVALUATION - Compliance with national standards

- The standards of the countries studied do not establish mechanisms for evaluating the performance of emergency response teams.

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
9	**Performance evaluation**	NO	NO	NO
9.1	Monitoring, measurement, analysis, and evaluation of performance	NO	NO	NO
9.1.2	Compliance Evaluation	NO	NO	NO
9.2	Internal auditing	NO	NO	NO
9.2.2	Audit program	NO	NO	NO
9.3	Management Review	NO	NO	NO

ISO 45001 10 IMPROVEMENT - Compliance with national standards

#	ISO 45001 SECTION	PERU	CHILE	ECUADOR
10	Improvement	P	P	NO
10.2	Incidents, nonconformities and corrective actions	P	P	NO
10.3	Continuous improvement	NO	NO	NO

- In the case of Peru and Chile, specific requirements for accident investigation and improvement processes are observed, which despite partially complying with the requirements of ISO 45001, allow information to be collected to identify opportunities.
- In the case of Ecuador, only the process of reporting an accident / occupational disease to Social Security is defined (Instituto Ecuatoriano de Seguridad Social / Ecuadorian Institute of Social Security IESS)

EMERGENCY PREPARATION AND RESPONSE (ISO45001-8.2)

- **Planned Response**
- **Training**
- **Tests and Exercises**
- **Performance evaluation**
- **Communicate and inform:**
  - Duties and responsibilities
  - Concerned parties (EMERGENCIES)

