

LAPPEENRANTA–LAHTI UNIVERSITY OF TECHNOLOGY LUT
School of Energy Systems
Department of Environmental Technology
Sustainability Science and Solutions
Master's thesis 2020

Anniina Salonen

**SUSTAINABLE MINING IN NORTHERN FINLAND: STANDARDIZATION AND
CURRENT PRACTICES**

Examiners: Assoc. prof. Mirja Mikkilä
Prof. Lassi Linnanen

ABSTRACT

LAPPEENRANTA–LAHTI UNIVERSITY OF TECHNOLOGY LUT
School of Energy Systems
Department of Environmental Technology
Sustainability Science and Solutions

Anniina Salonen

Sustainable mining in Northern Finland: Standardization and current practices

Master`s Thesis
2020

97 pages, 50 figures and 8 tables

Examiners:

Professor Mirja Mikkilä

Keywords: Mining industry, Sustainable mining

This thesis examines sustainable mining state and initiatives in metal mining company. The goal of the study was to evaluate current performance against Finnish TSM -standard (Towards Sustainable Mining –standard) with gap analysis and create a goal-directed step to milestone –project plan in order to develop the standard in Boliden Kevitsa. The goal was also recognize how Finnish TSM standard could be combined with the most commonly used ISO management standards ISO14001, ISO45001 and ISO50001. Study was performed as a qualitative single case study for Boliden Kevitsa Mining Oy. As a result of study it was noticed that the Finnish TSM standard can be combined the easiest with the ISO14001 standard consistent environmental management system but also with ISO45001 standard consistent health and safety management system as well as ISO50001 standard consistent energy management system. As a result is was also noticed that significant gaps in case organization were concerning the stakeholder cooperation activities in the facility level operation.

TIIVISTELMÄ

LAPPEENRANTA–LAHTI UNIVERSITY OF TECHNOLOGY LUT
School of Energy Systems
Department of Environmental Technology
Sustainability Science and Solutions

Anniina Salonen

Kestävä kaivostoiminta Pohjois-Suomessa: standardisointi ja käytänteet

Diplomityö

2020

97 sivua, 50 kuvaa ja 8 taulukkoa

Työn tarkastajat:

Professori Mirja Mikkilä

Hakusanat: Kaivosteollisuus, kestävä kaivostoiminta

Tässä diplomityössä tutkittiin kestävä kaivostoiminnan työkaluja ja tilaa metallimalmikaivoksella. Työn tavoitteena oli arvioida nykyistä toiminnan tilaa kaivosvastuujärjestelmää vasten gap –analyysin avulla ja laatia tavoitteellinen projektisuunnitelma suomalaisen kaivosvastuujärjestelmän kehittämiseksi kaivosyhtiössä. Tavoitteena oli myös tunnistaa, kuinka kaivosvastuujärjestelmä voidaan yhdistää yleisimmin käytettyihin ISO johtamisjärjestelmästandardeihin ISO14001, ISO45001 ja ISO50001. Työ tehtiin laadullisena tapaustutkimuksena Boliden Kevitsa Mining Oy:lle. Työn tuloksena havaittiin, että kaivosvastuujärjestelmä voidaan implementoida parhaiten ISO14001 standardin mukaiseen ympäristöjohtamisjärjestelmään, mutta myös ISO45001 mukaiseen työterveys- ja turvallisuusjohtamisjärjestelmään sekä ISO50001 mukaiseen energianhallintajärjestelmään. Tuloksena havaittiin myös suurimpien kohdeyrityksen puutteiden gap analyysissä kohdistuvan sidosryhmäyhteistyöhön laitostasolla.

TABLE OF CONTENTS

LIST OF TERMS AND ABBREVIATIONS.....	6
INTRODUCTION	8
1.1 Background.....	8
1.2 Objectives and research questions	12
1.3 Structure and boundaries	12
2 SUSTAINABLE MINING	15
2.1 Corporate social responsibility and sustainability	15
2.2 Sustainability topics for mining.....	18
2.3 Drivers for sustainable mining.....	19
2.4 Stakeholder involvement and social license to operate	21
3 SUSTAINABILITY INITIATIVES USED IN MINING SECTOR	24
3.1 ICMM Sustainable Development Framework (SDF).....	25
3.2 Global Industry Standard on Tailings Management (GISTM).....	28
3.3 Global Reporting Initiative (GRI).....	33
3.4 GRI Mining and Metals Supplement.....	35
3.5 The UN Global Compact	36
3.6 The UN Sustainable Development Goals (SDGs).....	37
3.7 Carbon Disclosure Project (CDP).....	39
3.8 IFC Environmental and Social Performance Standard.....	39
3.9 IRMA Standard for Responsible Mining.....	40
3.10 MAC Towards Sustainable Mining (TMS)	42
3.11 Use of the initiatives	44
4 SUSTAINABLE MINING DEVELOPMENT IN FINLAND.....	46
4.1 General guiding principles.....	47
4.2 Toolbox.....	48
4.3 Mining CSR report.....	49
4.4 TSM Standards	50
4.4.1 Community outreach.....	53
4.4.2 Biodiversity conservation	55
4.4.3 Tailings management.....	56
4.4.4 Water management	57
4.4.5 Energy use and GHG emissions	58
4.4.6 Health and safety	59

4.4.7	Crisis management.....	60
4.4.8	Mine closure	61
5	IMPLEMENTATION OF FINNISH TSM.....	63
5.1	Self-assessment results	63
5.1.1	Community outreach.....	65
5.1.2	Biodiversity conservation	68
5.1.3	Tailings management.....	71
5.1.4	Water management	74
5.1.5	Energy use and GHG emissions	79
5.1.6	Health and safety	82
5.1.7	Crisis management.....	86
5.1.8	Mine closure	87
5.2	Finnish TSM alignment to ISO standards.....	89
6	RESULTS	92
7	DISCUSSION.....	93
7.1	Reliability and validity of the study.....	93
7.2	Applicability of the study	94
8	CONCLUSIONS	95
	REFERENCES	98

LIST OF TERMS AND ABBREVIATIONS

Akwé: Kon Guideline	Guideline providing a collaborative framework ensuring the indigenous people and local communities' involvement in the cultural, environmental and social impact assessment processes.
Gap Analysis	Comparison of actual performance with potential or desired performance.
Material topic	Concept that defines why and how certain issues are important for a company. A material topic can have a major impact on the economic, financial, reputational and legal aspects of a company and its internal and external stakeholders.
No Net Loss –principle	Negative impacts on biodiversity are prevented by avoiding the creation of adverse impacts, by minimizing adverse impacts and by compensating for any residual adverse impacts .
Net Positive Impact –principle	Negative impacts on biodiversity are prevented by gaining of biodiversity.
Progressive mine closure	Closure activities done during the operating life of a mine providing an opportunity to test and demonstrate the effectiveness of closure activities.

BAM	Business area Mines in Boliden corporate
BAT	Best Available Techniques
BEP	Best Environmental Practice
BREF	Best Available Technique Reference Document
CDIV	Construction vs. Design Intent Verification
CMT	Crisis Management Team
COI	Community of Interest
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment

EHSQ	Environment, Health, Safety and Quality
EOR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FPIC	Free Prior and Informed Consent –framework
GHG	Greenhouse gas
GISTM	Global Industry Standard on Tailings Management
GMI	Global Mining Initiative
GRI	Global Reporting Initiative
HR	Human Resources
ICMM	International Council for Mining and Metals
IIED	International Institute for Environment and Development
ISO	International Organization for Standardization
ITRB	Independent Technical Review Board
MAC	Mining Association of Canada
MWEI BREF	Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries
MMSD	Mining, Minerals and Sustainable Development (Project)
NGO	Non-government organization
OMS	Operation, Maintenance and Surveillance
PDCA	Plan, Do, Check, Act
QC/QA	Quality Control and Quality Assurance
RTFE	Responsible Tailings Facility Engineer
SDG	Sustainable Development Goal
SDG2	the United Nations' Sustainable Development Goal number 2
STMP	Step to Milestone Plan
TSM	Towards Sustainable Mining
UN	the United Nations
UNGC	the United Nations Global Compact (UNGC)
UNGP	United Nations Guiding Principles on Business and Human Rights
WBCSD	World Business Council for Sustainable Development

INTRODUCTION

1.1 Background

A modern society needs minerals. Anything we cannot grow needs to be taken from the ground. Throughout the ages, the number of different elements that people use in everyday life has only increased. When in the 1700s humankind used only few elements, nowadays there are markets to even all elements in the periodic table (Minefacts, 2020). A global population growth and urbanization speeds the demand for metals, minerals and rock aggregates (The Ministry of Employment and the Economy, 2010). It is estimated that as many as 70 % of the world population will live in cities by 2030 which means 60-80 million people moving to cities annually (The Ministry of Employment and the Economy, 2010). In Finland, around 70 % of population already lives in cities but for many other developing countries rapid urbanization means increased need for build for example infrastructure and housing (Finnish Environment Institute, 2019). An increase in population also means increased food need. In order to secure adequate food supply increasing population the agriculture needs to be more efficient and that in turns requires mineral-based fertilizers and more agricultural equipment to be used (The Ministry of Employment and the Economy, 2010). Both, fertilizers and agricultural equipment needs metals and mineral from the ground.

In order to limit global warming, countries need to adopt cleaner, low-carbon energy technologies that requires a wide amount of minerals (World Bank Group, 2017). Low-carbon energy technologies are more mineral intensive and as manufacturing wind turbines, solar panels and batteries are needed more and more so are critical minerals to manufacture these (World Bank Group, 2017). World Bank Group estimates that the production of some minerals such as graphite, lithium and cobalt could be increased even 500% by 2050 in order to meet the increasing demand for clean energy technologies (The World Bank, 2020).

Even tough lifespan of metal products is decades, recycling can only partially meet the current demand for minerals (The Ministry of Employment and the Economy, 2010). As an example of copper, which average lifespan is more than 30 years and more than 80 % of copper is already recycled, recycled material only covers one-third of current need (The Ministry of Employment and the Economy, 2010). Globally, if recycling rate of copper and

aluminum would be scaled up to 100%, still it will not be enough for future need (The World Bank, 2020).

Mining is a heavy industry that is driven by many different aspects such as world market prices for metals, political decisions, projected future demand for minerals and the level of mineral resources mapping. The raw materials found in the Earth's crust are not renewable and are distributed unevenly around the globe. This divides countries to those who are depend of metal availability as well as pricing, and to those who can increase wealth through their local mineral resources (Öster, 2016). In spite of rapid increase of mineral raw material need, the depletion of raw materials is not a risk (The Ministry of Employment and the Economy, 2010). Instead for mining, the growing need of mineral materials means that more lower grade ore deposits needs to be utilized or a deposits which are technically more difficult to process (The Ministry of Employment and the Economy, 2010). These challenges requires new type of mining from future mining operations, new technologies and more underground operations to be developed (The Ministry of Employment and the Economy, 2010).

Each mining project is a unique regarding its location, mined ore and implementation of different mining technologies (Kokko, et al., 2013). Depending where the mining operation takes place, new mining activities can be welcomed locally as a source for new jobs or seen as a thread for other land use or business activities (Ranängen & Lindman, 2017). Local communities in Finland treat mining projects and mining activities mainly positively (Kokko, et al., 2013). Mining industry is expected to bring well-being to municipalities as well as to the individuals living nearby (Kokko, et al., 2013). In the case of Northern Finland, permanent inhabitants show more positive attitude towards mining compared to tourists (Kokko, et al., 2013). Despite the generally positive attitude, the one opinion is common for both of these stakeholder groups: there must be clear conditions for mining before it can be acceptable (Kokko, et al., 2013). Mining is a primary production that changes the area where it operates forever. Mining causes long-lasting environmental impacts, such as possibilities to future land use and impacts to landscape since mine wastes are usually deposited to the mine sites.

According to the World Bank more than a half of all mineral production originates from politically unstable areas and EU member countries consumes 25-30 % of all globally produced metals. Still, only 3 % of global metal production comes from EU and many of the important metals are not produced in the EU countries at all (The Ministry of Employment and the Economy, 2010). The equity ratio 2010 in Finland was low, 96 % of the important ferrous and base metals were imported outside from Finland. According to the Finland's mineral strategy, the vision for 2050 is that Finland would be a global pioneer in the sustainable utilization of minerals and that the mineral sector would be one of the pillars of our national economy. In the EU, access and refining of critical metals has also been seen important for the competitiveness and for self-sufficiency of European industry. Still, the growing production of minerals and metals has increased concern and resistance of its acceptance due to the environmental and social impacts and accidents around the world. The climate policy and increased need of diverse raw materials for renewable energy and carbon-free technologies (such as batteries, electric cars, smart grids) has also strengthen the vision that production of these metals must be also in Europe and that dependency on China must be reduced. (Tenberg, et al., 2017).

The mapping of mineral potential is the most advanced in Finland and Sweden among the EU area. The Fennoscandian shield is similar as important mining areas in Australia, Canada and South Africa (Öster, 2016). In the 2020 Fraser Institute's study, Finland was rated the second most interesting investment country regarding the mining industry worldwide (Fraser Institute, 2020). Strengths in Finland are good geological knowledge as well as ore potential and stable society (Fraser Institute, 2020). In addition, Finland has a high level of education and high-quality infrastructure (Fraser Institute, 2020).

Variety of different type of sustainability initiatives for mining and metal sectors started to develop in the 1990s as industry faced major challenges (Ruokonen, 2020). Access to land was threatened due to legal restrictions, commodity prices had dropped and investors were reluctant to invest in mining companies (Ruokonen, 2020). Also at the same time general criticism from the society towards mining operations was growing due to several major environmental incidents that happened in the 1990s and that were highly publicized (Ruokonen, 2020). This combination resulted bad reputation for the whole industry as well as decreased public trust towards companies (Ruokonen, 2020).

The need for mining industry worldwide and in Finland is apparent. Environmental impacts of mining are unavoidable and recent incidents in Finnish mining history are causing concerns regarding mining industry acceptance. Still, national strategy strives towards development of mining industry and Finland is seen attractive mining location also for international companies. These are the main drivers for sustainable mining practices. A common aspiration that Finland must be a pioneer in sustainable mining industry was found in fall 2012 and building of the action plan to lift Finland to this desired state was started. First models for sustainable mining were looked around the world and an interesting approach was found from Canada. The Canadian Towards Sustainable Mining (TSM) model was base for the Finnish Towards Sustainable Mining Standard which was launched 2016.

Mining companies are applying several different sustainability initiatives already in their operations, on average seven initiative per company (Ruokonen, 2020). The World Economic Forum (The World Economic Forum (WEF), 2015) and Kickler and Franken (Kickler & Franken, 2017) both stated that mining industry is looking for sustainability initiatives that are practical and easy to implement through existing environmental or safety management systems such as ISO14001 or ISO45001. Ruokonen also noted that this will be crucial when mining companies start to implement Finnish Towards Sustainable Mining standard (Finnish TSM) into their operation (Ruokonen, 2020). According to the Ruokonen study, 81 % of the respondents mining companies operating in Finland will take the Finnish Towards Sustainable Mining Standards into use. Also 81 % of the respondents noted that the Finnish TSM should be integrated into existing management systems (Ruokonen, 2020).

Even though mining companies are already following multiple sustainability frameworks and standards in Corporate Knights (CK) the Global 100 Most Sustainable Corporations ranking list there was only one metal ore mining company listed as a number 91 in 2020. This shows that mining companies sustainability work needs still more development. As the biggest large-scale mining companies are multinational, sustainability actions vary a lot from country to country. Sustainability frameworks that are developed to be suitable for most of the industries and countries does not necessarily are concrete and create value for the closest stakeholders. Concrete sustainability actions needs tools that can be tied to national level requirements and can be applied in facility level. Companies sustainability work must create value for the closest stakeholders such as local inhabitants or authorities and this requires

facility level sustainability tools and frameworks, such as Finnish TSM –standard to be taken into use. This work overviews the most used sustainability frameworks that mining companies are following in Finland and then assesses the facility level Finnish TSM –standard.

1.2 Objectives and research questions

The most of the mining companies operating in Finland are following some ISO management system standard in their facility level operation. The goal of this thesis is to recognize how Finnish TSM can be aligned with the existing ISO management systems (ISO 14001, ISO 45001, ISO 50001) and how case organization can implement and combine these multiple management systems effectively in the facility level operations.

The main research questions in this thesis are:

- What are the case organization's gaps in the sustainability management compared to the Finnish Towards Sustainable Mining standard?
- How to fill those recognized gaps?
- How Finnish Towards Sustainable Mining standard can be used beside the most commonly used ISO standard management systems?

1.3 Structure and boundaries

This thesis consists of theoretical section and empirical section. Theoretical section is a literature review which focuses on sustainability management in mining industry and new Finnish Towards Sustainable Mining (TSM) Standard. The empirical section evaluates the case organization compliance with the Finnish TSM Standard with the GAP analysis.

For this thesis work, the qualitative single case study was chosen as a research method because the purpose was to study phenomenon in a limited case organization. Typically, qualitative research method has been seen as an opposite to the quantitative research method thus the boundaries of these two methods are not so clear. The recognized characteristics of qualitative research are data collection method, research subjects' perspective, discretionary or theoretical sampling, qualitative-inductive analysis of data, hypothesis, research genre and presentation of results, researcher's position and narrative. (Eskola & Suoranta, 1998).

In qualitative research, different phases of the research study is often hard to separate since interpretation phase is usually continuous during the whole study research (Eskola & Suoranta, 1998). This also enables that research plan can be developed still during the research project (Eskola & Suoranta, 1998). Primary source for this study theoretical part material was LUT primo by the Lappeenranta academic Library. This material included academic publications, books, thesis works and scientific journals. Following keywords were mainly used when material was searched: *sustainable management, sustainable mining, corporate social responsibility and corporate sustainability*. Research arrangement of this study was that researcher of the study is working in the case organization. Since researcher makes the data collection in the qualitative study, the perspectives and interpretations related to the studied material gradually develops as the research process progresses. The qualitative research often focuses on a relatively small number of cases and intends to analyse them as thoroughly as possible. Essential is the used material quality not its quantity. The challenges of the qualitative study often is that the amount of qualitative material is endless, this is the reason why boundaries are important to set in order to keep analysing of the theoretical part relevant. (Eskola & Suoranta, 1998).

Structure of this thesis study is presented in Figure 1. The thesis will begin with opening the concepts sustainability and corporate social responsibility, what these both means in the mining industry sector and what are the drivers towards sustainable mining practices. After this the thesis will focus on the different sustainability initiatives that mining companies are already applying in their operation, and the Finnish Towards Sustainable Mining standard. Then the case organizations gap analysis is introduced.

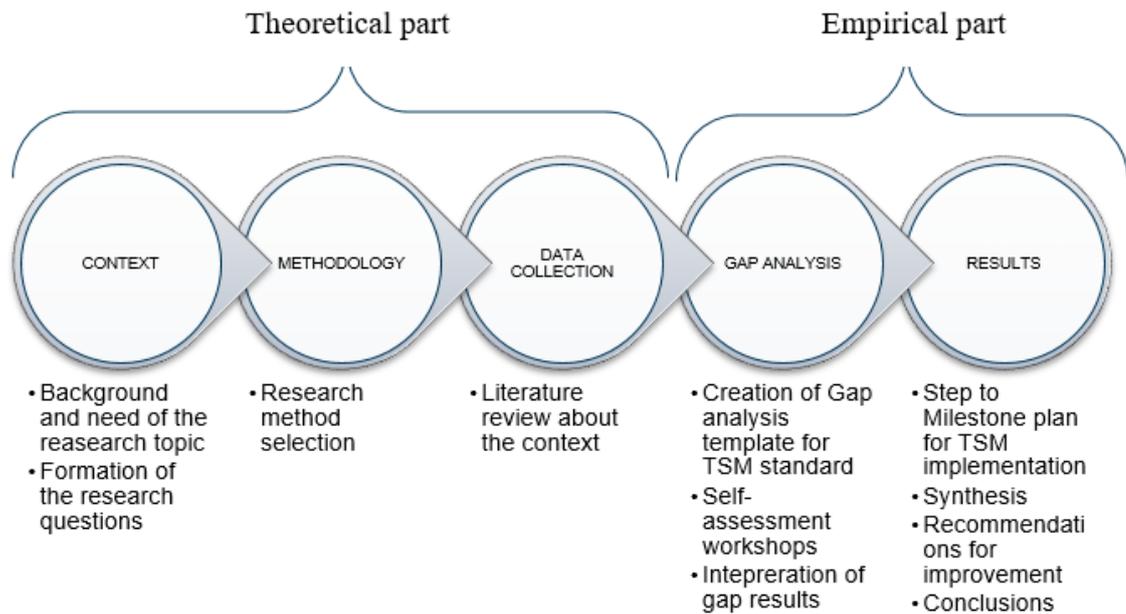


Figure 1. Structure of the study

The case organizations current practices against Finnish TSM standard was reviewed. This was done by comparing company practices against General Guiding Principles of the system and arranging 8 workshops for standard self-assessment questionnaire. Workshops were conducted between June 2020 and August 2020. After the completing self-assessment, results were still checked and analysed more in-depth and additional interviews were made in order to get the most realistic self-assessment results. Finnish TSM standards content were reviewed by each standards and compared to most widely used management systems (ISO14001, ISO45001 and ISO50001). Common sections from Finnish TSM and ISO standards were recognized and alignment proposed for both of these management systems. Finally, the step to milestone (STMP) project plan for Finnish TSM system for target organization was made. Purpose of the STMP is to divide TSM implementation project to project milestones according to the performance levels. This allows target organization to focus on the right actions, which drives performance towards each milestone (performance level). Also improvements for the Finnish TSM standard were considered as well as actions how companies could ensure their sustainability practices and effectively implement the Finnish TSM.

2 SUSTAINABLE MINING

Can be said that identity of the mining industry is definitely currently changing: mines will become the builders of a carbon-free world and so, to be part of the climate policy solution. The main challenge for the mining sector is to demonstrate that despite the usage of non-renewable natural resources, mining activities contribute to the welfare and wellbeing of the current generations without compromising the quality of life of future generations (Azapagic, 2004). Even though mining is an important part of society and technology development, it can have significant environmental and social impact. Mining industry consumes for example 11 % of total global energy use (World Bank Group, 2017). These are the reasons why it is crucial to pay attention that these raw materials are prospected, extracted and processed in a sustainable way as possible. In order to secure acceptance from local communities and stakeholders, so-called 'social license to operate', mining companies need to actually demonstrate continuous improvement for its stakeholders and maintain constant discussion with them. In sustainable mining, an essential part is following the development of best available techniques (BAT) and best environmental practices (BEP) and utilizing those in the operations as well as the closure phase (EU, 2018).

2.1 Corporate social responsibility and sustainability

Corporate social responsibility is one of the most significant phenomena of the 21st century that has developed businesses around the globe (Jussila, 2010). Development of corporate social responsibility started in the 1990s when the concept of sustainable development was launched (Jussila, 2010). It was noticed that the business world needs more concrete principles and tools that drive companies towards sustainable development practices (Jussila, 2010). When a company is approaching and practicing social responsibility, the overarching goal for an organization is to maximize its contribution to sustainable development (ISO, 2010). Practicing of corporate social responsibility can be considered to have started in 1999 when the first corporate responsibility framework was published by UNEP (Jussila, 2010). This framework was later formed to GRI (Global Reporting Initiative) framework and organization (Jussila, 2010). Different elements of social responsibility reflect the expectations of society at a particular time, and are therefore liable to change (ISO, 2010). As a society's concerns change, its expectations of organizations also change to reflect those concerns (ISO, 2010).

Sustainable development can be treated as a way of expressing the broader expectations of society as a whole (ISO, 2010).

Sustainable development as a concept has gained international recognition from so-called Brundtland report (World Commission on Environment and development 1987), which defined sustainable development as “*a development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (United Nations, 1987). In sustainable development, future generations can be understood as stakeholders. Sustainable development consist three different dimensions: economic, social and environmental dimension (ISO, 2010). This is also called as a triple bottom line, which means that the activities of businesses should be looked through social, environmental and economic criteria, not only profits (Figure 2).



Figure 2. Triple bottom line

European Commission defines corporate social responsibility (CSR) as the responsibility of enterprises for their impact on society. Commission also states, acts done under the rubric of CSR should therefore be led by the companies itself. According to the EU Commission, companies can evolve their social responsibility by following the law as well as integrating social, environmental, ethical, consumer and human rights concerns into their strategy and operations. (European Commission, 2020). ISO 26000 standard defines CSR as the group of

actions that are undertaken by an organization in order to accept the responsibilities resulting from the impact of its activities on society and the environment (ISO, 2010).

Archie B. Carroll defines corporate social responsibility as a pyramid, which consist of four different categories of CSR actions (Figure 3). Pyramid shape describes the importance of different CSR categories: primarily, the company must be financially in a good state in order to manage its economic responsibilities. This can be also seen so that there are no base for other CSR actions if the bottom of the pyramid is not stable and strong enough. At the same time as business is expected to be a profitable, it is expected to obey the law and regulations. What this category means to each company varies depending the nature of business as well as location where it operates. For multinational companies this means that they have to be well aware several different countries legal requirements and adjust operations to each local legal framework. (Carroll, 1991).

When company economics and legal responsibilities are handled with a good manner, there is room for develop ethical responsibility of a business. Ethical responsibility means all those expectations that arise towards business from other than what is codified to legislation. In order to be ethically responsible, company needs to recognize its stakeholders and where these expectations, different standards or norms might be raised. Ethical responsibility may also been seen more up-to-date view what surrounding society expect business to meet compared to valid legislation which changes usually takes more time. (Carroll, 1991).

The last step of CSR pyramid is philanthropic responsibilities, which Carroll sees more like a voluntary category of CSR because society do not see company unethical if they do not comply with philanthropic responsibilities even tough community can expect so. Philanthropic responsibilities shortly means different type of resources that company can afford to community in order to improve quality of life such as contribution to education and different campaigns. (Carroll, 1991).



Figure 3. The pyramid of corporate social responsibility (Carroll, 1991)

2.2 Sustainability topics for mining

Ranängen & Lindman studied Nordic mining companies stakeholders expectations towards sustainability issues and based on the study they proposed sustainability subjects and criteria for the Nordic mining industry (Figure 4) (Ranängen & Lindman, 2017). Criteria's were classified to three different priority level from A to C according to implementation order where A was the most urgent one (Ranängen & Lindman, 2017). Stakeholders of the Nordic mining companies expect that mining companies carry out good stakeholder management practices, respect the law and manage their risks. Occupational health and safety includes the physical, social and mental well-being of the workers and prevention of these caused by the working conditions. From the environmental criterias all expect one got the highest priority level A and this shows that the environmental issues are very important subject for the mining industry overall. (Ranängen & Lindman, 2017). Also according to the Lempiäinen 2019 study, mining companies stakeholder's interest on corporate social responsibility focuses more on environmental issues and social responsibility in the northern Finland mining sector (Lempiäinen, 2019).

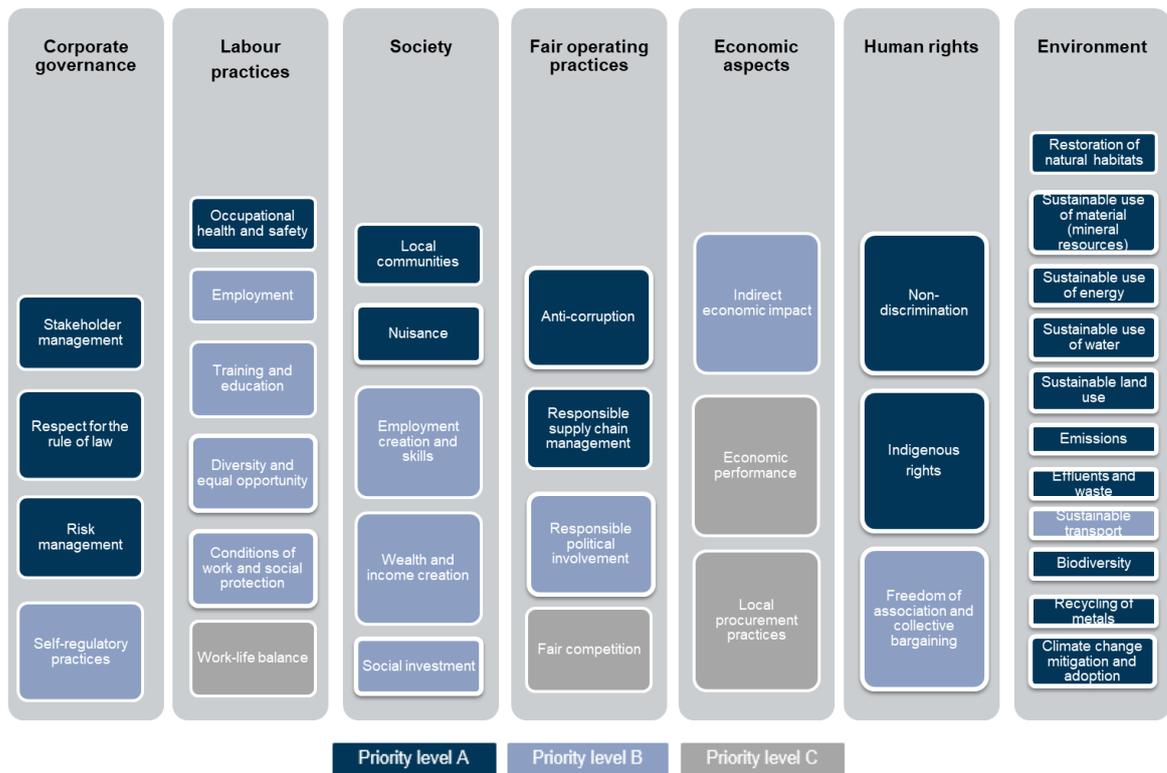


Figure 4. Sustainability criteria recommendation for the Nordic mining industry (Ranängen & Lindman, 2017)

2.3 Drivers for sustainable mining

Sustainability is often seen as a cost if the benefits and value that it brings are not clearly understood in the organization. Implementation of corporate responsibility and sustainable business brings several advantages for businesses even though often these are hard to measure. These benefits can be lower labor and health costs when working environment is safe and healthy, cleaner production methods which are less expensive, easier access to lenders and insurers, lower closure and post-closure costs. Also these actions can bring strategic benefit compared to other competitors by improving the company reputation and image. (Azapagic, 2004).

Consumers and customers are nowadays more interested of the origin and sustainable production of food and clothing. In Finland and the EU the responsibility of industrial products

is also increasingly being discussed. The Finnish Mining industry sees that in future discussion will extend to cover also mining and metal industry as consumers want to know more where the metal is origin from and where it has been produced as they choose for example new bicycle (Suomela, 2020). So-called traceability of the metals will be new competitive factor for companies (Suomela, 2020). In Finland, companies have all basis to become world's leaders in corporate social responsibility issues (European Commission, 2020). Finland is a democratic society with the freedom of speech, we respect human rights and don't allow corruption or bribery (European Commission, 2020). Also strong labor, occupational safety, health and environmental legislation, which gives a strong start point for all work done towards CSR. (European Commission, 2020). On April 2013 Ministry of Economic Affairs and Employment of Finland published 'Action Plan for Development of Sustainable Extractive Industries' which included 35 actions towards sustainable mining industry development. One of the actions was that mining companies will introduce a corporate social responsibility program and appropriate indicators, reporting and monitoring tools will be developed (Table 1). Incorporating responsibility practices into the business provides protection against external shocks and strengthens risk preparedness as well as helps to build a profitable business. (UN Global Compactin kymmenen periaatetta -koulutus, 2020).

Table 1. Action plan for development of sustainable extractive industries, mining companies' responsible actions

Action
1. Development of water management plans for mines and developing a water technology
2. Increase of activities and research regarding the waste sorting, tailings and waste rock utilization
3. Systematic development of extractive industries energy efficiency
4. Safety of mine sites and pit areas and knowledge relating to safety issues will be developed
5. Companies will introduce a corporate social responsibility program and appropriate indicators, reporting and monitoring tools will be developed
6. Active, diverse and interactive cooperation with various stakeholder will be maintained
7. Synergies with local actors are actively sought
8. Companies own communication activities will be developed to be more faster and transparent
12. Developing processes and methods and increase regional and impact data from ore-critical areas that are central to society's rock and mineral supply in order to support coordination
14. Guides will be produced for stakeholders of participation and influence opportunities and for actors on the application of legislation
16. A research strategy for the extractive industries will be created including the research for infrastructure development and key research areas
18. To carry out long-term inventory and modeling of ore reserved and ensure adequate resources
23. Nordic countries cooperation in the extractive industries will be intensified
28. Supporting companies' access to export markets

Interest towards the responsible metals and minerals production are expected to be growing even more as due to the legislative pressure as well as consumers' interest to know origin of the product that they buy. Currently sustainability information is provided consumers from the downstream supply chain operations such as manufacturing of the products. Mining industry is part of the upstream supply chain and traceability of the sustainability issues is not yet developed to include the whole supply chain of the product. Metals and minerals are traded globally, and companies that are following high environmental and social standards are not gaining any advantage from the supply chain compared to the companies that are not following as a high standards. Investors are as well currently developing sustainable investment options factors so interest towards transparent sustainability information from metals and mineral chain is definitely needed more and more in the future. There are no sustainability scheme for metal minerals that takes account the whole supply chain from upstream processes to downstream processes. These type of schemes are currently developed for example for gold, silver and platinum production in developed countries (Fairtrade). (Kickler & Franken, 2017).

According to the Ruokonen study, mining companies see reputational issues as the most important expected benefits of sustainable mining and implementation of Finnish TSM (Ruokonen, 2020). Mitigation of risks, continuous improvement and brand were also seen as an important benefits (Ruokonen, 2020).

2.4 Stakeholder involvement and social license to operate

Globalization, greater ease of mobility and accessibility, and the growing availability of instant communications mean that individuals and organizations around the world finds easier knowledge of the decisions and activities of organizations in both nearby and distant locations (ISO, 2010). This means that wider group of stakeholders can follow organizations activities and decisions and those can be easily compared worldwide (ISO, 2010). Stakeholders are usually strongly involved when mining operation is in its environmental impact assessment (EIA) phase. Unfortunately often after this phase, when actual mining operation starts, cooperation with the stakeholders is less frequent. Stakeholder expectations, needs and external communication overall are not prioritized at the mines (Ruokonen, 2020). This may be due to organizational structure: stakeholder relations and communication are focused

in the corporate level and not so much in the unit operation level (Ruokonen, 2020). Mining industry's stakeholders are looking for transparent system for sustainability performance reporting of the issues that corresponds to their needs. (Ruokonen, 2020).

Mining always affects a lot to surrounding society in every phase of its life cycle. In mining sector Social License to Operate (SLO) has been a popular term during the recent years. In the global mining industry the concept of SLO came into use at the late of 1990s. With the boom in mining it landed to Finland in the early 2010s (Sairinen, 2018). It has been defined as a social acceptance of local community and other stakeholders, and it is dynamic and non-permanent because it is strongly based on opinions, beliefs and perceptions. Always, Social License needs to be earned by the company and also it requires continuous maintain in order to keep it (Shinglespit Consultants Inc, 2018). For mining industry, social license to operate is crucial since mining operation can not be moved any other place. Mine operates where the ore deposit on the ground is. As Eerola and Ziessler states, mining industry needs actively aim and maintain acceptance (social license) for its operation due to the environmental challenges from history (Eerola & Sofia, 2013).

Mining sector stakeholders are acting in five different levels: regional, municipal, provincial, national and global level (Figure 5). Local approval of mining operations depends largely on how the company manages its stakeholder activities, i.e. how it communicates, seeks contact and manages its relations with the local community in its area of operation at different stages of the mining life cycle. In addition, local social acceptance may depend on factors related to the locality, such as economic history, power, population and economic structures, distance from growth centres, party policy, and previous environmental struggles. Organizations transparency towards its stakeholders can avoid conflicts that may cause due to unconsciousness.

However, despite the importance of the local stakeholder nearby mining activity, the national and global level cannot be ignored because negative feedback towards mining projects often comes from outside the local area where mining affects. Local events can have an impact at both national and international levels, also some local stakeholders can have such a broader dimension. These include e.g. the Sámi, NGOs and the media, which act from the local to

the global level. Investors, financiers and international organizations and organizations operating at a global level may be affected by conflicts, which in turn can affect the ability of companies to operate at the local level. Therefore, it is also economically justified to take into account the media, the Sámi, the Sámi and environmental organizations and to contact them at an early stage together with other stakeholders. However, this does not necessarily eliminate the possibility of resistance, but the attitude of stakeholders towards the actor may still be more constructive than in the absence of direct contact and dialogue. (Eerola & Sofia, 2013).

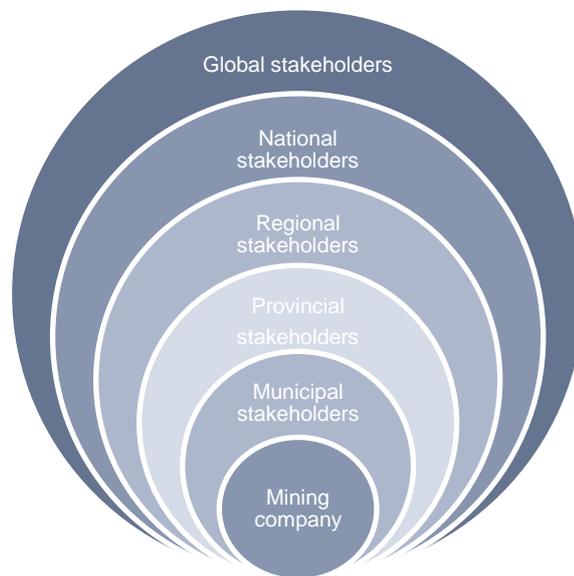


Figure 5. Stakeholders acting levels compared to mining company (Source: adjusted according to (Jussila, 2010))

Active interaction with stakeholders started as early as possible increases the confidence towards the mine and helps to avoid conflicts. It also promotes business risk management by understanding the local community better, identifying and preparing for potential pain points and promotes the planning of activities together with the surrounding community. Active interaction enables consideration of community concerns from the early stages of planning. (Kestävän kaivostoiminnan verkosto, 2017).

3 SUSTAINABILITY INITIATIVES USED IN MINING SECTOR

When mining industry recognized the need for image change in 1998, nine of the largest mining companies CEOs implemented the Global Mining Initiative (GMI) (Filer, 2002). The aim of the initiative was to improve mining industry's role in the transition to sustainable development (Filer, 2002). The GMI also decided to commission the International Institute for Environment and Development (IIED) to perform a study how mining industry could increase its economic, environmental and social sustainability (Filer, 2002). The study resulted to more detailed investigation led by the World Business Council for Sustainable Development (WBCSD) that became known as the MMSD project (Mining, Minerals and Sustainable Development project) (Filer, 2002). During the 2001 and 2002 the MMSD project convened 22 workshops on a range of global issues and produced total of 221 reports concerning the mining and minerals sector (Filer, 2002). IIED performed a follow-up review in 2012 for the mining sector and its activities, and it stated that mining and minerals industry has made major improvement towards sustainability but still same time it was not clearly ensured how industry can contribute towards sustainable development (International Institute for Environment and Development, 2009).

Sustainability initiatives are different and some of them are just commitments and some more comprehensive reporting and communication standards and tools (Kickler & Franken, 2017). On average, the Nordic mining companies follows seven sustainability initiatives in their operations (Ruokonen, 2020). Ranängen and Lindman (2017) examined which sustainability initiatives the mining companies operating in Nordic countries are following. According to their 2016 study, all mining companies operating in Finland (five in total) followed Global Reporting Initiative (GRI) reporting standards (Ranängen & Lindman, 2017). The next most widely used initiative was International Organization for Standardization (ISO) 14001 standard for environmental management, which four companies out of five were following (Ranängen & Lindman, 2017). GRI separate Mining and Metals Sector Supplement, Occupational Health and Safety Assessment OHSAS 18001 (nowadays ISO 45001) and ISO 9001 standard for quality management were using three mining companies of each (Ranängen & Lindman, 2017). In addition to these all, The UN Global Compact, ISO 26000 for social responsibility and ISO 50001 for energy management were using two mining companies of each (Ranängen & Lindman, 2017). Following sections presents

shortly the content of these most widely used sustainability initiatives in Finland among the metal mining companies. (Ranängen & Lindman, 2017).

3.1 ICMM Sustainable Development Framework (SDF)

The International Council on Mining and Metals (ICMM) was founded on 2001 and it has taken the responsibility to follow-up the activities identified in MMSD. With the sustainability reporting and commitments on sustainable development, the ICMM strives to ensure society's trust and respect, so-called 'social license to operate'. ICMM is a CEO-led organization which consist of 23 different global mining and metals companies and 34 associations. The organization's aim is to strengthen the mining industry's social license to operate. (Kickler & Franken, 2017).

Members of the ICMM commits to the organization's Sustainable Development Framework (SDF). The SDF requires its company members to commit to the ICMM 10 Principles and six Position Statements that fill the principles with more detailed information (Figure 6). ICMM members committed to GRI reporting in 2005 and the whole ICMM organization in 2008 since the GRI launched its Mining and Metals Sector Supplement in 2004. The ICMM has generated 10 principles that complement the UN's global development agenda and SDGs.

ICMM principle 1 is for ethical business and sound governance and it includes five requirements which defines the expectations towards mining companies in this topic (Figure 6). Companies are expected to establish systems for legal compliance in order to show their stakeholders the systematic approach in obeying law and requirements in local level. Companies are expected also to prevent bribery and corruption through policies and practices, and implement policies and standards that are consistent with the ICMM policy framework. Companies needs to assign accountability for sustainability performance at the Board and/or Executive Committee level. Companies are also expected to disclose financial contributions directly or through an intermediary. (ICMM, 2020).

1. Ethical business	<ul style="list-style-type: none"> • 1.1 Legal compliance • 1.2 Prevent bribery and corruption • 1.3 Adherence to ICMM policies • 1.4 Accountability • 1.5 Disclose financial contributions
2. Sustainable development in decision-making	<ul style="list-style-type: none"> • 2.1 Sustainability in decision-making • 2.2 Responsible business partners
3. Respect for human rights	<ul style="list-style-type: none"> • 3.1 Respect human rights • 3.2 Avoid involuntary relocation • 3.3 Manage security while protecting human rights • 3.4 Respect the rights of workers • 3.5 Fair pay and working conditions • 3.6 Respect Indigenous Peoples • 3.7 Work to obtain free, prior and informed consent • 3.8 Promote workplace diversity
4. Effective risk management	<ul style="list-style-type: none"> • 4.1 Environmental and social impact assessment • 4.2 Operating in conflict-affected or high-risk areas • 4.3 Management of health, safety and environmental risks • 4.4 Emergency response planning
5. Health & safety performance	<ul style="list-style-type: none"> • 5.1 Continually improve health and safety • 5.2 Health and safety training
6. Environmental performance	<ul style="list-style-type: none"> • 6.1 Plan for closure • 6.2 Water stewardship • 6.3 Manage tailings • 6.4 Prevent pollution and related impacts • 6.5 Reduce GHG emissions
7. Conservation of biodiversity & land-use planning	<ul style="list-style-type: none"> • 7.1 Protect World Heritage Sites and legally designated areas • 7.2 Protect biodiversity
8. Responsible use & supply of materials	<ul style="list-style-type: none"> • 8.1 Reduce waste • 8.2 Manage hazardous materials
9. Social contribution	<ul style="list-style-type: none"> • 9.1 Development of local communities • 9.2 Local economic opportunities • 9.3 Local Stakeholder engagement • 9.4 Artisanal mining
10. Engagement & transparent reporting	<ul style="list-style-type: none"> • 10.1 Transparency in stakeholder engagement • 10.2 Payments to governments • 10.3 Annual reporting • 10.4 Assurance and validation

Figure 6. ICMM 10 principles

Second ICMM principle requires companies to integrate sustainability into corporate strategy and decision-making processes relating to investments and in the design, operation and closure of the mine sites. Also companies should support responsible suppliers, contractors and joint venture partners based on the risk. (ICMM, 2020).

Third principle concerning the human rights is the most extensive one in ICMM principles. It expects that companies develop policy commitment to respect human rights, undertake human right due diligence and if unfavourable human rights impact occur, members are ex-

pected to provide or cooperate the processes that enables the remediation of cause. Companies must avoid involuntary resettlement due to mining operation and if this is not possible, companies should apply the mitigation hierarchy and improve the living standards of those who have been displaced. Companies must manage security while they are protecting human rights, respect the right of their workers and provide fair pay and working hours. Third principle includes also the requirement that companies respects the indigenous people and promotes workplace diversity. (ICMM, 2020).