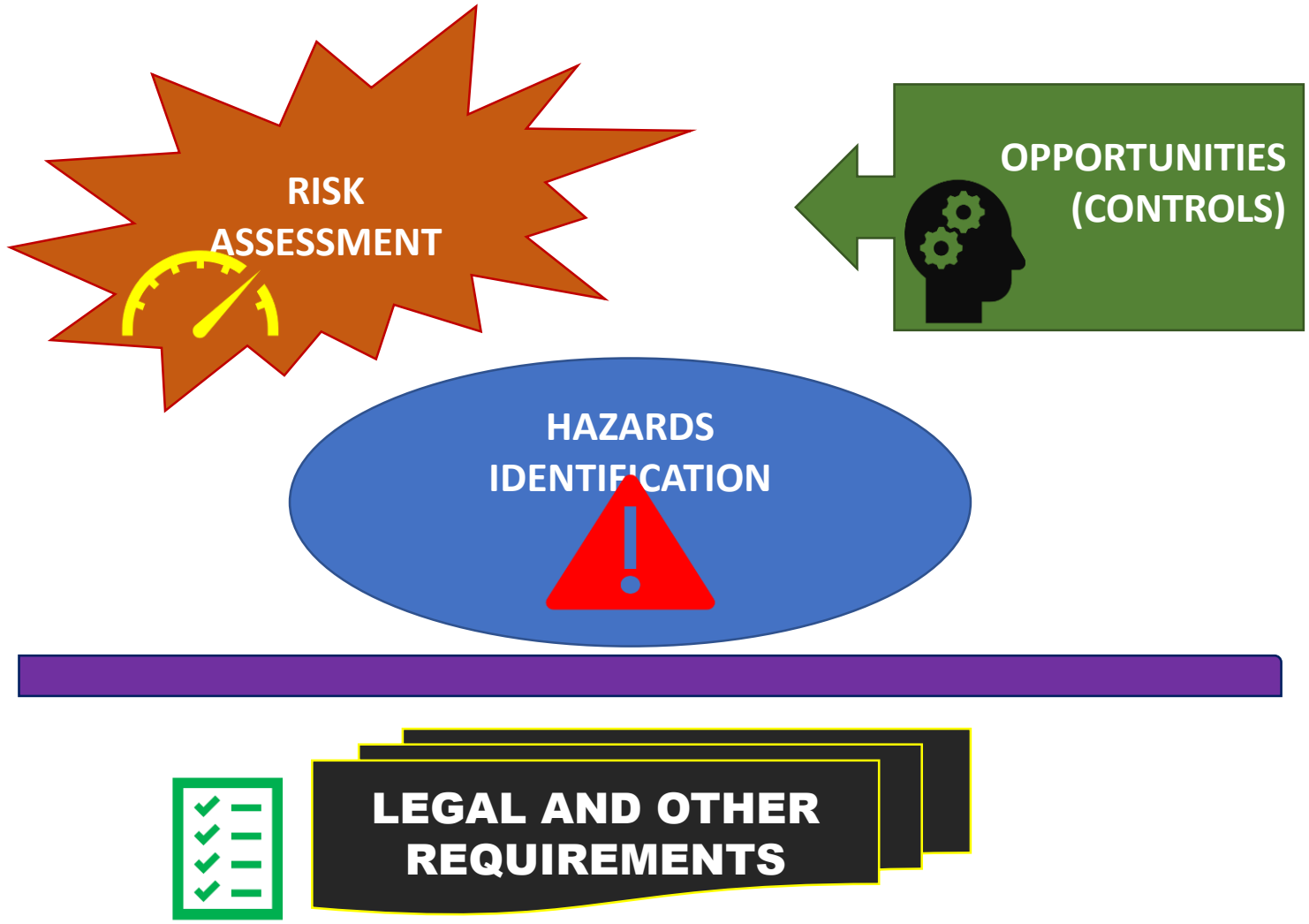
EMERGENCY RESPONSE

- Execution of actions to mitigate consequences to human health and safety, quality of life and property and the environment during an emergency.

  ISO 11320:2011, 3.6 Nuclear Critical Safety Emergency Preparadness and Response

PREPARATION AND RESPONSE BEFORE EMERGENCIES

- Planned Response
- Training
- Tests and Exercises
- Performance evaluation
- Communicate and inform:



EMERGENCY RESPONSE: ACTORS (Concerned parties)

COMPANY

DECISION MAKERS — DIRECTIVES, MANAGERS

COORDINATORS — SUPER-INTENDENTS, HEADS

EXECUTORS — SUPERVISORES, MIEMBROS DE LOS EQUIPOS DE RESCATE MINERO

GOVERNMENT

LEGISLATIVE → OVERSIGHT → RESPONSE

COMMUNITIES

EMERGENCY SCENARIO

CONCLUSIONS:

RESCUE TECH

- In Ecuador, current standards do not establish emergency response criteria for the medium and large-scale mining industry.
- The implementation of the requirements of ISO 45001 into national standards is a great opportunity for Ecuador.
- It is the best time to update the standards on Emergency Response for mining due to the change of phase, from construction to operations

CONCLUSIONS:

RESCUE TECH

- Establish the Emergency Response requirements according to:
  - Phase
  - Owner / Operator and Contractor
- There is currently no accident record for the mining sector.
- In EMERGENCY RESPONSE activities, the development of parameters and models to manage the risk of responders is still incipient.

CONCLUSIONS:

RESCUE TECH

- Safety and health standards must require a risk assessment process for mining rescue work.
- Mining standards for prevention and emergency response need to be developed.

RECOMMENDATIONS: NATIONAL STANDARDS

- UPDATE the safety and health standards for mining.
- Define the accident registration methodology in Mining Occupational Safety and Health (OSH).
- Implement safety indicators used in the industry (DART, TRC, DAFW, DJTR, ORC)
- Establish the specific audit process in OSH by a single State agency.