Effective risk management principle expects company members to assess their environmental and social risks when starting a new projects or when existing project has a significant change and systematically manage these risks. When companies are sourcing from or operating in high risk areas, they are expected to undertake risk-based due diligence according to the OECD Due Diligence Guidance. Health and safety performance principle requires continuous improvement in health and safety issues as well as management of health and safety according to the recognized international standard or management system. Companies are also expected to provide health and safety training for workers in accordance to the workers responsibilities. (ICMM, 2020).

Principle 6 for environmental performance includes requirement to plan and design closure of the mine site in cooperation with the relevant authorities and other stakeholders, implement water stewardship practices and effectively manage tailings. Sites that have tailings facilities with the “Extreme” or “Very high” potential consequences must also be in accordance with the Global Industry Standard on Tailings Management (GISTM) by 6th of August in 2023 and other sites by 6th of August 2025. Companies must prevent pollution and manage releases and waste and apply mitigation hierarchy, as well as implement measures to increase energy efficiency and contribution to a low-carbon future. (ICMM, 2020).

Performance expectations for conservation of biodiversity includes avoidance of world heritage sites and respect of legally designated protected areas when developing new mines or when practicing exploration. Companies must also assess and address risks and impacts to biodiversity and ecosystem by practicing the mitigation hierarchy, and aiming to achieve no net loss of biodiversity overall. Responsible production principle (principle 8) expects company members to recover, re-use and recycle of materials, natural resources and energy as

well as assess the hazards of the products of mining according to the UN Globally Harmonized System of Hazard Classification. Social contribution principle (principle 9) demands companies to contribute to surrounding community development, support local economic opportunities, and conduct local stakeholder engagement and to practice cooperation with government regarding artisanal and small-scale mining improvement in environmental and social practices. Stakeholder engagement principle expects companies to engage corporate stakeholders transparently, publicly support the implementation of the Extractive Industries Transparency Initiative (EITI), report annually according to the GRI and conduct assurance and validation on ICMM guidance. (ICMM, 2020).

3.2 Global Industry Standard on Tailings Management (GISTM)

The Global Industry Standards on Tailings Management (GISTM) was published on August 2020 as a consequence of January 25th 2019 a tailings storage dam failure in Brumadinho, Brazil. This environmental catastrophe raised globally the question can mining industry manage their tailing facilities in order to protect local communities, workers and environment. After the incident, the ICMM started an independent, multi-stakeholder work came up with the new Global Industry Standard on Tailings Management. Purpose of the new standard is to set a strong, global benchmark to achieve strong environmental, social and technical outcomes in tailings management, with a strong emphasis on disclosure and accountability. The implementation of new standard is starting from August 2020 into existing ICMM membership commitments. Standard classifies tailings facilities to five different consequence classes with consequence classification matrix. Consequence classifications are low, significant, high, very high and extreme. Classification takes account dam failure consequences regarding the potential population at risk, potential loss of life as well as environmental, health, social, cultural, infrastructure and economics losses due to possible failure. Mine sites that have 'Extreme' or 'Very high' potential consequences of tailings incidents will comply with the standard within three years so in August 2023. Other sites will be in compliance in August 2025. The ICMM work group will also publish a guidance that helps mining companies implement this new standard. The standard will apply to approximately 1200 tailings dams around the world, which are operated through ICMM member companies. ICMM

members presents the one third of the global mining industry. Standard includes 15 principles that are more detailed described with the multiple requirements (Figure 7). (Global Tailings Review, 2020).

PRINCIPLE 1. Respect the rights of project-affected people and meaningfully engage them at all phases of the tailings facility lifecycle, including closure

PRINCIPLE 2. Develop and maintain an interdisciplinary knowledge base to support safe tailings management throughout the tailings facility lifecycle, including closure

PRINCIPLE 3. Use all elements of the knowledge base - social, environmental, local economic and technical - to inform decisions throughout the tailings facility lifecycle, including closure

PRINCIPLE 4. Develop plans and design criteria for the tailings facility to minimise risk for all phases of its lifecycle, including closure and post-closure

PRINCIPLE 5. Develop a robust design that integrates the knowledge base and minimises the risk of failure to people and the environment for all phases of the tailings facility lifecycle, including closure and post-closure.

PRINCIPLE 6. Plan, build and operate the tailings facility to manage risk at all phases of the tailings facility lifecycle, including closure and post-closure

PRINCIPLE 7. Design, implement and operate monitoring systems to manage risk at all phases of the tailings facility lifecycle, including closure

PRINCIPLE 8. Establish policies, systems and accountabilities to support the safe and integrity of the tailings facility

PRINCIPLE 9. Appoint and empower an engineer of record

PRINCIPLE 10. Establish and implement levels of review as part of a strong quality and risk management system for all phases of the tailings facility lifecycle, including closure

PRINCIPLE 11. Develop an organisational culture that promotes learning, communication and early problem recognition

PRINCIPLE 12. Establish a process for reporting and addressing concerns and implement whistleblower protections

PRINCIPLE 13. Prepare for emergency response to tailings facility failures

PRINCIPLE 14. Prepare for long-term recovery in the event of catastrophic failure

PRINCIPLE 15. Publicly disclose and provide access to information about the tailings facility to support public accountability

Figure 7. The Global Industry Standards on Tailing Management (GISTM) principles

The Global Industry Standard on Tailings Management (GISTM) consist 15 principles and under each principle, there are two to eight requirements (Figure 7). Principle 1 consists four requirements regarding the affected communities. It states that companies needs to respect human rights in accordance with the United Nations Guiding Principles on Business and Human Rights (UNGP) (requirement 1.1). Companies also need to conduct human rights due diligence in order to inform management decisions throughout the tailings facility lifecycle. Risks to human rights concerning the tailings facility failure scenarios needs to be addressed. Conformance according to the Free Prior and Informed Consent (FPIC) framework needs to be obtained and maintained in new tailings facility areas, which may influence to the rights of indigenous or tribal peoples (requirement 1.2). Requirement 1.3 states that companies needs to demonstrate that people, who are affected of the project, are engaged throughout the tailings facility lifecycle in decisions and in building the knowledge base. Companies needs to establish an effective facility-level grievance mechanism for project-affected people relating to the tailings facility (requirement 1.4). (Global Tailings Review, 2020).

Tailings Standard principle 2 and 3 are for integrated knowledge base. Principle 2 includes four requirements that concerns tailings facility knowledge base. Social, environmental and local economic knowledge of tailings facility needs to be documented and developed in the companies according to the international best practices (requirement 2.1). This knowledge base needs to be updated at least every five years and it should include uncertainties due to the climate change. Requirement 2.2 demands companies to prepare, update and document a detailed site characterization of tailings facility sites. This site characterization should include data on geology, geomorphology, geochemistry, geotechnical, climate, hydrogeology and hydrology (quality and flow of surface and groundwater) and seismicity. Tailings chemical and physical properties shall be characterized and updated regularly due to variability in ore processing and properties. Companies needs to document and develop a tailings facilities breach analysis with methodologies that takes account credible failures modes, site conditions and the properties of the slurry (requirement 2.3). Breach analysis results should include the estimate of the area where potential dam failure affects. If tailings facility is clas-

sified with Consequence Classification of ‘High’, ‘Very High’ or ‘Extreme’, the breach analysis results should also include estimate of flow arrival time, depth and velocities and depth of material deposition. (Global Tailings Review, 2020).

Principle 3 requires companies to regularly update and use climate change knowledge in the tailings facility lifecycle (requirement 3.1) and that new tailings facilities undertake a multi-criteria alternative analysis of all feasible site (requirement 3.2). This analysis needs to be reviewed by the Independent Tailings Review Board (ITRB) or a senior independent technical reviewer. In addition, for new tailings facilities the social, environmental and local economic impacts needs to be assessed for tailings facility whole lifecycle as well as potential failure of the facility (requirement 3.3). (Global Tailings Review, 2020).

Principles from 4 to 7 concerns tailings facilities design, construction, operation and monitoring. According to the principle 4 tailings facility consequence class needs to be determined (requirement 4.1), tailings facility preliminary designs needs to be consistent with both the current selected consequence class and with the higher consequence classification (requirement 4.2). According to the requirement 5.3, the tailings facilities needs to have a water management program, which is also designed to protect against unintentional releases. Potential failure mode risks needs to be addressed for the structure, its foundations, abutments and reservoir to minimize risk to as low as reasonable possible. Requirement 5.6 demands that tailings facility closure phase is designed so that it takes account all the requirements of the GISTM and includes progressive closure and reclamation during operations. Tailings facility operator must manage the quality and adequacy of the operation process and construction by implementing the quality control and assurance (QC/QA) and construction vs. design intent verification (CDIV) (requirement 6.2). In addition, detailed construction records report, ‘as-built’ report shall be prepared (requirement 6.3). Requirement 6.4 demands that tailings facilities Operations, Maintenance and Surveillance (OMS) Manual should follow best practices and be annually developed and reviewed as well as trained to all personnel on site who are involved with the tailings management. Principle 7 concerns the design, implementation and operation of tailings facility monitoring systems. (Global Tailings Review, 2020).

Principles 8 to 12 handles the tailings facilities management and governance topics. Principle 8 requires tailings facility operator to establish policies, systems and accountabilities to support the integrity and safety of the tailings facility. According to the requirement 8.5, all sites must appoint a site-specific Responsible Tailings Facility Engineer (RTFE) who is accountable for the integrity of the tailings facility. Also, according to the requirement 8.6, qualifications and experience requirements for all safety-critical roles in the operation of a tailings facility needs to be identified. Principle 9 handles the appointment and empower of an engineer of record (EOR). Engineer of record is an engineering firm with expertise and experience in the design and construction of tailings facilities. EOR can be also appointed an in-house engineer with the relevant expertise and experience. EOR authority, role and responsibilities needs to be clearly written in an agreement (requirement 9.2). If the EOR needs to be changed during the operation, there must be a plan how data, information, knowledge and experience is transferred (requirement 9.5). Requirement 10.1 sets the demand to conduct multi-disciplinary team risk assessment at least every three years and that ITRB or senior independent technical reviewer must review the assessment results. Companies needs to perform internal audits in order to verify consistent implementation of company procedures, guidelines and corporate governance requirements (requirement 10.3). Principle 11 highlights development of an organizational culture that promotes learning, communication and early problem recognition. Principle 12 requires companies to establish a process for reporting and addressing concerns and implement whistleblower protections. (Global Tailings Review, 2020).

Principles 13 includes four requirements and principle 14 five requirements concerning the emergency response and long-term recovery. Companies needs to use best practices and emergency response expertise to prepare and implement a site-specific tailings facility Emergency Preparedness and Response Plan (EPRP) (requirement 13.1). Project-affected people need to be also engaged to develop community-focused emergency preparedness measures. Principle 14 requires tailings facility operator to prepare for long-term recovery in the event of catastrophic failure. Principle 15 handles public disclosure and access to information via three requirements. Requirement 15.1 lists the documentation for new and existing tailings facilities that operator must update at least on annual basis and what information this documentation shall include. (Global Tailings Review, 2020).

3.3 Global Reporting Initiative (GRI)

The first version of the Global Reporting Initiative (GRI) Guidelines was published in 2000 by an independent organization GRI and it was the first worldwide framework for sustainability reporting. GRI organization was formed in 1997 by the US non-profit organizations Coalition for Environmentally Responsible Economies (CERES), the Tellus Institute, with support from The United Nations Environment Programme (UNEP). It has been used more than 90 countries and thousands of organizations to report publicly about their impacts on the economy, the environment and the society. In 2004, the GRI G3 guidelines were updated with the mining-specific indicators when the GRI-ICMM working group published GRI Mining and Metals Sector Supplement 7. In 2016, the GRI Guidelines content were restructured into a set of modular interrelated standards. The main objective is to support companies, governments, NGOs and other organizations to understand, measure and communicate the critical impact of their business on sustainability issues through regular reporting. Total of 93 % of the world's largest 250 corporation from various industries report on their sustainability performance and 82% of these use GRI's Standards for the reporting. (Kickler & Franken, 2017).

In the GRI, there are three universal standards for used by all the organizations that makes sustainability reporting (Table 2). Also there are three series of topic-specific standards which cover economic, environmental and social impacts (Table 3). The GRI 101 Foundation standard is the starting point for using the standard by explaining how to use the standards and how to reference the set of standards. It also introduces the 10 reporting principles and explains how to prepare a report that is in the accordance with the standards. By applying the materiality principle from GRI 101 standard, organizations can identify their own material topics those with the most significant impacts and influence with stakeholders. The focus on the materiality helps organizations report the impacts that matter the most. Based on the material topics, organizations select the topic specific standards that are relevant for them. Also the other two Universal Standards, GRI 102 for General Disclosures and GRI 103 for Management Approach are applied by every organization. GRI 102 General Disclosures is for reporting contextual information about your organization and its reporting practices. GRI 103 Management Approach is used for report how organizations manage their material topics. (Global Reporting Initiative, 2020).

Table 2. GRI Universal Standards

Universal Standards		
GRI 101 Foundation <i>"Starting point for using the GRI Standards"</i>	GRI 102 General Disclosures <i>"To report contextual information about an organization"</i>	GRI 103 Management Approach <i>"To report the management approach for each material topic"</i>

The benefits of GRI Standards are that it is easy to adopt for different type of organizations as organizations can identify the most important materials topics to their own business. GRI Standards are also well known and widely spread. Criticism that GRI has faced is that mining companies GRI reports are not easy to compare (Ruokonen, 2020).

Table 3. GRI Topic-specific Standards

Topic-specific Standards		
GRI 200 Economic <ul style="list-style-type: none"> •201: Economic Performance •202: Market Presence •203: Indirect Economic Impacts •204: Procurement Practices •205: Anti-corruption •206: Anti-competitive Behavior •207: Tax 	GRI 300 Environmental <ul style="list-style-type: none"> •301: Materials •302: Energy •303: Water and Effluents •304: Biodiversity •305: Emissions •306: Waste •307: Environmental Compliance •308: Supplier Environmental Assessment 	GRI 400 Social <ul style="list-style-type: none"> •401: Employment •402: Labor/Management Relations •403: Occupational Health and Safety •404: Training and Education •405: Diversity and Equal Opportunity •406: Non-discrimination •407: Freedom of Association and Collective Bargaining •408: Child Labor •409: Forced or Compulsor Labor •410: Security Practices •411: Rights of Indigenous Peoples •412: Human Rights Assessment •413: Local Communities •414: Supplier Social Assessment •415: Public Policy •416: Customer Health and Safety •417: Marketing and Labeling •418: Customer Privacy •419: Socioeconomic Compliance

3.4 GRI Mining and Metals Supplement

The GRI Mining and Metals Sector Supplement is a version of GRI's G3 Guidelines, which is modified especially for mining and metals sector. The ICMM and GRI developed the supplement 2003 with assistance a multi-stakeholder work group in order to improve sectors sustainability reporting so that it would cover effectively the sector's key sustainability issues. Mining and Metals sector supplement includes comments and additional performance indicators for the mining sector. (GRI, 2010). GRI Mining and Metals sector supplement brings 11 additional indicators to GRI reporting which are presented in Table 4. (GRI, 2010).

Table 4. Mining and Metals sector supplement additional indicators to GRI

Aspect	Indicator
Biodiversity	MM1 = Amount of land (owned or leased, and managed for production activities or extractive use) disturbed or rehabilitated
	MM2 = The number and percentage of total sites identified as requiring biodiversity management plans according to stated criteria, and the number (percentage) of those sites with plans in place.
Emissions, Effluents and Waste	MM3 = Total amounts of overburden, rock, tailings, and sludges and their associated risks.
Labor / Management Relations	MM4 = Number of strikes and lock-outs exceeding one week's duration by country.
Freedom of Association and Collective Bargaining	MM5 = Total number of operations taking place in or adjacent to Indigenous Peoples' territories and number and percentage of operations or sites where there are formal agreements with Indigenous Peoples' communities.
Community	MM6 = Number and description of significant disputes relating to land use, customary rights of local communities and Indigenous Peoples.
	MM7 = The extent to which grievance mechanisms were used to resolve disputes relating to land use, customary rights of local communities and Indigenous Peoples, and the outcomes.
Artisanal and Small-scale Mining	MM8 = Number (and percentage) of company operating sites where artisanal and small-scale mining (ASM) takes place on, or adjacent to, site site; the associated risks and the actions taken to manage and mitigate these risks.
Resettlement	MM9 = Sites where resettlement took place, the number of households resettled in each, and how their livelihoods were affected in the process.
Closure Planning	MM10 = Number and percentage of operations with closure plans.
Material Stewardship	MM11 = Programs and progress relating to materials stewardship

3.5 The UN Global Compact

The UN Global Compact is a corporate responsibility initiative, a global framework and a value base for corporate responsibility, which is launched by the UN in 2000. It promotes and develops the ecological, social and economic responsibility of each community, utilizing the UN Sustainable Development Initiative as well as the ten principles of the Global Compact. With the Global Compact's commitment, organizations and companies show their will to be part of the international cooperation that strengthens the responsibility and sustainability. This commitment is physically given to the UN Secretary as the whole Global Compact initiative was originally origin from the UN Secretary. Global Compact is not a standard or criteria against which companies' performance is assessed. Instead is more like a value framework as well as learning and cooperation network. The Global Compact is based on the transparency and annually companies that are committed to the initiative are required to report their progress towards these principles and give an update that they are still willing to improve their operation towards these goals. (UN Global Compactin kymmenen periaatetta -koulutus, 2020).

UN Sustainable Development Initiative includes a goals and agenda to guide global development efforts up to 2030. It has been agreed by the UN member states in New York 2015 and these goals entered into force at the beginning of the 2016. These goals are universal so they bind both, poor as well as rich countries. The Agenda for Sustainable Development ('Agenda2030') aims to end extreme poverty and to sustainable development, that takes into account the environment, the economy and the people on an equal footprint. The core principle of the program is that no one is left behind from the development. There are total of 17 universal sustainable development goals and a total of 169 sub-goals for these. The aim of the goals is that global development takes account human well-being, human rights, economic prosperity and the stability of societies are secured in an environmentally sustainable way. UN has also compiled a set of 243 different indicators, in order to follow the progress of these goals. More than 11 000 companies and 3 000 other actors from all industries and in total of 156 countries has committed to the UN Global Compact. (Suomen YK-liitto, 2017). (Global Compact Suomi, 2020). The UN Global Compact is based on ten principles relating to human rights, working life, the environment and anti-corruption, to which all Global Compact companies must commit.

Human Rights	<ul style="list-style-type: none"> • Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights • Principle 2: make sure that they are not complicit in human rights abuses
Labour	<ul style="list-style-type: none"> • Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining; • Principle 4: the elimination of all forms of forced and compulsory labour • Principle 5: the effective abolition of child labour • Principle 6: the elimination of discrimination in respect of employment and occupation
Environment	<ul style="list-style-type: none"> • Principle 7: Businesses should support a precautionary approach to environmental challenges • Principle 8: undertake initiatives to promote greater environmental responsibility • Principle 9: encourage the development and diffusion of environmentally friendly technologies
Anti-Corruption	<ul style="list-style-type: none"> • Principle 10: Businesses should work against all forms of corruption, including extortion and bribery.

Figure 8. UN Global Compact ten principles

3.6 The UN Sustainable Development Goals (SDGs)

All United Nations Member States adopted the UN Sustainable Development Goals (SDGs) in 2015. It consist total of 17 different goals that are part of UN Nations Member States decision called “The 2030 Agenda” and includes 169 different targets to achieve towards these goals. The aim of goals are to call all member nations and companies to take a part of actions to end poverty, protect the planet and fighting inequalities while ensuring that no one is left behind from the development. The objective of the goals is to create understanding that we are all working together towards these goals. (United Nations, 2020).

All Sustainable Development Goals are presented in Figure 9. Goals 1, 5, 8, 9 and 10 are linked to economic impacts, goals 2, 3 and 4 to social impacts and goals 6, 7, 11, 12, 14 and 15 to environmental impacts. (Esposito, 2018).



Figure 9. Sustainable Development Goals (SDGs)

Metals and minerals are important part in order to reach the United Nations' Sustainable Development Goals (SDGs). International Council on Mining & Metals (ICMM) has recognized the need of metals and minerals in order to tackle the UN's Sustainable Development goals 2,3, 6 and 7. For example sustainable development goal 2 (SDG2) sets out to end hunger, achieve food security, improve nutrition and promote sustainable agriculture. Sustainable farming is needed because global population grows, and at the same time usable agricultural land area is diminishing. Farming is also vulnerable to climate change and usable farming area is continuously decreasing due to the urbanization, erosion and pollution. So to say, more food is needed to produce with fewer resources in the coming years in order to achieve SDG2. Sustainable farming includes precision farming, variable rate controls, GPS technology, remote sensing and mineral fertilization. All of these requires new specialized machinery, tech-driven solutions, satellites, sensors, computers and drones needs variety of different metals.

3.7 Carbon Disclosure Project (CDP)

Carbon emissions is one of the main environmental aspects of mining industry as mining consumes a significant amount of fuels. Companies report their greenhouse gas emissions (GHGs) through different channels and Carbon Disclosure Project (CDP) is one of the widely used standards for reporting carbon emissions and other vital environmental information. The CDP was founded in 2000 by the group of institutional investors who were interested in incorporating information on businesses' carbon emissions into their analyses and assessments. Carbon data according to the CDP standard is collected annually through a questionnaire that is sent to the world's largest listed firms. The CDP offers information for global markets about climate change and the online database managed by the CDP is the world's largest for the greenhouse gas register. In 2016, 92 % of Fortune 500 companies who followed the CDP used the GHG Protocol to calculate their greenhouse gas emissions. (CDP Worldwide, 2020).

3.8 IFC Environmental and Social Performance Standard

International Finance Corporation (IFC) is a member and a sister organization of the World Bank Group established in 1956 (IFC, 2020). IFC concentrates on the private sector investment in developing countries and it is the largest global development institution owned by its 185 member countries (IFC, 2020). The IFC Environmental and Social Performance Standards were developed in 2006 for project owners that are financed by IFC in order to minimize and manage risks (Figure 10). IFC's first performance standard concerns the assessment and management of environmental and social risks and impacts. Performance standard 2 is for labor and working conditions and standard 3 for resource efficiency and pollution prevention. Community health, safety and security is covered in performance standard 4 and land acquisition and involuntary resettlement in standard 5. IFC performance standard 6 handles biodiversity conservation and sustainable management of living natural resources. Performance standard 7 concerns indigenous people and standard 8 cultural heritage.



Figure 10. Content of IFC Environmental and Social Performance Standards

3.9 IRMA Standard for Responsible Mining

Multi-stakeholder group that consisted of NGO's, trade unions, communities, mining companies and other businesses that purchase minerals and metals as they raw material, founded the Initiative for Responsible Mining Assurance (IRMA) in 2006. IRMA standard defines leading performance requirements and determines objectives for socially, and environmentally practice. IRMA was developed in order to gain value for mining companies for proven responsible performance and for purchasers of metals and minerals in order to source raw materials from mines that meet a full array of leading practices in environmental and social responsibility. It is also tool for workers, civil society organizations and surrounding communities to express their social license. (Responsible Mining, 2018).

Development of IRMA standard has included several different phases. The first phase was called "Launch Phase" and it included version 1 of the IRMA Standards for Responsible Mining that was published in June 2018. Purpose of the launch phase was to gain comments

and identify gaps, engage stakeholders as well as clarify any conflicts that standard may arise during its implementation. Launch phase included on-line self-assessment tool for mining companies and independently verified scoring of mine site performance. For launch phase it was also developed IRMA online Responsible Mining Map, where mine sites as well as other stakeholders can express their interest towards responsible mining. Through map, companies who are performed the self-assessment, can share their results. Purpose of the map is also that investors and purchasers of raw materials can use the map to identify mines with a commitment to responsible mining activities. All the data collected in launch phase will be used for developing version 2 of the IRMA standard to be even more useful tool for the mining companies. Launch phase was closed in the end of June 2019 and version 2 of the Standard for Responsible Mining will be available soon. (Responsible Mining, 2018).

Pinciple 1: Business Integrity	Principle 2: Planning and Managing for Positive Legacies	Principle 3: Social Responsibility	Principle 4: Environmental Responsibility
<ul style="list-style-type: none"> • 1.1 - Legal Compliance • 1.2 - Community and Stakeholder Engagement • 1.3 - Human Rights Due Diligence • 1.4 - Complaints and Grievance Mechanism and Access to Remedy • 1.5 - Revenue and Payments Transparency 	<ul style="list-style-type: none"> • 2.1 - Environmental and Social Impact Assessment and Management • 2.2 - Free, Prior and Informed Consent (FPIC) • 2.3 - Obtaining Community Support and Delivering Benefits • 2.4 - Resettlement • 2.5 - Emergency Preparedness and Response • 2.6 - Planning and Financing Reclamation and Closure 	<ul style="list-style-type: none"> • 3.1 - Fair Labor and Terms of Work • 3.2 - Occupational Health and Safety • 3.3 - Community Health and Safety • 3.4 - mining and Conflict-Affected or High-Risk Areas • 3.5 - Security Arrangements • 3.6 - Artisanal and Small-Scale Mining • 3.7 - Cultural Heritage 	<ul style="list-style-type: none"> • 4.1 - Waste and Materials Management • 4.2 - Water Management • 4.3 - Air Quality • 4.4 - Noise and Vibration • 4.5 - Greenhouse Gas Emission • 4.6 - Biodiversity, Ecosystem Services and Protected Areas • 4.7 - Cyanide • 4.8 - Mercury Management

Figure 11. Content of IRMA standard

IRMA standard consist four separate principles that are business integrity, planning and managing for positive legacies, social responsibility and environmental responsibility (Figure 11).

3.10 MAC Towards Sustainable Mining (TSM)

The Mining Association of Canada (MAC) published the Towards Sustainable Mining (TSM) initiative in 2004 and it became mandatory to all MAC member companies (Canada, 2017). TSM is a commitment that the Mining Association of Canada (MAC) has made towards responsible mining practices. Objective of the MAC TSM is to ensure mining companies operation in the most responsible possible way social, economic and environmental point of view (Canada, 2017). Initiative includes several different type of sustainability tools and indicators which performance is measured mainly at the site level (Canada, 2017). The MAC TSM is built on transparency so results are reported to the stakeholders publicly and regularly externally verified (Canada, 2017). Whole MAC TSM programme is built so that it encourages companies to improve their sustainability management issues as results are comparable to each other through easily understandable ratings (Canada, 2017). MAC's TSM tool helps to improve companies' management practices above the legal requirements in Canada (Kickler & Franken, 2017).

Five other countries - Finland, Argentina, Botswana, the Philippines and Spain have also implemented the TSM programme with the MAC's support, Finland being the first one (Government of Canada, 2019). MAC TSM programme requires other countries to include certain elements to their country specific as well, like establishing a "community of interest advisory panel" but otherwise countries can modify the standard content to be more suitable for local context (Government of Canada, 2019). The Canadian TSM Standards has been criticized for its narrow coverage of sustainability issues regarding the social and business practices. (Ruokonen, 2020). The MAC's TSM consist of eight standards protocols that are: aboriginal and community outreach, biodiversity conservation management, tailings management, water stewardship, energy use and GHG emissions management, crisis management and communications planning, safety and health and preventing child and forced labour (Figure 12).

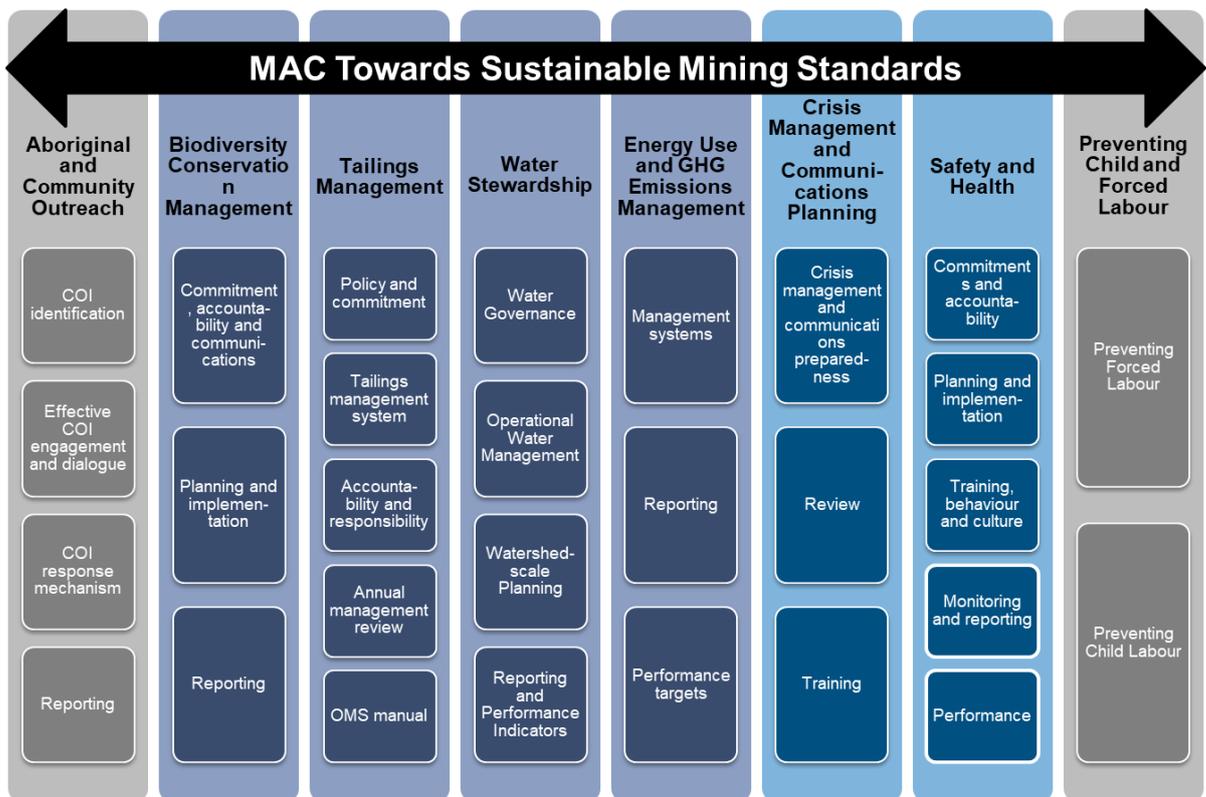


Figure 12. MAC's Towards Sustainable Mining Standards

MAC's Towards Sustainable Mining system consists eight different management standards that are:

- aboriginal and community outreach,
- biodiversity conservation management,
- tailings management,
- water stewardship,
- energy use and GHG emissions management,
- crisis management and communications planning,
- safety and health and
- preventing child and forced labour.

Each standard contains two to five performance indicators that each is evaluated separately.

3.11 Use of the initiatives

The amount of voluntary sustainability initiatives in mining sector starts to be high and it may be find easily confusing to understand the need for all. Initiatives are applied in different operational levels (company level / site level), which means that the information-receiving stakeholders varies. Figure 13 present the previously in chapters 3.1-3.10 examined the most used sustainability initiatives among the mining companies operating in Northern Finland. Each initiative has also a specific objective, for example, some of the initiatives are more aspirational and some give guidance for example sustainability reporting issues. It can be seen that during the last ten years sustainability initiatives that measure actual sustainability performance level has started to rise and develop. Investors, civil society organizations or downstream companies pressure often drives the development of sustainability initiatives. This also creates the variety of different standards, tools and frameworks.

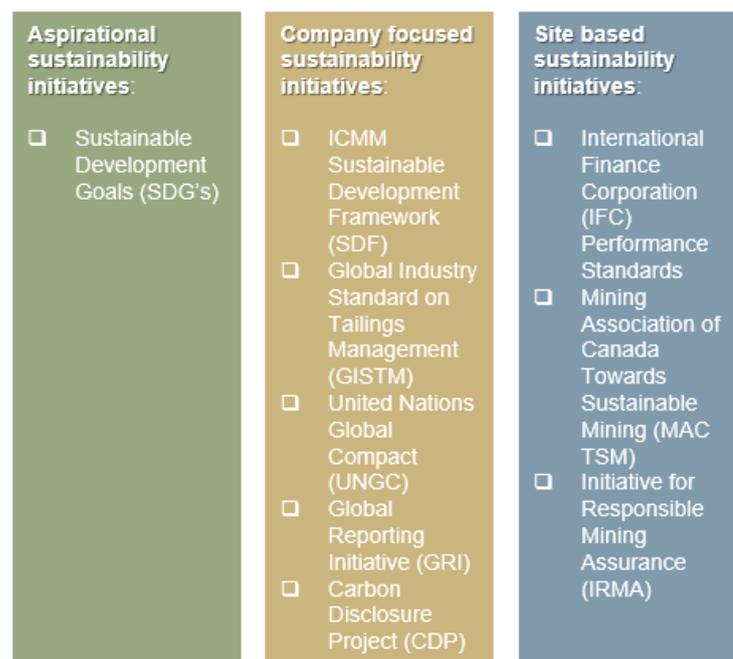


Figure 13. Sustainability Initiatives by objective (Source: adjusted according to (The World Economic Forum (WEF), 2015)

In Northern Finland, where many multinational mining companies are currently operating, is real need for site based sustainability initiative. Initiative that is available in local language and the performance is reported on local language, provides the most useful information to

local site level stakeholders. Only Finnish language sustainability initiative for mining companies is Finnish TSM (Towards Sustainable Mining) –standard, which mining companies have begun to implement.

4 SUSTAINABLE MINING DEVELOPMENT IN FINLAND

The mining industry in Finland and its stakeholders started to discuss about future of Finnish mine industry and its sustainability topics on fall 2012 in so-called round table meetings. A common aspiration that Finland must be a pioneer in sustainable mining industry was found and building of the action plan to lift Finland to this desired state was started. On April 2013 Ministry of Economic Affairs and Employment of Finland published ‘Action Plan for Development of Sustainable Extractive Industries’ which included 35 actions towards sustainable mining industry development. One of the actions was that companies in mining industry need to implement a corporate social responsibility program and appropriate indicators for it as well as reporting and monitoring of the system need to be developed. (Ministry of Economic Affairs and Employment of Finland, 2013).

The Finnish Network of Sustainable Mining was established in May 2014. The purpose of the network was to act as a platform for open stakeholder discussions and to develop practical tools to improve the sustainability of mining and ore exploration in Finland. The Finnish innovation Fund (Sitra) was in charge for building the network and leading the operation of the network for first one and a half year. After working under the lead of Sitra, the network became independent in August 2015. Since then the network has been working under the Finnish Mining Industry (FinnMin) and has published yearly CSR report, a sustainability toolbox for new companies and Finnish TSM standard. (The Finnish Network for Sustainable Mining, 2016).

Finnish Towards Sustainable Mining cooperation commitments has been signed by

- Finnish Mining Association,
- Finnish Industry Association,
- Finnish Industry Investment Ltd,
- Association of Finnish Municipalities,
- Regional Council of Lapland,
- The Central Union of Agricultural Producers and Forest Owners (MTK),
- Metsähallitus,
- Reindeer Herder’s Association,
- The Finnish Association for Nature Conservation (FANC),

- WWF,
- Metal Processors Association and
- Sitra.

Reindeer Herder's Association, Metsähallitus, WWF, MTK, FANC, Finnish Industry Association, Association of Finnish Municipalities and Finnish Mining Association are the member of Sustainable Mining Network. (Kestävän kaivostoiminnan verkosto, 2017).

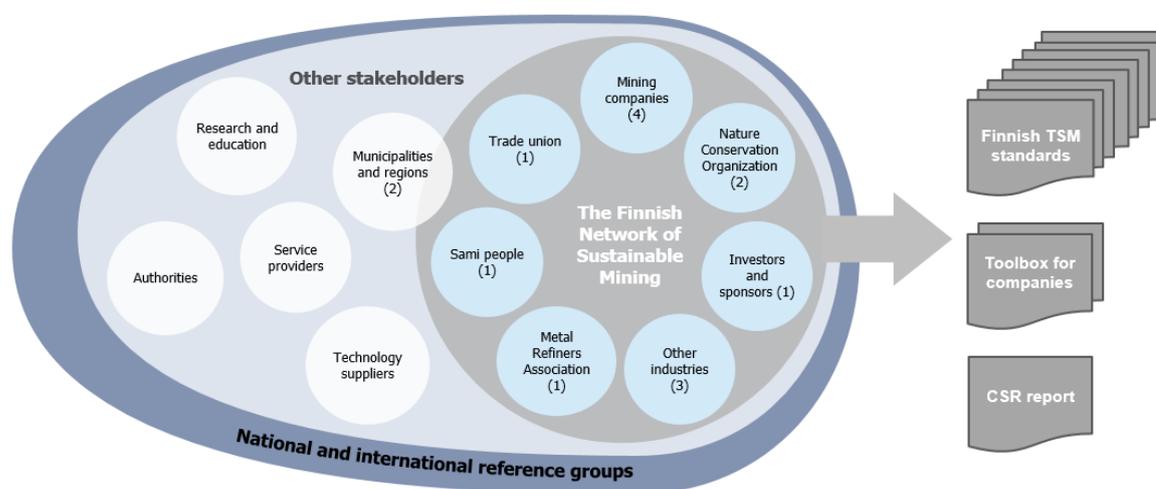


Figure. The recognized stakeholder groups of the Finnish Network of Sustainable Mining and the practical tools that network created

4.1 General guiding principles

The Board of the Mining Network confirmed the General Guiding Principles of the Finnish Towards Sustainable Mining (TSM) Standard on 16th of February 2017. These principles work as a guideline when companies are applying the system's assessment tools. Companies that are committed to take Finnish TSM standard into use are also committed to adhering to, or at least moving towards all these principles. (Kestävän kaivostoiminnan verkosto, 2017).

General guiding principles as well as the Finnish Towards Sustainable Mining Standard states that companies are transparent and they will operate according to the mining industry

best practices and strive to continuous improvement. Companies should also minimize negative impacts towards communities and environment, respect the surrounding community and culture and maintain active communication with its stakeholders. Companies should contribute to projects, which secure the vitality of the mining operation area after the mine closure. Companies will not endanger the health and safety of their employees or local communities and will promote the sustainable use of mineral resources. Companies should also participate to projects that aim to safe and responsible production and recycling of metals and minerals. Companies are also committed to close their active operations safely and support the development of mine closure activities. (Kestävän kaivostoiminnan verkosto, 2017).

4.2 Toolbox

Network has also published two different toolboxes; one for ore exploration companies and one for mining companies. Toolboxes are handbooks for companies about the best practices to involve local stakeholders to its actions when companies are planning to move into a specific region in Finland. The whole content of the toolbox is not compulsory for the companies but companies are committed to take these best practices into use when they develop their TSM management systems. Toolbox has collected best practices and case examples of stakeholder cooperation from mining field (Table 5).

Table 5. Content of mining companies toolbox

MINING COMPANIES TOOLBOX:
Purpose and use of the toolkit
The importance of the local stakeholder cooperation
Profiling of the company operations
Mapping and profiling of the stakeholders and the local operating environment
Identification and assessment of social impacts
Key means of stakeholder cooperation
Sharing socio-economic benefits
Corporate social responsibility management plan
Reporting

4.3 Mining CSR report

Mining companies that are operating in Finland have already been reporting a long time about their operation to different authorities, investors, owners and to parent companies. Problem has been, that different information sources such as company level GRI reports, authorities reporting databases (like VAHTI) does not find locally operating companies most closest and most affected stakeholders. To improve information flow towards the local stakeholders, the Finnish Sustainable Mining network decided to created CSR report for mining (Figure 14). The very first corporate social responsibility report for mining industry was published 2014. The report collected information from mining and exploration companies that are operating in Finland, 19 companies participated to compile the report. Nowadays the report consists information from four categories: operation, environment, human resources and safety, and stakeholder cooperation (The Finnish Innovation Fund Sitra, 2015).

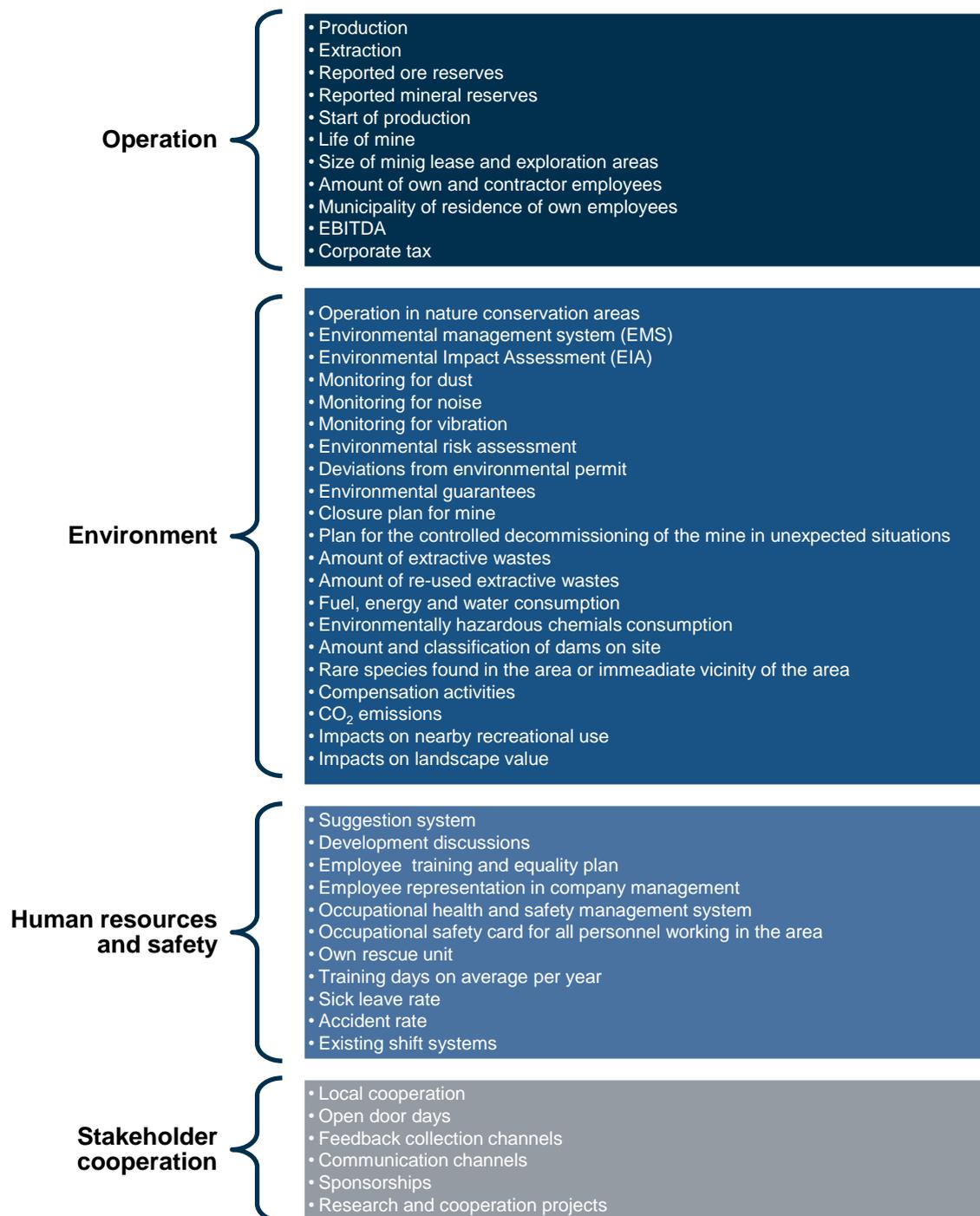


Figure 14. Sustainable mining network CSR report content

4.4 TSM Standards

The most essential practical tool that network created was a new sustainability standards for mining and ore exploration in Finland (The Finnish Network for Sustainable Mining, 2016).

The standard is based on the Canadian initiative Towards Sustainable Mining (TSM) and modified to suit in the Finnish legislation (The Finnish Network for Sustainable Mining, 2016). The Finnish TSM covers the whole lifecycle of mining operation from exploration, operation until the mine closure phase (The Finnish Network for Sustainable Mining, 2016) and it is targeted for large scale-mining (Ruokonen, 2020). Unlike the MAC's TSM standard, The Finnish TSM standard is not compulsory for the members of the Finnish Mining Association, at least yet. The mining companies who are committed to take the Finnish TSM standards into use, are also committed to develop their operation up to level A performance in all standards. There are total of eight different protocols in the standard for used in mine sites locally. (The Finnish Network for Sustainable Mining, 2016).