RECOMMENDATIONS: Criteria for developing MINING RESCUE standards

RESCUE TECH

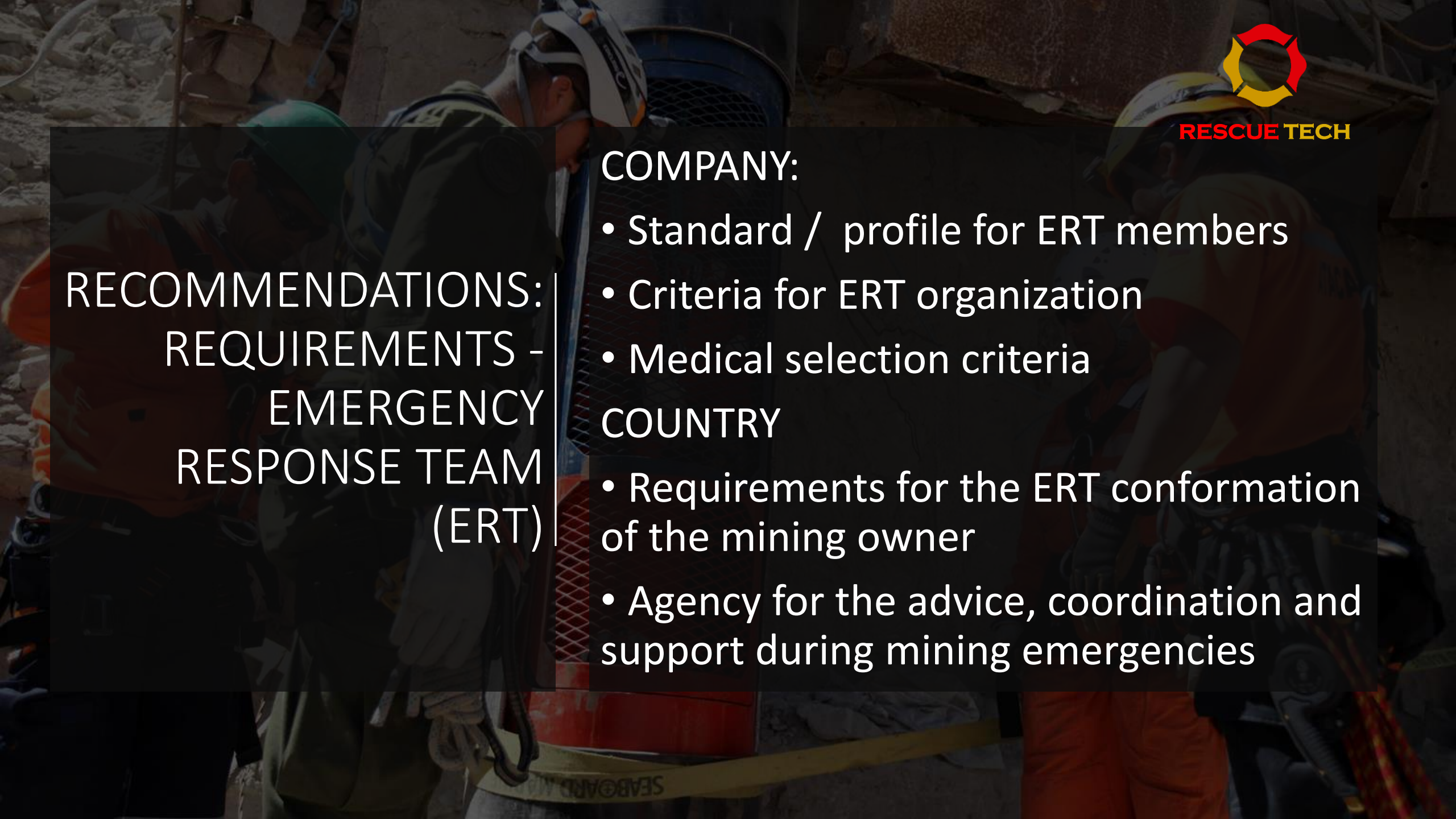
Training	*Mining Rescue Personnel Selection Criteria*	*Equipment*
Infrastructure	*Organization*	*Specialized staff*
Response Planning	*Emergency Procedures*	*Mining Rescue Procedures*

RECOMMENDATIONS: Risk evaluation

RESCUE TECH

- Evaluation processes by emergency scenario.
- Determination of probabilistic risk levels.
- Establish the level of operational risk in emergencies

Probability	Threats Risk Score = Probability x Impact					Opportunities High (RED) / Med (YEL) / Low (GRN)				
0.90 Very Likely	0.05	0.09	0.18	0.38	0.72	High	High	High	Med	Low
0.70 Likely	0.04	0.07	0.14	0.28	0.56	High	High	Med	Med	Low
0.50 Possible	0.03	0.05	0.10	0.12	0.40	High	High	Med	Low	Low
0.30 Unlikely	0.02	0.03	0.06	0.12	0.24	High	Med	Med	Low	Low
0.10 Very Unlikely	0.01	0.01	0.02	0.04	0.08	Med	Low	Low	Low	Low
	0.05	0.10	0.20	0.40	0.80	Very High	High	Med.	Low	Very Low
	Example Impact Definitions – May Be Tailored to Each Project Objective Impact on an Objective (e.g. Cost, Schedule, Scope, Quality)									



RESCUE TECH

RECOMMENDATIONS: REQUIREMENTS - EMERGENCY RESPONSE TEAM (ERT)

COMPANY:

- Standard / profile for ERT members
- Criteria for ERT organization
- Medical selection criteria

COUNTRY

- Requirements for the ERT conformation of the mining owner
- Agency for the advice, coordination and support during mining emergencies

THANK YOU

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RESCUE TECH

SEGURIDAD, SALUD Y RESPUESTA A EMERGENCIAS PARA MINERÍA