Figure 15. The Finnish Sustainable Mining Standards

The Finnish Sustainable Mining Standard consist of eight protocols, which are related to social and environmental sustainability aspects (Figure 15). These protocols and a system as a whole can be compared to any management system like ISO 14001 or ISO 45001. The system goes further than what Finnish legislation requires and goal is that all mining companies in Finland would voluntarily adopt the system and at their own pace (Ruokonen,

2020). All the eight protocols includes three to five performance indicators that each are evaluated separately with five performance levels. The lowest level, level C corresponds to operation according to the national legislation and the highest level AAA to international highs (Table 6). The overall result of each protocol performance indicators are reported according to the lowest result. The protocols consist of several different requirements regarding technical, environmental, social and operational issues (Ruokonen, 2020). The system stands as a guarantee that the mining companies take corporate responsibility issues seriously and that companies are continuously striving to improve its practices. External verification for the standard is required every third year and verification results will be reported public which created the transparency for the system (Ruokonen, 2020). Structure of each standard protocol is presented in Figure 16. Each standard starts with a statement of purpose. Assessment criteria's for each level of performance and supporting guidelines are described in the protocol. In each protocol appendix 1 is for frequently asked questions and appendix 2 consist self-assessment checklist.

Table 6. Performance levels of mining standard

Performance levels

<i>Level</i>	Description
<i>C</i>	Operation comply with the Finnish legislation requirements. There are no systems in place and operation is often responsive. Procedures may be in place but have not been incorporated into documented policies and management systems.
<i>B</i>	Actions are not fully consistent or not documented. Systems/processes have been designed and are being developed.
<i>A</i>	Processes have been developed and put into practice. Communication is transparent and reporting is public.
<i>AA</i>	Systems/processes are integrated into management decision-making and functions.
<i>AAA</i>	The system is excellent and leading in the industry.

The Finnish Sustainable Mining Standards for biodiversity conservation, tailings management, energy use and GHG emissions, and health and safety are similar to MAC TSM standards. MAC TSM first standard concerns aboriginal and community outreach (Figure 12). Finland has modified this to be more suitable to Finland and it concerns only community of interest (COI) issues. Both, MAC TSM and Finnish TSM includes protocol standard for water management but content of the standards differ. Also crisis management standard in

MAC system includes also more communications planning aspects compared to Finnish TSM. In the MAC TSM there is also one standard for preventing child and forced labour which is not included in the Finnish TSM. In addition, Finland has composed own protocol for mine closure activities which MAC TSM does not include.

Successful implementation of the Finnish TSM system requires the facility level top management team commitment, adequate resource allocation for implementation of the system and a already existing and functioning management system. The implementation is seen to be easier if the organization have already in place communication and stakeholder engagement practices on facility level. (Ruokonen, 2020).

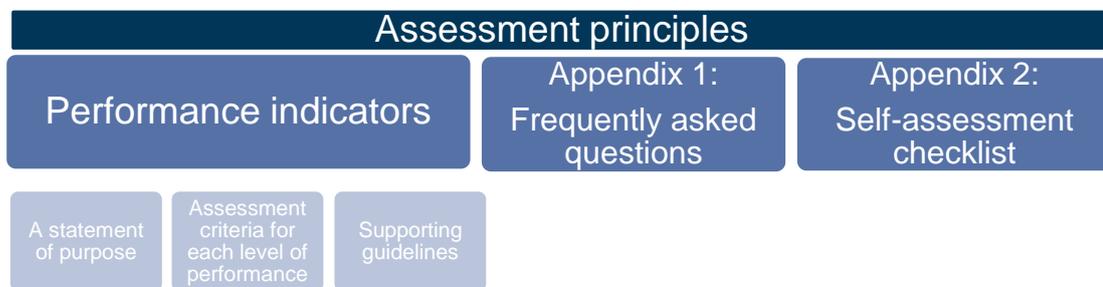


Figure 16. Structure of each standard protocol.

4.4.1 Community outreach

Purpose of the community outreach protocol is ensure that mining companies are aware socially, economically and environmentally responsible practices are a prerequisite for the social acceptance of the mining operation. Protocol aims to the state where good and regular interaction with communities of interest (COIs) is part of the company's day-to-day operation. Interaction should also be active during the whole life cycle of the mine, from exploration to the closure of the mine site. Mining companies should agree that good COI cooperation creates the basis for even better decisions. COI groups include e.g. non-governmental organizations and associations, local inhabitants, landowners, authorities and employees. (Kestävän kaivostoiminnan verkosto, 2020).

Community outreach protocol includes four different performance indicators:

1. COI identification

2. Effective COI engagement and dialogue
3. COI response mechanism
4. Reporting

TSM General Guiding Principles also highlights following seven requirements concerning the community outreach that companies committed to TSM are expected to follow:

1. Companies shall identify the main stakeholders and encourage them to participate to discussion and handling of important issues. The companies shall also identify key stakeholders interests and needs, as well as the impact of activities on each stakeholder.
2. Companies engage to take use the practices that are described in the stakeholder cooperation toolkit in order to improve communication between company and its stakeholders.
3. Companies shall conduct their operations with sincerity and transparency. Stakeholders will be informed and they are consulted in a timely and active manner. There shall be enough time reserved for stakeholders to process company proposals and familiarize themselves with the materials.
4. Stakeholders are consulted in a spirit of mutual appreciation. The companies are committed to enhance identifying of social and environmental impacts with stakeholder cooperation, and actively seeking and implementing means to mitigate negative impacts. Impact of mining towards local communities is monitored in cooperation with stakeholders.
5. Companies are committed to collect feedback from their stakeholders in order to develop it's operation and stakeholder cooperation. Concerns raised by stakeholders will be addressed and solutions to these concerns aim to be found.
6. Companies are committed to fact that Sámi as an indigenous people has rights to maintain and develop their culture and to pursue their traditional livelihoods are not weaken. In addition, when operating if the Sámi area, the Akwé Kon –guidelines will be followed.
7. Companies are committed to follow Sustainable Mining Network local operation toolkit -guidelines for mining activities in the Sámi area.

4.4.2 Biodiversity conservation

Purpose of the biodiversity conservation protocol is that mining companies recognize that access to land and a company's social license depend upon responsible social, environmental and economic practices and that there is a strong business case for supporting biodiversity conservation. Protocol aims to the state where companies seek to minimize adverse impacts on biodiversity and compensate such impacts in full in accordance with the No Net Loss/Net Positive Impact –principle. (Kestävän kaivostoiminnan verkosto, 2020).

Biodiversity conservation protocol includes three different performance indicators:

1. Commitment, accountability and communications
2. Planning and implementation
3. Reporting

TSM General Guiding Principles also highlights following seven requirements concerning the biodiversity conservation that companies committed to TSM are expected to follow:

1. The companies will make a positive contribution to the conservation of biodiversity through all stages of the mining life cycle
2. The companies will work with key communities of interest (COI) to develop and implement responsible policies and practices to:
 - integrate biodiversity conservation with mining and land-use planning and management strategies, including considering the option of not proceeding with a project;
 - assess and monitor the state of biodiversity throughout the project cycle;
 - avoid, minimize, mitigate and/or compensate for significant adverse biodiversity effects;
 - enhance, through research, information sharing and/or partnerships, the industry's understanding of and contribution to biodiversity conservation, science and traditional knowledge;
 - establish, finance and implement comprehensive reclamation plans that restore mine sites into viable and diverse ecosystems and that take account of other land uses in the area.

3. The companies are committed to openness and transparency as well as public reporting on issues related to mining and biodiversity conservation.
4. Recognizing that Natura areas, legally-designated nature reserves and other areas and sites that are valuable in terms of nature conservation can contribute to biodiversity conservation, the companies will comply with the relevant conditions and requirements set in national legislation. The companies are committed to working with key communities of interest to develop transparent, inclusive, informed and equitable decision-making processes to promote nature conservation.
5. No exploration or mining activities will be carried out in World Heritage sites.
6. No mining can be carried out in Natura areas, the neighboring areas affecting them, or other legally designated nature reserves unless legal obligations are met and any negative impacts on biodiversity are compensated for in full, in accordance with the No Net Loss/Net Positive Impact –principle.
7. The companies commit to ensuring that existing and future operations in legally designated nature reserves and adjacent to such areas are compatible and in accordance with biodiversity goals.

4.4.3 Tailings management

Tailings management and dam safety is one of the biggest environmental aspects of large-scale mines. The aim of the tailings management standards is to ensure responsible tailings management that cause no adverse impacts on the environment or human health or safety such as accidents caused by dams, dust or leachate. (Kestävän kaivostoiminnan verkosto, 2020).

Tailings management protocol includes five different performance indicators:

1. Policy and operational guidelines
2. Tailings management system
3. Accountability and responsibility
4. Annual management review
5. Operation, Maintenance and Surveillance (OMS) –manual

TSM General Guiding Principles also highlights following seven requirements concerning the tailings management that companies committed to TSM are expected to follow:

1. The companies will identify dam safety risks and seek to prevent them throughout the mine life cycle.
2. The companies will establish a tailings management policy and operational guidelines, and ensure that these are maintained and updated.
3. The activities of the companies will comply with Finnish legislation. In addition, the companies will implement a tailings management system in conformance with best available practices.
4. The companies will consult with communities of interest when developing tailings management systems.
5. The companies will have clearly assigned internal accountability and responsibility for tailings management.
6. Tailings management will be reviewed and reported to corporate management annually. Up-to-date information on the adequacy and effectiveness of the management systems will be available for the management.
7. The facilities of the companies will develop and implement guidance for tailings management. In addition, the facilities will prepare documented emergency preparedness and response plans.

4.4.4 Water management

Beside tailings management and dam safety, water management is also one of the most significant environmental aspects and source of risk in mine sites. Mine sites footprint is large and they affect to surrounding areas extensively through surface waters and groundwater. Water management protocol aims to comprehensive and systematic way to manage mine site water sources and balance, and engage companies to minimize negative environmental impacts to water sources. (Kestävän kaivostoiminnan verkosto, 2020).

Water management protocol includes five different performance indicators:

1. Policy and operational guidelines
2. Tailings management system
3. Accountability and responsibility

4. Annual management review
5. Operation, Maintenance and Surveillance (OMS) –manual

TSM General Guiding Principles also highlights following six requirements concerning the water management that companies committed to TSM are expected to follow:

1. The companies will prepare and maintain water management action plans that cover all stages of the mining life cycle. The companies will maintain a water balance model, which is a calculation model describing all different water fractions coming, leaving and stored in mine site.
2. The companies must be aware of their site's water management stage at all times and ensure knowledge and mitigation of water management risks systematically
3. Provisions that climate change and exceptional circumstances requires needs to be taken into account in the companies water management plans
4. The companies will engage relevant stakeholders to develop and implement policies and practices to:
 - recognize stakeholders values related to water use and include values into water management planning and implementation
 - avoid negative impacts on water sources
 - strengthen, through research, cooperation and/or information distribution the industry's knowledge of water treatment and management
5. Companies will be open, transparent as well as report and communicate publicly water management related issues and progress of achieving the water management targets
6. Companies will improve their water management activities continuously, update plans related to water management and take account new technologies and take these into use when possible

4.4.5 Energy use and GHG emissions

Energy use and Greenhouse gas (GHG) emissions protocol aims to the state where mining companies recognize that climate change is a global issue depending the source of emissions or location. Mining companies are encouraged to develop performance targets for energy use and greenhouse gas emissions reductions. (Kestävän kaivostoiminnan verkosto, 2020).

Energy use and greenhouse gas emissions protocol includes three different performance indicators:

1. Energy use and GHG management systems
2. Energy use and GHG emissions reporting
3. Energy use and GHG emissions performance targets

TSM General Guiding Principles also highlights following six requirements concerning the energy use and greenhouse gas emissions that companies committed to TSM are expected to follow:

1. The companies are committed to take into use greenhouse gas emissions and energy management systems into their operation
2. Significant improvement areas as well as key issues related to greenhouse gas emissions and energy use will be identified
3. With appropriate systems, companies will monitor greenhouse gas emissions and energy use as well as report their performance externally and internally
4. The companies will take into use greenhouse gas emissions and energy use performance targets
5. Significant energy consumption and greenhouse gas emissions sources will be evaluated regularly and this information will be used in planning and decision-making processes
6. The companies commit to reduce their dependence on fossil fuels and change their energy sources to renewable energy and low carbon energy sources

4.4.6 Health and safety

Health and safety protocol aims to maintain health, safety and wellness of member companies employees, contractors, visitors and local communities (Kestävän kaivostoiminnan verkosto, 2020). Health and safety protocol includes five different performance indicators:

1. Corporate policy, commitment and accountability
2. Planning, implementation and operation
3. Training, behaviour and culture

4. Monitoring and reporting
5. Performance

TSM General Guiding Principles also highlights following eight requirements concerning the health and safety that companies committed to TSM are expected to follow:

1. All occupational diseases and accidents are preventable so the ultimate goal of the companies is to target to zero accidents together with contractors and suppliers.
2. Practices and behaviour that improve and maintain employee health and working conditions must be built, supported and sustained. The level of performance will be monitored and in addition, companies will implement a health and safety management system.
3. The companies will clearly define the responsibility and accountability of the health and safety performance among the board and senior management level
4. The companies business and risk management plans shall include health and safety targets
5. The companies will encourage and promote wellness and health issues even during the leisure time
6. The companies will support and encourage suppliers and contractors as well as other relevant stakeholders in building their capacity to be safe and healthy.
7. Health and safety performance metrics shall be reported to key stakeholders, contractors and employees

4.4.7 Crisis management

Crisis management protocol aims companies to commit to maintain and develop the crisis management preparedness for emergencies and accidents such as political and security risks, environmental releases and natural disasters (Kestävän kaivostoiminnan verkosto, 2020). Crisis management protocol includes three different performance indicators which are:

1. Crisis management preparedness
2. Internal review
3. Training and exercises

TSM General Guiding Principles also highlights following six requirements concerning the crisis management that companies committed to TSM are expected to follow:

1. The company's management will appoint the Crisis Management Team (CMT) and allocate the material, human and financial resources for CMT
2. The companies will prepare a crisis management plan where practices and preparedness for emergencies, accidents, environmental releases, natural catastrophes, political and security risks and other potential crises are described. The companies will also identify own operations risks and possibility to comment the crisis management plan will be provided for relevant stakeholders.
3. The companies will do regular assessments to make sure their crisis management plans meets the requirements of the company, is according with the identified risks and takes account of the industry's best practices. Based on the assessment results, the crisis management plan will be updated if needed.
4. Regular crisis management exercises and training will be organized where company's personnel, key authorities and contractors related to crisis management will participate.
5. The crisis management plan shall be informed to contractors, environmental authorities, operators and residents in the area affected, fire and rescue authorities, own employees and for other relevant stakeholders.
6. The companies will share practices and experiences related to crisis management with each other to learn from them

4.4.8 Mine closure

Mine closure protocol aims that in the mining lease areas, there would be operations even after the mine closure or if not, the area will be restored to its natural state. Closure of the site is aimed to conduct such a way that the site does not cause risk to the public health, safety or to the environment (Kestävän kaivostoiminnan verkosto, 2020). Mine closure protocol includes three different performance indicators:

1. Mine closure policy and operational guidelines
2. Mine closure planning and management system based on the mine life cycle
 - A. Mine closure planning at the project design stage
 - B. Progressive mine closure and assigned accountability for mine closure

C. Mine closure and post-closure activities

3. Reporting on mine closure measures

TSM General Guiding Principles also highlights following ten requirements concerning the mine closure that companies committed to TSM are expected to follow:

1. Mine closure plans will be developed, updated and maintained for the mine sites
2. The companies will work with its stakeholders in order to take their objectives and values regarding the mine closure and post closure activities to account
3. The company's mine-specific closure plans for existing and new mines will be based on the each mines needs. Closure planning and implementation will be based on the good practices and include clear definition of objectives, a budget, a monitoring plan, a risk assessment identification of alternatives and indicators to assess the effectiveness of closure measures.
4. The mine closure planning will be started at the early stages of the mine project and plans will be specified throughout the mine life cycle. Progressive mine closure is recommended where possible.
5. The companies will include temporary mine closure scenarios in their closure plans
6. The companies are committed to keep their cost calculations for closure as well as closure plans up to date
7. The companies will ensure financial arrangements for closure
8. The responsibility and accountability for mine closure planning, a budget, post-closure monitoring and mine closure measures are clearly assigned in the companies
9. Closure plans will be implemented and through measures ensured that the closure objectives are met
10. Mine closure planning and implementation measures are reported annually within the companies in order to provide up-to-date information for management level

5 IMPLEMENTATION OF FINNISH TSM

5.1 Self-assessment results

Gap analysis for the Finnish TSM standard and the target organizations current operation was performed with the TSM system self-assessment questionnaire. Self-assessment questions were sorted in a excel form in order to track answers, reference documents and keep record of results between the coming years (Figure 17).

WIMZ BOLIDEN					
COMMUNITY OUTREACH PROTOCOL		2020			
		Assessment date:		23.6.2020	
		Participants name/role:			
		Result	Description and examples	Reference document	Document location
Performance indicator 1: Community of interest (COI) identification					
Level B	Have some local COIs been identified	Yes			
	Are plans in place to develop a formal system for identifying COIs?	Yes			
Level A	Is there a formal and documented system for identifying COIs?	Yes			
	Does the system allow for the identification of COIs at the local or site level, including those with challenging interests?	Yes			

Figure 17. Example of self-assessment excel form

The Finnish TSM standards were reviewed and evaluated by answering the self-assessment questions in each of the eight standard. Evaluations were done in working groups that consisted operational side personnel as well as environmental, human resources and safety personnel from the Boliden (Figure 18). Purpose was to bring more broad view to the assessment results when evaluation group was different for each standard. The leader for each evaluation group was environmental departments personnel. This was noticed as a good structure of the evaluation groups because there is always need for the person who is familiar with the standard requirements. The self-assessment questions were answered either “yes” or “no”, or when the question did not concern the Kevitsa mine, the answer was “not applicable”. The results were gathered together and all the “yes” answers shows compliance with the protocol and all the “no” answers shows non-compliance.

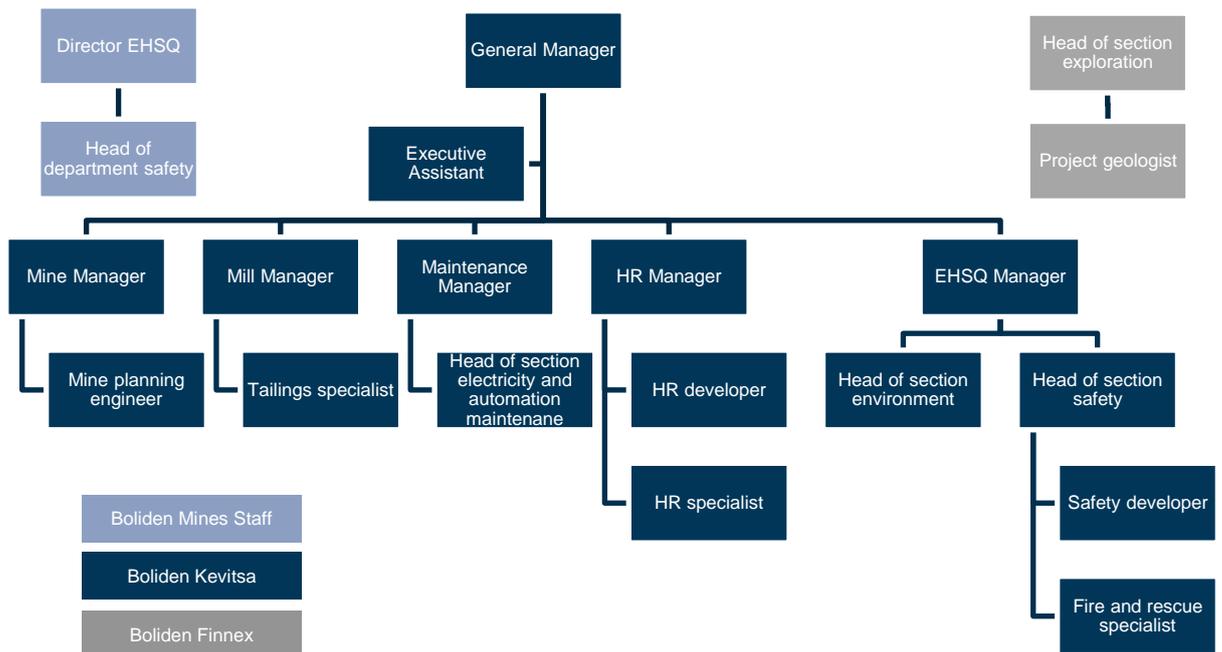


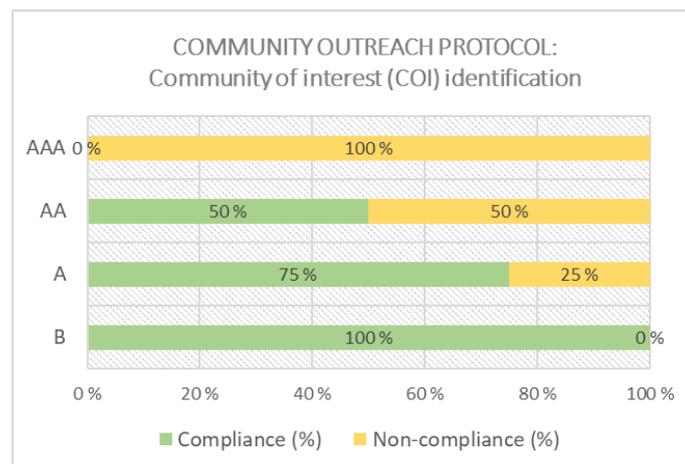
Figure 18. Participants to self-assessment groups

In each self-assessment workshop there was total of four to six participants (Table 7). For each workshop one hour time was reserved and results of discussion was documented in the excel form (Figure 17). Questions that were unclear to workshop participants were marked and further disussed with FinMin in order to gain better understanding of the standard. Column for questions and answers was created to excel form. Following sections 5.1.1-5.1.8 describes the results of each self-assessment workshops and performed gap analysis.

Table 7. Self-assessment group participants in each protocol (BAM=Business area mines)

<i>Protocol standard</i>	<i>Self-assessment group</i>
<i>Community outreach</i>	General manager, Executive assistant, HR-specialist, Project geologist, EHSQ manager, Head of section environment
<i>Biodiversity conservation</i>	Head of section exploration, Project geologist, Mine planning engineer, EHSQ manager, Head of section environment
<i>Tailings management</i>	Mill manager, Tailings area specialist, EHSQ manager, Head of section environment
<i>Water management</i>	Mill manager, Tailings area specialist, Mine planning engineer, EHSQ manager, Head of section environment
<i>Energy and GHG emissions</i>	Maintenance manager, Head of section electricity and automation maintenance, EHSQ manager, Head of section environment
<i>Health and safety</i>	Mine manager, Head of section safety, Safety developer, Senior HR developer, EHSQ manager, Head of section environment
<i>Crisis management, group level</i>	Director EHSQ (BAM), Head of department safety (BAM), General manager, HR manager, Executive assistant, EHSQ manager
<i>Crisis management, site level</i>	General manager, Executive assistant, Head of section safety, Fire and rescue specialist, EHSQ manager
<i>Mine closure</i>	Mine manager, Mill manager, Mine planning engineer, EHSQ manager, Head of section environment

5.1.1 Community outreach

**Figure 19.** Self-assessment of community outreach, performance indicator 1

As seen in Figure 19, the target organization complies with all performance level B requirements, 75 % of level A requirements and 50 % of level AA requirements. Level B requires

that local stakeholders has been recognized and there are at least a plan to develop documented system for stakeholder mapping. Target organization has carried out stakeholder mapping according to the Boliden group guidance. Level A full compliance is achieved when recognized stakeholders can nominate representatives to dialogue. Performance level AA could be achieved when management sets targets for stakeholder cooperation and those are evaluated annually. Level AAA requires that stakeholder mapping is done with the already recognized stakeholders.

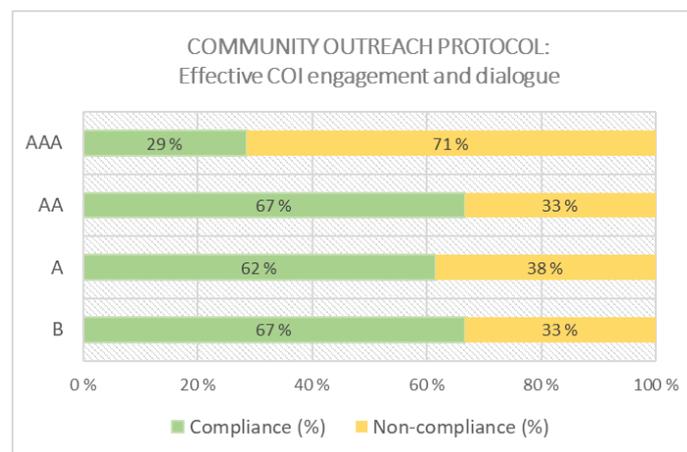


Figure 20. Self-assessment of community outreach, performance indicator 2

Performance indicator two “effective COI engagement and dialogue” did not reach level B because the lack of communications and interaction plan and the strategy for plan implementation (Figure 20). Level A could be achieved if target organization takes into use documented system for COI dialogue, follows the communication and interaction plan, nominates and implements the cooperation group and gives training for nominated personnel regarding reindeer herders hearing practices. Level A also requires that COIs can discuss proposals and form their own view on them on the basis of sufficient information provided in advance. Level AA could be achieved if COI’s input into decisions that affect them is actively encouraged and cooperation group(s) meet regularly and their work is systematic. At the level AAA the facility has to have a consistent history of meaningful cooperation and dialogue with COIs. There also has to be formal processes for building the capacity of COIs to allow them to participate effectively in dialogue. Feedback needs to be collected annually about the cooperation group from COIs and COIs needs to have possibility to contribute to periodic reviews of engagement processes in order to enable continual improvement. Also

cooperation group needs to concretely participate in the planning and development of operations.

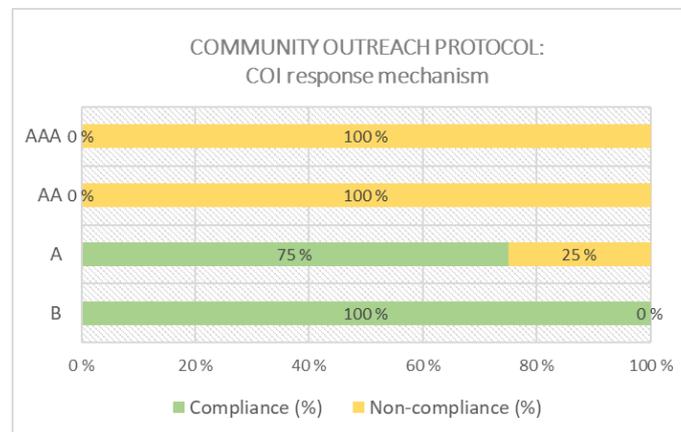


Figure 21. Self-assessment of community outreach, performance indicator 3

Target organization achieved level B in the third performance indicator which is for COI response mechanism' (Figure 21). At the level B full compliance, organization takes occasionally account COI concerns, there is an informal complaint and response system in place and there are plans to develop a formal system. Target organization could reach to level A if the input received from COIs would be analyzed and act on, and input would be considered in the decision making processes. The target organization did not fulfil any of the level AA or AAA requirements.

The level AA requires that the organization have thorough and documented knowledge of COI issues and concerns. Management level needs to evaluate the results of engagement and dialogue processes at least annually in order to determine whether and how to act on them. Also there should be sufficient time built into the site processes for considering and responding to COI concerns before the specific plans are implemented on site level. Level AA states that feedback collected from cooperation group needs to be taken into account in the operation and there has to be concrete examples of it.

The highest level AAA in COI response mechanism demands that organization collaborates with COIs in order to establish and achieve common objectives, and this collaboration should extend to address common community goals. Also feedback from cooperation group

needs to be collected in a goal-oriented manner and it should be applied in the organizations activities. Cooperation group needs to have opportunity to participate in the planning and development of operations.

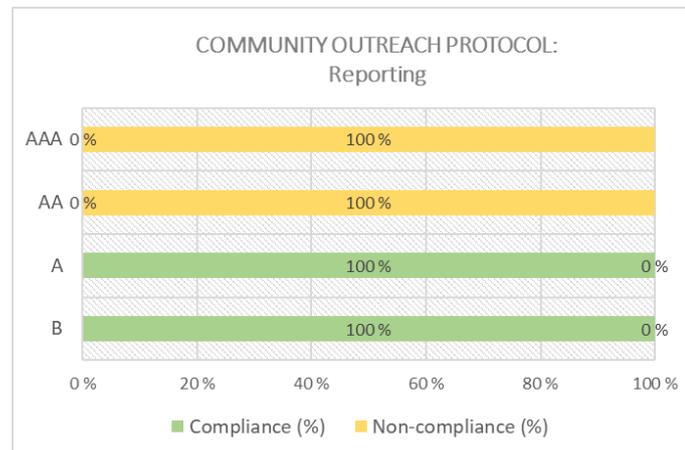


Figure 22. Self-assessment of community outreach, performance indicator 4

As seen in Figure 22, target organization reached level A in the reporting performance indicator. At the performance level B organization does some internal reporting about community engagement and dialogue. Level A requires that there are formal reporting systems on COI engagement and dialogue activities in place and the system includes responses to COIs on the concerns raised by them. In order to reach level AA the organization should do a public and regular reporting about responses to COIs concerns and the feedback of this reporting should be COIs possible to give. At the level AAA feedback of public reporting should be asked from COIs as well as feedback of engagement and dialogue processes. Feedback and dialogue and engagement activities should be publicly reported as a part of corporate responsibility reporting.

5.1.2 Biodiversity conservation

As seen in Figure 23, the target organization complies with all performance level B requirements and 50 % of level A requirements. There is a commitment for biodiversity in place and a plan to address the gaps where the commitment is not consistent with the intent of Mining and Biodiversity Conservation Framework. In order to reach the level A, target organization needs to communicate the biodiversity conservation commitment to the relevant

employees, contractors and facility-level COIs. Also the roles, responsibilities and accountabilities involved in the implementation of the commitment needs to be clarified.

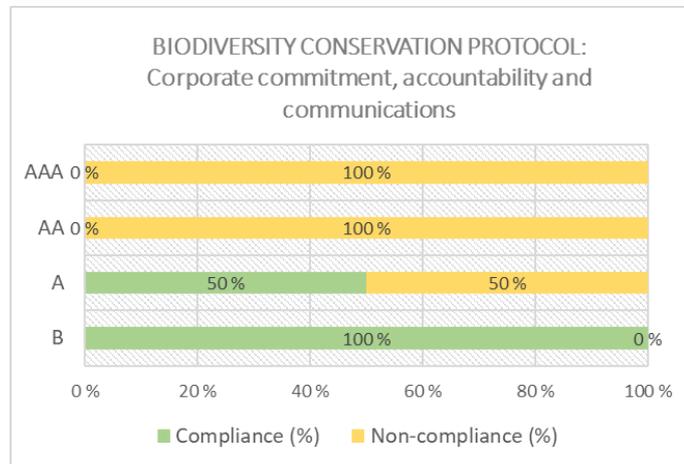


Figure 23. Self-assessment of biodiversity conservation, performance indicator 1

Level AA can be reached with the independent verification/review (internal or external) of the biodiversity commitment and its implementation. Level AA requires that the verification/review is no older than 3 years. The highest level AAA in this performance indicator can be achieved if the biodiversity commitment includes a commitment to active cooperation with other organizations in biodiversity conservation. Roles, responsibilities and resources needs to be clearly assigned to support this commitment.

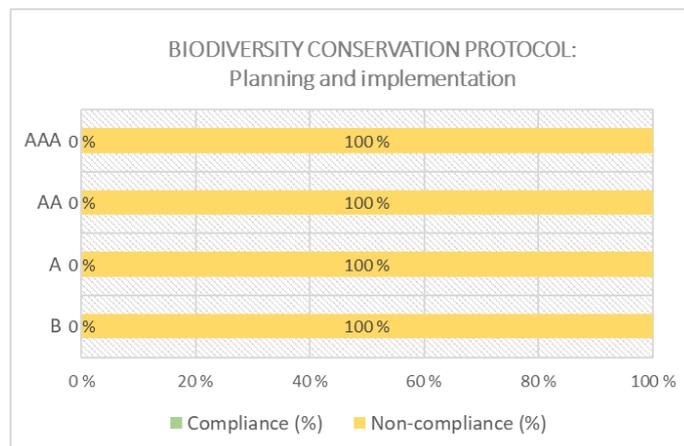


Figure 24. Self-assessment of biodiversity conservation, performance indicator 2

Target organization was non-compliance with all level B to AAA questions regarding the planning and implementation (Figure 24). Level B required that organization have to have facility-level biodiversity conservation plan or management system. This plan or system must include facility-level baseline data, monitoring of biodiversity, identification of significant biodiversity aspects and identification of key communities of interest. Plan needs to be approved by facility-level management and plan needs to be under the implementation. Level A requires that target organizations performs an assessment of potential impacts/risks to biodiversity, assign the responsibility to facility-level staff for biodiversity conservation management and biodiversity conservation awareness should be included in facility training programs for the key personnel. In addition key COIs needs to be consulted and/or engaged regarding biodiversity conservation management, progress towards biodiversity targets needs to be regularly tracked and reported to facility-level management. Level A requires the application of the No Net Loss principle and biodiversity offsetting reflected in the operations of the organization.

At the level AA the facility needs to be able to demonstrate that biodiversity conservation management is integrated into business planning processes and tools. Also biodiversity needs to be included in company's business plan as well as to budget and internal or external audit needs to be performed concerning the biodiversity conservation management plan. In order to stay level AA, the internal or external audit needs to be performed every third year. The highest level AAA requires organization to be able to prove how "Net Positive Impact" –principle has been applied. Organization needs to also include biodiversity conservation to it's business strategy. Business strategy also must include at least two of the following requirements:

- funding of research and development projects which increase knowhow of biodiversity conservation,
- description how knowledge towards biodiversity conservation is increased,
- participation to industry or region level guidance development processes,
- increase of biodiversity outside the mining lease area,
- achieved national or regional recognition of biodiversity conservation acts,
- evaluation of ecosystem values in the area and support of protection of those or
- encourage to workers participation in voluntary work towards biodiversity conservation.

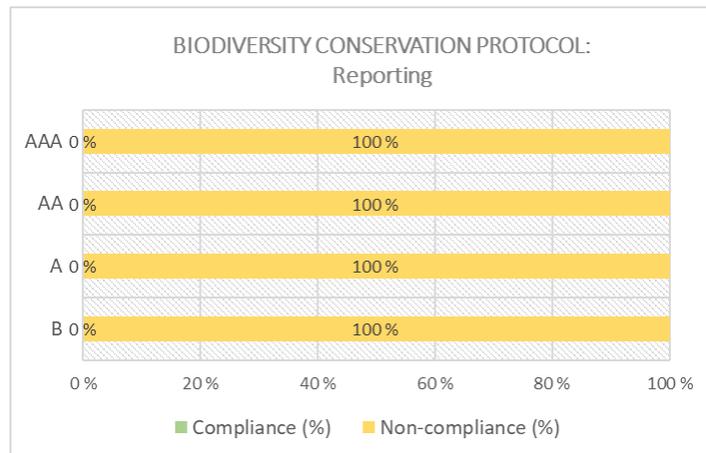


Figure 25. Self-assessment of biodiversity conservation, performance indicator 3

Figure 25 shows that target organization did not reach any requirements regarding the biodiversity conservation reporting. Level B demands that organization does site level based monitoring and reporting of the biodiversity conservation topics. Level A requires that organization has documented procedures for biodiversity conservation reporting, reporting has been done of biodiversity conservation topics in order to support decision-making processes in facility level and public reporting of biodiversity conservation actions has been carried out. At the level AA internal or external audit regarding biodiversity conservation reporting needs to be performed to facility during the last three years. Level AAA can be achieved when feedback is actively collected from stakeholders about biodiversity conservation actions and reporting. At the level AAA feedback needs to be also taken into account in the development of facility level processes and this needs to be reported publicly.

5.1.3 Tailings management

Target organization achieved 100 % compliance in level B requirements and 80 % compliance in level A requirements (Figure 26). In order to reach performance level A in tailings management first performance indicator, target organization should fully implement tailings management general guiding principles. Performance level AA can be achieved with the independent external audit for level A requirements, and the highest level AAA if the audit has assessed effectiveness of the tailings management policy and guidelines.

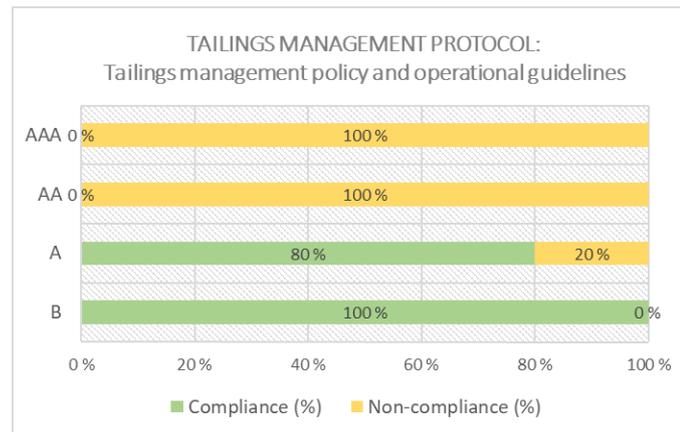


Figure 26. Self-assessment of tailings management, performance indicator 1

Second performance indicator concerns tailings management system and as it can be seen from Figure 27, the organization complies with all requirements except the 67 % level A requirements. Non-compliances in level A concerns stakeholders. Tailings management system development should be done in performance level A by hearing the stakeholders and their aspects.

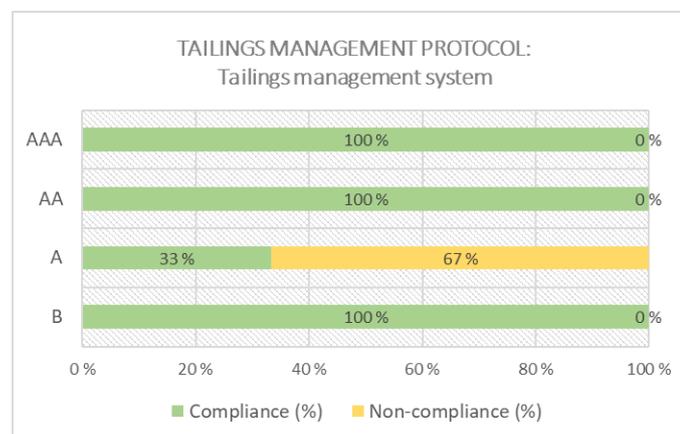


Figure 27. Self-assessment of tailings management, performance indicator 2

Level A in third performance indicator, assigned accountability and responsibility for tailings management, can be achieved if target organization performs internal audit where accountabilities and responsibilities for tailings management is verified (Figure 28). In addition, audit needs to cover verification that responsibilities for tailings management imple-

mentation, reporting and budgeting has delegated according to the Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries (MWEI BREF) or according to the MAC Guide to the Management of Tailings Facilities.

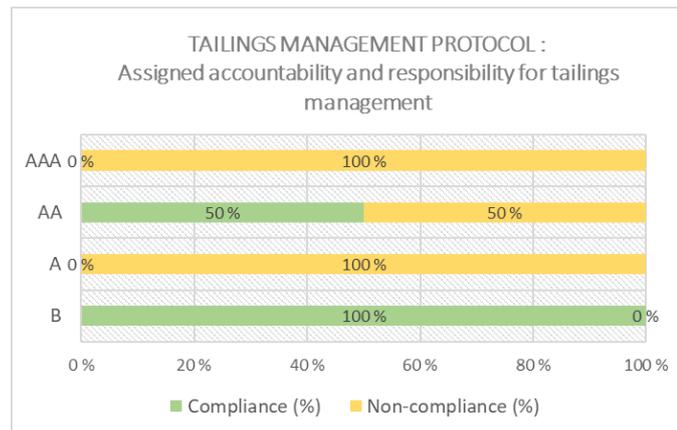


Figure 28. Self-assessment of tailings management, performance indicator 3

As it can be seen from Figure 28, target organization complies 50 % with the level AA requirements. Level AA demands that organization needs to do independent external audit against previously mentioned MWEI BREF and MAC Guide documents concerning the accountabilities and responsibilities. Target organization has performed the Independent Technical Board Review audit (ITRB) for tailings management in 2018 where part of the level AA requirements were verified. Performance level AAA requires that independent external audit verifies that the accountabilities and responsibilities concerning the tailings management are applied effectively in the organization.

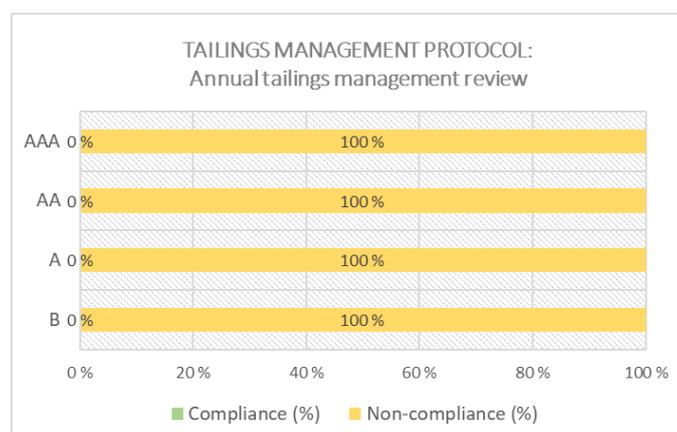


Figure 29. Self-assessment of tailings management, performance indicator 4

Annual tailings management review in the tailings management protocol means annual comprehensive inspection where previous years operation in tailings facility as well as significant aspects related to operation is went through and reported to the management level. Target organization does not comply with level B-AAA requirements because reviews has not accomplished according to the MAC Guide to the Management of Tailings Facilities (Figure 29). Level B demands that annual tailings management reviews are performed according to the guidance, in level A these reviews needs to be verified by internal audit, level AA requires independent external audit and level AAA independent external audit needs to be done to evaluate the effectiveness of annual review.

Figure 30 shows that target organization complies fully with the level B, A and AA requirements concerning the OMS manual. In order to achieve the highest level AAA the organization needs to carry out independent external audit where effectiveness of the tailings operation, maintenance and surveillance (OMS) manual appliance is verified.

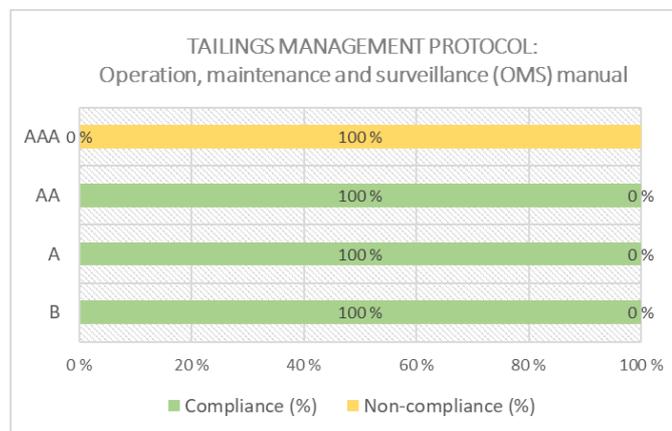


Figure 30. Self-assessment of tailings management, performance indicator 5

5.1.4 Water management

Water Management protocol first performance indicator ‘policy and operational guidelines’ could be improved to level A if company’s guidelines and principles would be updated to be fully in accordance with water management general guiding principles. At the level A this accordance with general guiding principles needs to be internally audited. Also company’s principles and water management commitment should be publicly available for all stakeholders.

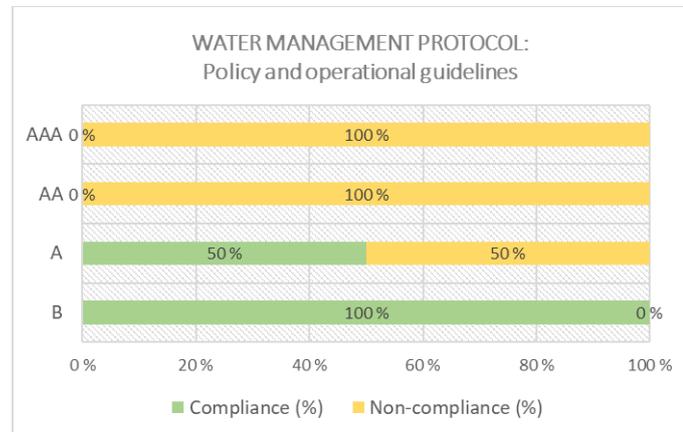


Figure 31. Self-assessment of water management, performance indicator 1

Performance level AA requires external audit for all level A requirements, and level AAA the external independent audit needs to be focused on effectiveness of these principles and commitments towards sites water management. At the level AAA company's water management principles must include also commitment of active partnership with local communities and other actors with the resources and responsible persons described.

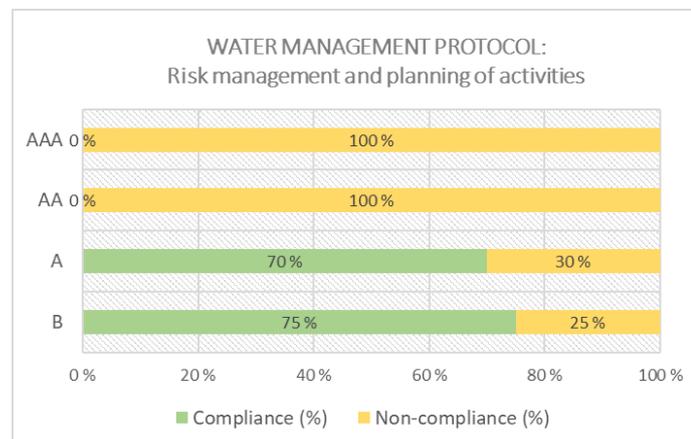


Figure 32. Self-assessment of water management, performance indicator 2

Target organization is at level C in the risk management and planning of activities performance indicator (Figure 32). Organization fulfills 75 % of level B requirements and could be improve performance to level B if the most important stakeholders related to water management would be recognized and these stakeholders would be informed about plans and actions that can affect to water usage, availability and impacts. Level A could be achieved if

specific risk assessment and risk management plan related to water management would be developed. Plan must include the most significant risks concerning the water amount and water quality and social risks that are related to stakeholders. Level A also demands that relevant stakeholders are involved into development process of water management plans. Internal audit is also demanded in level A to verify that water management plans are by all means in accordance with level A requirements.

Level AA requires target organization to agree with local, regional and national stakeholders of common activities how additional information will be collected for mine site's water management planning as well as for development of regional planning. At the level AA water management plans needs to be audited in the independent external audit. The highest level AAA demands that company's water management operation plan includes at least one target from following:

- company invests to research and development which targets industry's knowhow increase concerning the mine sites water management,
- company contributes to scientific research, which increases the knowledge of fresh water reserves or targets towards water protection,
- company contributes to composition and development of industry or regional water management guidance, or
- company involves significantly in its operational area or outside of it to fresh water protection or compensation acts.

At the level AAA efficiency of these water management plans needs to be audited in the independent external audit.

Organization did not fulfil any of the third performance indicator requirements regarding the water management system (Figure 33). Level B requires that organization have to have facility level water management plan. This plan needs to include targets for water management and plans how these target can be achieved, description of water management technical solutions on site and how water balance has been taken into account when these solutions have been implemented. Plan needs to also include description of actions how potable water and sanitary services will be ensured on site, how site has prepared to unexceptional situations

regarding water management and how site water monitoring information has taken into account in overall water management on site.

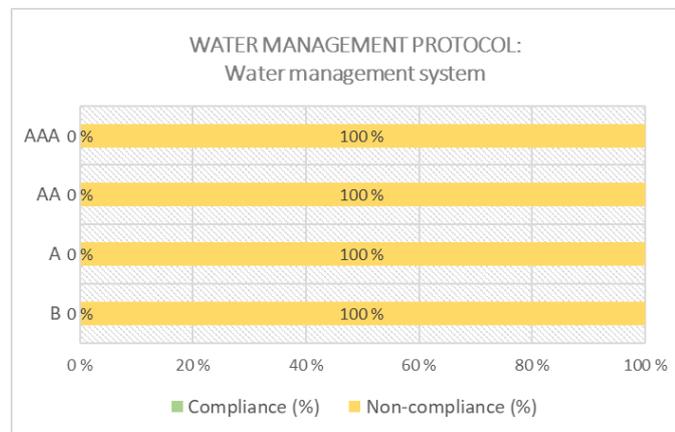


Figure 33. Self-assessment of water management, performance indicator 3

In level A this plan needs to also include description on water source compensation actions, how effectiveness of these compensations is evaluated and how measurement data affects to development of compensation actions. Also there need to be description of how water balance is updated and what type of changes water balance update can cause for site, when and for what reasons water monitoring plan is updated and how monitoring results are taken into account when water management is developed. There also must be description on all risk management actions towards water management as well as how feedback of water management is collected and how the feedback affect to concrete actions on site level. Level A also requires internal audit to ensure that water management system is in accordance with level A and B requirements.

In order to reach level AA, target organization needs to hear relevant stakeholders when water management plans are evaluated as well as independent external audit needs to be performed for water management system. In the highest level AAA effectiveness of the water management system and continuous improvement of water management needs to be assessed in independent external audit. Water management systems needs to present the best available technique and it needs to affect at least two of the following:

- contribute the understanding or effectiveness of water management in the industry,

- contribute the regional water management systems towards to best available practices,
- contribute to mining sector water management or other water protection scientific development,
- contribute significantly to regional water protection.

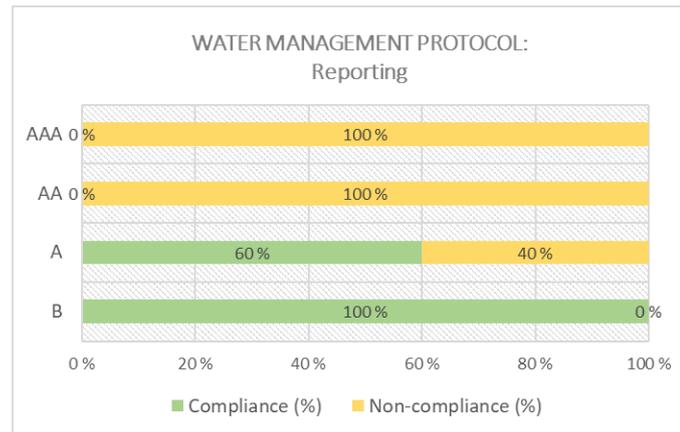


Figure 34. Self-assessment of water management, performance indicator 4

As it can be seen from the Figure 34, target organization reached all level B requirements regarding the water management reporting. At the level B there needs to be site level water management annual report which includes monitoring results and actions that have been made for the water management issues on site. Also water monitoring results and actions needs to be reported to site level management regularly. Total of 60 % of the level A demands where fulfilled and in order to achieve full accordance with level A, the target organization needs to collect feedback of its water management reporting and conduct internal audit to make sure that its reporting practices are in line with level A requirements. Level AA requires independent external audit for reporting practices and commitment to improve practices according to the audit findings. The highest level AAA demands that facility level water management is reported in official company reports and that reporting system has audited in the independent external audit to make sure it presents the best available practices.

5.1.5 Energy use and GHG emissions

The target organization was level C in the first energy use and GHG performance indicator (Figure 35). Level B states that organization needs to have an energy management system, which includes following practices:

- facility level management commitment to manage sites energy use and greenhouse gases,
- responsibilities regarding energy consumption and greenhouse gas emissions has defined in facility level,
- practices to define most significant energy consumption and greenhouse gas emissions sources or sources where the most significant energy efficiency improvements could be achieved has been taken into use,
- other than energy consumption and production related greenhouse gas emissions has recognized and evaluated,
- standardized quantification and evaluation methods are used to convert energy and greenhouse gas emission information to comparable units,
- facility level information record is maintained.

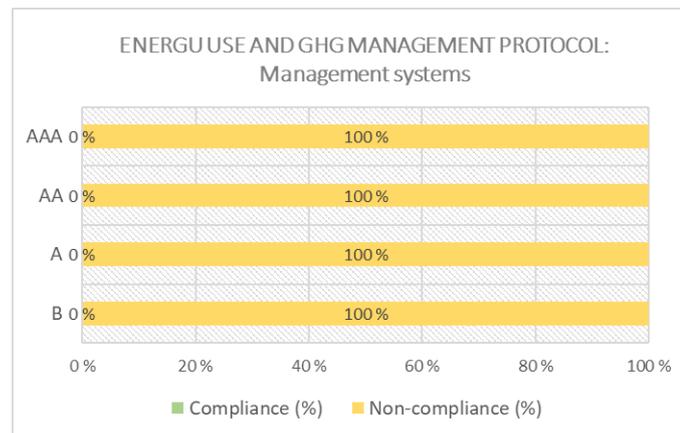


Figure 35. Self-assessment of energy use & GHG management, performance indicator 1

In the level A the organization needs to have a greenhouse gas management system, which includes following practices that completes the level B system:

- the most significant energy consumption and greenhouse gas emissions sources are recognized and evaluated annually in facility or in business unit level including own transports,
- restriction of greenhouse gas emissions and usage of renewable energy sources,
- accountability of energy consumption and greenhouse gas emissions has pointed clearly to operative management level,
- energy consumption information is evaluated regularly and evaluation has integrated as a part of high energy consumption processes control,
- actions and process modifications that affect to energy consumption and greenhouse gas emissions are taken into account in significant energy usage sources and greenhouse gas emissions sources management,
- general energy usage and greenhouse gas emissions knowledge of facility level personnel is increased by training.

Level AA requires that energy consumption, greenhouse gas emissions and usage of renewable energy sources are taken into account in the facility level business planning. Organization needs to also invest in renewable energy source projects or/and energy recovery projects. Also internal assessment needs to be performed for energy consumption and greenhouse gas emission systems. The highest performance level AAA demands that external inspection has been carried out for organizations energy consumption and greenhouse gas emissions management systems. Also organization need to include energy consumption and greenhouse gas emissions management to a part of more comprehensive sustainable development business strategy which needs to also include at least two of the following actions:

- energy efficiency and decrease of greenhouse gas emissions has taken as a part of sourcing and delivery management practices,
- company invest voluntarily to research, product development, feasibility studies and/or new technologies and/or new processes which drives to improve energy efficiency and decrease greenhouse gas emissions,
- company does cooperation with the stakeholders regarding energy efficiency improvements and greenhouse gas emissions decrease.

Target organization had a 100 % compliance with level B requirements in energy use and GHG reporting, 50 % compliance with level A requirements, 0 % compliance with level

AA and 50 % compliance with the highest level AAA requirements (Figure 36). In order to reach level A full compliance, target organization needs to take into use reporting system that includes regular reporting to facility level management about energy consumption and GHG emissions to support decision-making processes.

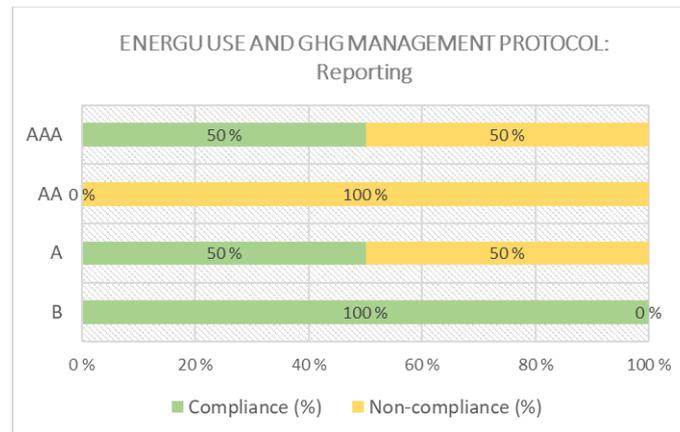


Figure 36. Self-assessment of energy use & GHG management, performance indicator 2

Level AA requires that organization conduct an internal inspection for energy consumption and GHG emissions reporting system, reports annually publicly energy consumption and GHG emission targets and achievement of those, and publish a general facility level overview of the energy consumption and the GHG emissions. At the level AAA there needs to be performed external inspection for scope 1 and scope 2 GHG emissions reporting system. Target organization is already reporting part of the scope 3 GHG emissions so it has a 50 % compliance with level AAA requirements already.

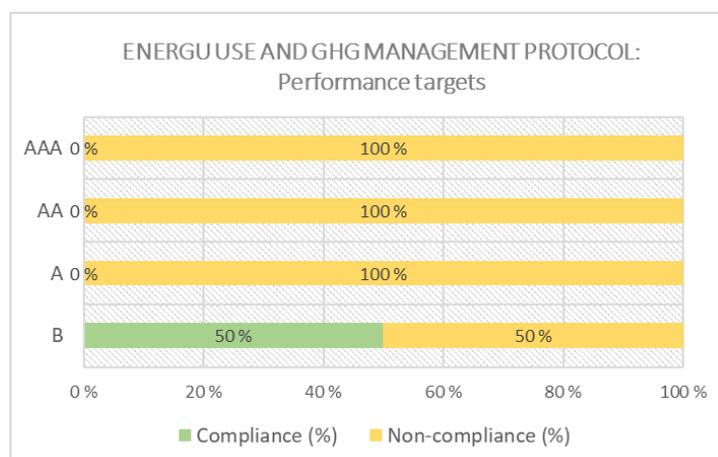


Figure 37. Self-assessment of energy use & GHG management, performance indicator 3

Target organization reached 50 % of the level B requirements from the energy use and GHG performance targets performance indicator (Figure 37). In order to reach full level B compliance, organization needs to set targets for facility level energy consumption. Organization already have a GHG targets but energy consumption targets for facility level are missing. In addition, there needs to be a plan how these targets are achieved. Level A can be reached if these energy consumption and GHG targets are achieved during the reporting year. At the level A organization also needs to take into account significant energy consumption sources as well as financial, operational and commercial conditions, legal demands, technical possibilities, stakeholder aspects and possibilities to improve energy efficiency when it defines its facility level targets. Level AA requires measurable performance target for renewable energy usage and actual achievement of that as well as achievement of other energy consumption and GHG emission reduction target during the three years counting from the last four years. Also at the level AA energy consumption and GHG emissions target results needs to be inspected internally.

The highest level AAA requires that results from energy consumption and GHG emissions management are externally audited and that business strategies or projects fulfils at least two of the following:

- the required rate of return is defined for investments, which determines whether a project to reduce energy consumption or greenhouse gas emissions is implemented and implementation of investments is evaluated,
- targets for continuous improvement are set where the reduction of energy use is based on past trends,
- investments in new technologies and / or processes have led to significant reductions in energy use.

5.1.6 Health and safety

Target organization achieved 50 % compliance of level B requirements in health and safety policy, commitment and accountability (Figure 38). In order to fulfil all level B requirements, organization needs to inform its health and safety general principles for all facility level contractors and to other relevant stakeholders. At the moment communication has been done only to organization's own employees. For level A organization needs to make sure

that its policy and commitments fulfil TSM general guiding principles. Level AA requires internal audit and level AAA external audit.

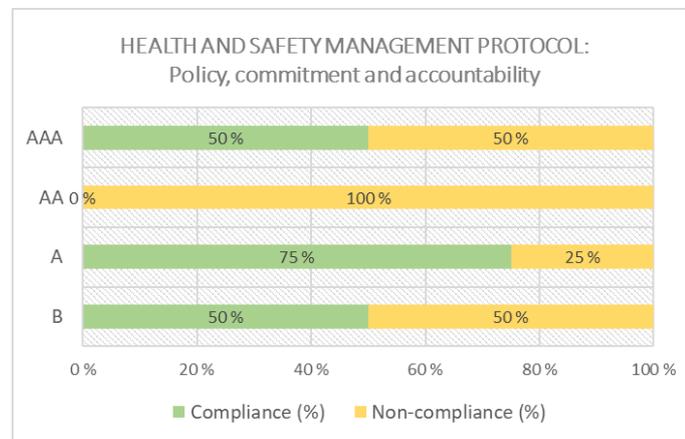


Figure 38. Self-assessment of health & safety management, performance indicator 1

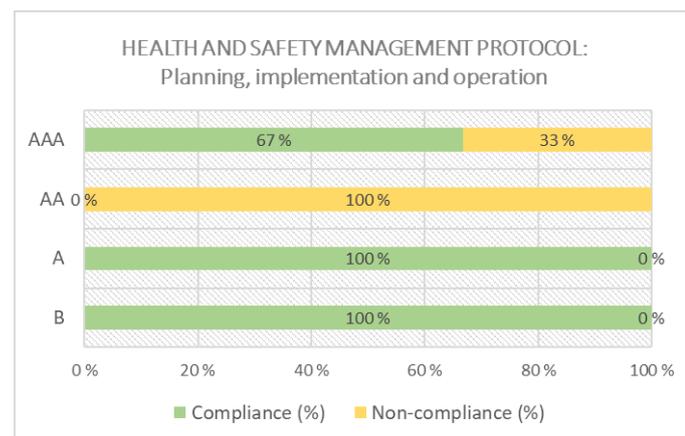


Figure 39. Self-assessment of health & safety management, performance indicator 2

Figure 39 shows that target organization has a full compliance with level B and A requirements regarding the health and safety planning, implementation and operation. Annual evaluation how sites operation exceeds the legal demands in planning, implementation and operation is required to improve organization result to level AA. Level AA also requires target setting above the legal demands regarding cooperation, prevention of accidents and continuous improvement of operation. In addition, every third year implementation of risk assessments and suitability of used methods needs to be assessed in order to confirm development of health and safety practices. In level AA internal audit needs to be performed to confirm

that planning, implementation and operation is in accordance with level A and AA requirements. Independent external audit is required for level AAA to confirm that planning, implementation and operation fulfils level A, AA and AAA demands.

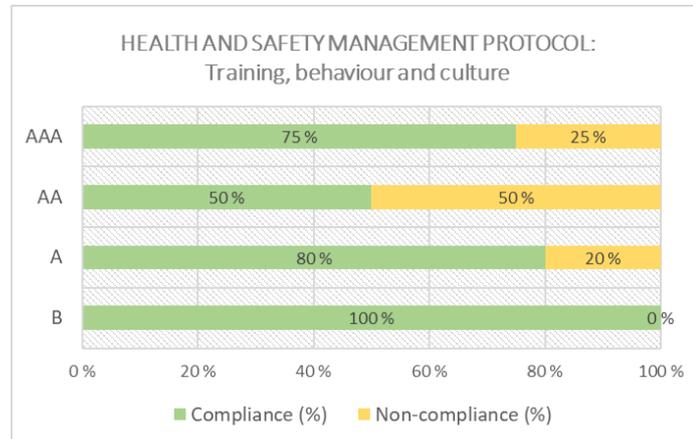


Figure 40. Self-assessment of health & safety management, performance indicator 3

Training, behavior and culture is the third performance indicator in health and safety management protocol. Target organization was in level B according to the self-assessment and fulfilled 80 % of the level A requirements (Figure 40). In order to improve its operation to level A, organization needs to arrange risk based health and safety trainings and all trainings as well as health and safety practices needs to be based on the risk assessments. For level AA organization needs to assess annually content and update needs of the health and safety practices, content of trainings and training methods. Level AA requires also that health and safety trainings content needs to be developed so that it increases the health and safety knowledge of employees and contractors. Level AAA requires independent external audit.

As Figure 41 presents, target organization is on the level B regarding the monitoring and reporting performance indicator, fulfils 75 % on level A requirements and 50 % of level AAA requirements. In order to reach level A full compliance, organization needs to include results of risk assessments and actions based to those risk assessment to its health and safety monitoring and reporting system. At the level A there is also needed health and safety audit programme. Level AA requires internal audit for performance indicator and the highest level AAA external audit.

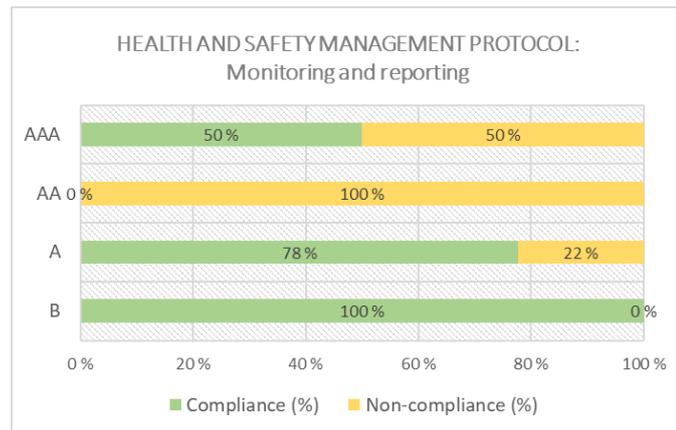


Figure 41. Self-assessment of health & safety management, performance indicator 4

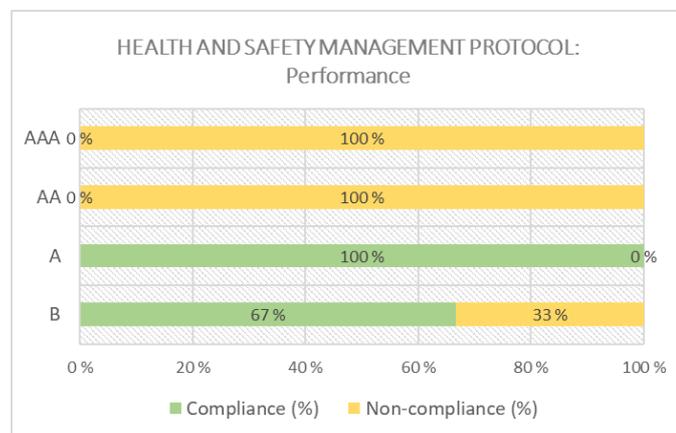


Figure 42. Self-assessment of health & safety management, performance indicator 5

Organization fulfilled 67 % of level B requirements and all level A requirements according to the self-assessment (Figure 42). Full level B compliance requires that organization sets health and safety targets annually also for site level contractors. Health and safety performance level AA requires that site level health and safety results are in-line with general level in the industry and that internal audit has performed to facility. Level AAA requires independent external audit as well as accident rate under 5 and that organization has achieved its continuous improvement targets at least during the three years of four.

5.1.7 Crisis management

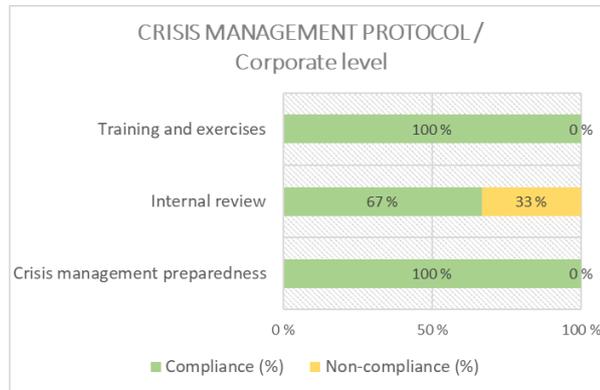


Figure 43. Self-assessment of corporate level crisis management

The crisis management protocol is assessed separately in the corporate level and in the facility level regarding the three different performance indicators: training and exercise, internal review and crisis management preparedness. Protocol does not include performance levels from C to AAA so only compliance levels per performance indicators are presented in figures 42 and 43. Case organization as well as Boliden AB as corporate fully compliances with the training and exercise as well as crisis management preparedness. In order to gain full compliance with the internal review, on corporate level as well as on facility level the crisis management team (CMT) members needs to be given induction to the crisis management plan within the three months.

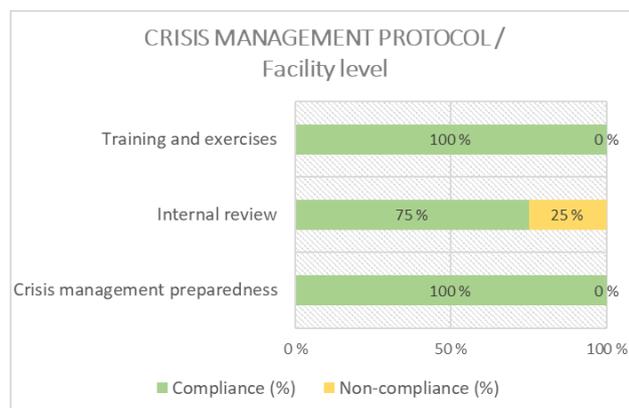


Figure 44. Self-assessment of facility level crisis management

5.1.8 Mine closure

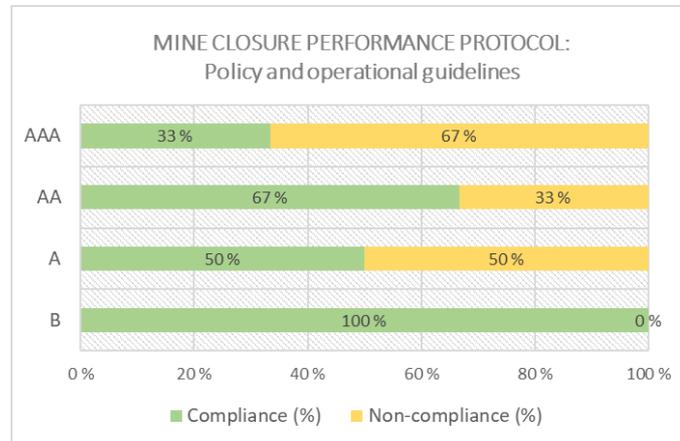


Figure 45. Self-assessment of mine closure, performance indicator 1

First performance indicator in mine closure protocol is policy and operational guidelines. Target organization achieved fully compliance in level B requirements, 50 % compliance in level A requirements, 67 % compliance in level AA and 33 % in level AAA requirements (Figure 45). In order to achieve level A full compliance, organization needs to update its own closure principles and commitments according to the TSM general guiding principles and prepare these in cooperation with the relevant stakeholders. Level AA requires internal audit and level AAA external audit. Level AAA requires also that organization strived to find actions how negative social impacts could be minimized due to mine closure.

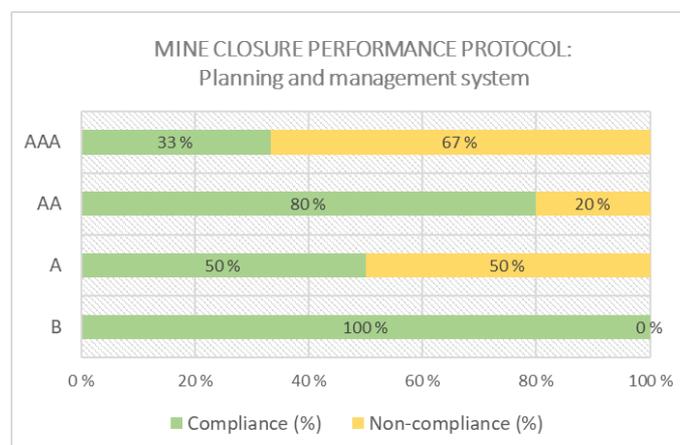


Figure 46. Self-assessment of mine closure, performance indicator 2

Mine closure planning and management system performance indicator could be improved to level A if target organization would update its closure plan in cooperation with the relevant stakeholders or ask comments of the closure plan from stakeholders (Figure 46). Organization also needs to prepare communication plan for post-closure time in cooperation with the stakeholders. Level A also requires that closure plan is update more often what environmental permit requires and stakeholder feedback is taken into account in the update process if possible. In addition, there needs to be responsible manager nominated for mine closure.

Level AA could be achieved if closure plan is assessed in the internal audit. Level AAA could be achieved if organization shares its best practices regarding closure for other mine sites and presents actions how negative social impacts could be avoided. Level AAA requires also that company has committed to actions regarding municipality level changes due to mine closure and has set a budget for these actions. Official and independent external audit is also required in order to reach level AAA full compliance.

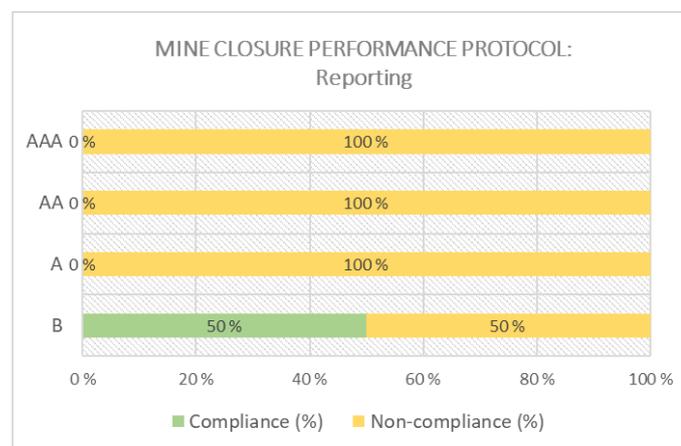


Figure 47. Self-assessment of mine closure, performance indicator 3

Target organization achieved 50 % compliance in mine closure reporting performance indicator and none of the level A, AA or AAA requirements (Figure 47). Full compliance could be achieved if organization would report publicly its updates to environmental guarantees. Level A requires that closure actions are reported through external communication practices and in stakeholder cooperation group. Reporting needs to also include information about set guarantees, update of guarantees and information of provisions recorded in the company's balance sheet. In addition, feedback needs to be collected from stakeholder regarding closure

actions and feedback needs to be taken into account in operations continuous improvement actions. Level AA requires reporting of closure targets and internal audit for reporting practices. Level AAA requires more comprehensive reporting content as well as external audit for mine closure reporting practices.

5.2 Finnish TSM alignment to ISO standards

The target organization was developing the environmental management system according to the standard ISO14001, occupational health and safety system according to the standard ISO45001 and energy management system according to the standard ISO50001 while the implementation of Finnish TSM was also ongoing. The overall target is to achieve multi-certification of all these three ISO standards. Because of this, combination possibilities of ISO standards and Finnish TSM were recognized during this study in order to enable efficient implementation with current available resources.

The International Organization for Standardization (ISO) develops and publish international standards. Management system standards are one of the most popular standards providing a model how to implement and operate different management systems such as ISO 14001 for environmental management or ISO 45001 for safety management. ISO standards are based on the Plan-Do-Check-Act (PDCA) model that strives to continuous improvement (Figure 48).

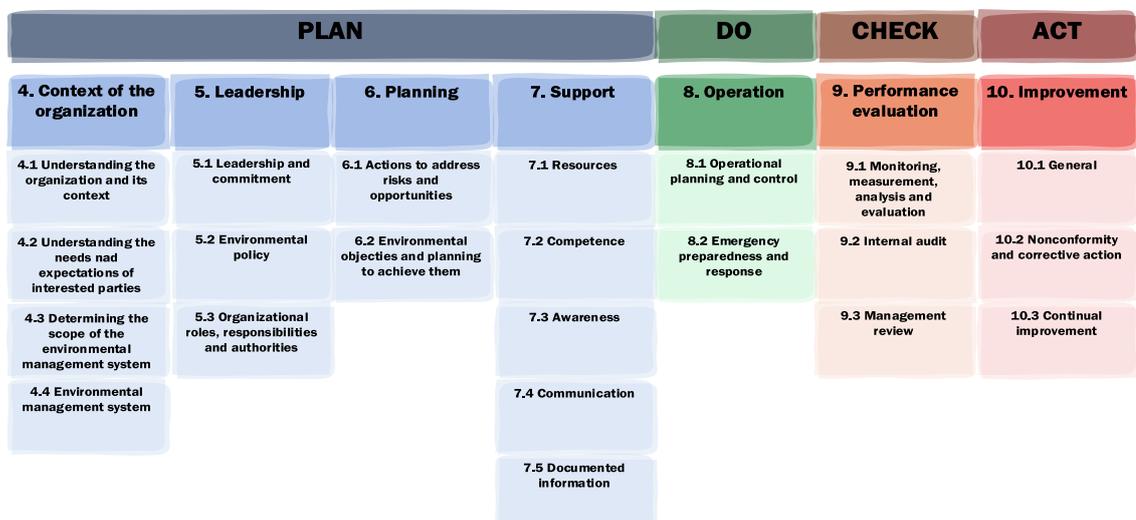


Figure 48. ISO14001 Environmental Management standard content in PDCA –model

After the all TSM protocol self-assessment workshops were held, the actions required to improve each of the protocol status were identified. Actions were classified to four categories which were: need of written documentation, stakeholder cooperation, communication and audits. From each protocol was identified what type of written documentation is needed in order to create practices according to the TSM standard. It was also recognized from each protocol which topics needs stakeholder cooperation and public communication. In order to develop performance to level A, AA or AAA, different type of internal and external audits are required so those were identified separately. Classification of actions into these categories helped to place actions to step to milestone plan (STMP) project template (Figure 49). Purpose of the STMP was that milestones were different performance levels in each protocol. Tasks were placed under each performance level and estimated time to complete the task was allocated. Companies who have committed to Finnish TSM system are also committed to improve their performance to level A in each protocol so STMP timeline supports this commitment.



				Start Date
				30-dec
Area	Deliverable	Responsible	Project Member	Week 1
Planned Absence	Name 1			
	Name 2			
	Name 3			
	Name 4			

Figure 49. Example of step to milestone plan (STMP) template in Boliden

After the STMP creation, the similarities of each protocol performance indicator (PI) and ISO standard content were identified. The aim was to find places where ISO standards and Finnish TSM overlaps and where existing ISO standard documentation could be modified to be suitable with Finnish TSM requirements. This saves time and resources as duplicate documentation and continuous update of the documentation is not needed. Most of all there were alignments with the environmental management system standard ISO14001 (Table 8).

Table 8. Content of ISO14001, ISO45001 and ISO50001 standards compared to Finnish TSM standards (PI = Performance indicator)

ISO standards			Towards Sustainable Mining Standards								
Section	ISO14001	ISO45001	ISO50001	1. Community outreach	2. Biodiversity Conservation	3. Tailings Management	4. Water Management	5. Energy and GHG emissions	6. Health and Safety	7. Crisis Management	8. Mine Closure
4.2	x x	x	x	PI 1.1, PI 1.2, PI 1.3, PI 1.4	PI 2.2	PI 3.2	PI 4.2				
5.2	x x				PI 2.1	PI 3.1	PI 4.1				PI 8.1
6.1	x x	x					PI 4.2		PI 6.2, PI 6.3	PI 7.1	
6.2	x	x	x					PI 5.3	PI 6.5		
6.6	x		x					PI 5.2			
7.2	x x	x x							PI 6.3	PI 7.2	
7.4	x x x	x	x	PI 1.2						PI 7.1	PI 8.2, PI 8.3
8.1	x x		x		PI 2.3	PI 3.1, PI 3.2, PI 3.3, PI 3.4, PI 3.5	PI 4.1, PI 4.2, PI 4.3		PI 5.1	PI 6.1	PI 8.1, PI 8.2
8.2	x	x				PI 3.5				PI 7.1, PI 7.3	
9.1	x	x					PI 4.4		PI 6.4		

Community outreach protocol could be emerged to all of the three (ISO14001, ISO45001, ISO50001) standards. ISO standard section 4.2 is for understanding the needs and expectations of interested parties/stakeholders and section 7.4 is for communication. Biodiversity conservation protocol could be combined with ISO14001 standard to sections 4.2, 5.2 and 8.1. ISO14001 standard section 5.2 is for environmental policy and if the policy includes commitment to biodiversity conservation it is suitable for both management systems. Section 8.1 of ISO standard is for operational planning and control and there biodiversity management plan could be proposed. Tailings management protocol can be aligned with ISO14001 standard sections 4.2, 5.2 and 8.1, and to both ISO14001 and ISO45001 regarding the performance indicator 3.5. Water management protocol could be implemented with ISO14001 standard to standard sections 4.2, 5.2, 6.1, 8.1 and 9.1. Energy and GHG emissions protocol could be combined with both, environmental management system ISO14001 and energy management system ISO50001 to the standard sections 6.2, 6.6 and 8. Health and safety management protocol could be implemented to ISO45001 standard sections 6.1, 6.2, 7.2, 8.1 and 9.1. Crisis management protocol fits to both ISO14001 and ISO45001 standards for the ISO standard sections 6.1, 7.2, 7.4 and 8.2. Mine closure performance protocol could be combined with ISO14001 standard sections 5.2, 7.4 and 8.1.

6 RESULTS

The selected research questions in this thesis were:

- What are the case organization's gaps in the sustainability management compared to the Finnish Towards Sustainable Mining standard?
- How to fill those recognized gaps?
- How Finnish Towards Sustainable Mining standard can be used beside the most commonly used ISO standard management systems?

The target organization's gaps compared to the Finnish Towards Sustainable Mining Standards were identified with the seven different self-assessment workshops which consisted participants from several different professions from the target organization. After the gaps were identified, the study developed a step to milestone plan (STMP) in order to achieve committed level A in each standard protocol performance. Gaps were also classified according to what type of action it requires from target organization: new written documentation, stakeholder cooperation, communication or performance of different type of internal or external audits. During the study it was also recognized how each standard can be used beside the most widely used ISO management standards and where are the overlaps of these management systems. Implementation of multiple different management systems or standards creates also extra costs for organizations so finding the most effective and smart way of managing all these system was identified important factor during the study. The selected ISO standards were ISO14001 for environmental management systems, ISO45001 for occupational health and safety management systems and ISO50001 for energy management systems because target organization had a target to gain multi-certification to all these three standards. It was find out that the Finnish TSM consolidation with the ISO14001 standard is the easiest as the TSM standard contents can be combined under the environmental aspects in ISO14001.

7 DISCUSSION

The objective of this study was to analyze the content of Finnish Towards Sustainable Mining Standard (TSM) and find gaps between the target organizations practices and the standard requirements. Aim was also find how the Finnish TSM standard could be combined with the most widely used ISO standards in the mining field (ISO14001, ISO45001, ISO50001).

7.1 Reliability and validity of the study

Quality of the completed study is described through the research concepts reliability and validity. Reliability of study describes the applicability of the completed study research in a different research setting. If the achieved results from the research setting can be replicated with the same research study design, the research can be noted to be reliable. Validity of the study describes the accuracy of the analysis, suitability of the used measurements and generalizability of the study findings. (Eskola & Suoranta, 1998).

In a qualitative study the analysis phase of the data and the reliability assessment cannot be separated as sharply as in a quantitative study. For this reason qualitative studies have been criticized for the obscurity of the reliability criterias. Qualitative study gives more freedom for researcher to work back and forth with the different phases of the study compared to the quantitative study. (Eskola & Suoranta, 1998).

In a qualitative research the main criteria for reliability is the researcher itself, since researcher makes the data collection in the qualitative study. So it can be stated that the researcher is the main research tool for the whole research study. Research arrangement of this study was that researcher of the study is working in the case organization. Validity of this study could be improved by investigation other case company's sites or by visiting other mining companies in Finland. This was not possible to conduct in the limited amount of resources and time that was budgeted for the study. At this study observations are based on the one mine site operation in the case organization.

7.2 Applicability of the study

The target organization of the study was implementing the ISO 14001, ISO 45001 as well as ISO 50001 during the same time with the Finnish TSM system. The results of this study can be utilized in the other large scale mining companies operating in Finland as well as in other mining companies who work in order to harmonize ISO standards with Towards Sustainable Mining (TSM) system which is based on the Mining Association of Canada (MAC) TSM model. The results of this study help organizations to build effective, harmonized multi-certificate management system that takes account the Finnish TSM requirements beside the most commonly used ISO management systems. The harmonization of the sustainability initiatives and standards is vital in order to limit duplicate work for different standards and so to save time and money of the companies.

8 CONCLUSIONS

In the mining sector there are currently available sustainability initiatives for gold, silver and platinum production that takes account the whole supply chain of the metal from upstream processes to downstream processes. This type of sustainability initiative does not currently exist for metal minerals and all studied initiatives focuses only to exploration and mining (Figure 50). Sustainability initiatives, which companies are using, should be selected based on where the operation takes places as different initiatives have emphasis on different sustainability aspects. That is the reason why prioritization of different used sustainability initiatives can differ from county to another.

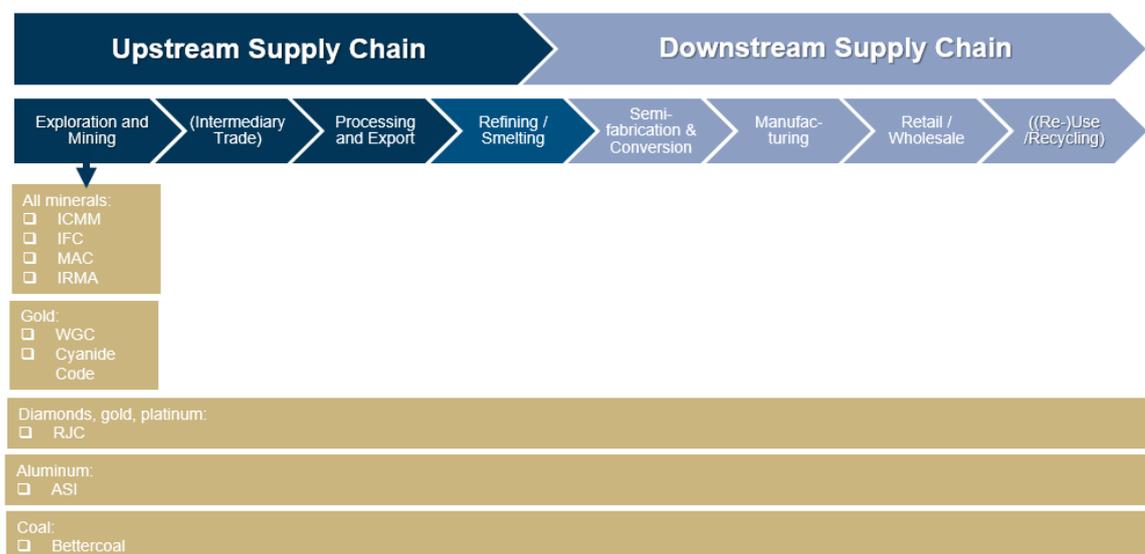


Figure 50. Large-scale mining sustainability initiative grouping according to supply chain coverage (Source: adjusted according to (Kickler & Franken, 2017)).

The implementation of the Finnish TSM system is currently ongoing in the several mining companies operating in Finland. Self-assessment results have been reported to the Network of Sustainable Mining in 2019 and 2020. Probably self-assessment results are directional before the first third party audit has been conducted for sites. The nature of TSM standards are different compared to the other facility level standards (like ISO standards) as the lowest level of performance is operation according to the Finnish legislation. It was noticed that during the self-assessments workshops that these performance level criteria's are often forgotten when assessment is done. In the TSM standards there are also several references to

other comprehensive guidance documents such as MAC Tailings Guide or MWEI BREF documentation so in order to perform self-assessment the participants to self-assessment workshops must be well aware of all these multiple guidance document contents. The Finnish TSM system could be improved to that the amount of the reference documents referred are minimized and additional check list could be provide for support the self-assessment processes. The collection of company level sustainability data for CSR reports could also be improved so that the data is in the form and in standardized units where it can be easily used and compared. Clear definitions what different report sections means and how they are extracted (such as emission) could be implemented for the TSM system.

As the target organization is part of the Swedish Boliden Mineral AB corporation, the recommendation is to make Boliden corporate level personnel more aware of the Finnish TSM standards. Many of the gaps are concerning the missing documentation or internal audit practices so these could be easier to take into use at the facility level if corporate level documentation is already following the Finnish TSM or MAC's TSM system. The Finnish TSM system relies a lot of stakeholder cooperation, the another recommendation for the target organization is to set up the stakeholder cooperation group as well as take into use documented electronic system for stakeholder communication. When the stakeholder cooperation group starts its regular meetings, it can be assumed that comments, concerns, aspects from them increases little by little so it could be good to document these easily to one system. In addition, if other Boliden sites take the Finnish or MAC's TSM system or at least best practices from those systems into use, could stakeholder communication be followed more easily from each site. This could also gain more board understanding even to corporate level of stakeholder concerns and values. The third recommendation for target organization is to point responsible persons for each recognized tasks in the step to milestone plan (STMP) and start regular follow-up meetings for TSM system implementation where progress of the system building is followed among cross-organizational working groups. Self-assessment done once a year basis is too rare when system is in ramp-up phase.

In addition, target organization's communication functions are based on a corporate level and as performance according to the Finnish TSM standard requires a lot of internal as well as external communication, it is recommended that communication practices are imple-

mented more to facility level operations. Target organization Boliden AB is already following several sustainability initiatives such as ICMM, SDF and GRI. The Finnish TSM system fulfils the coverage of sustainability issues well as there are no any facility or site level initiative for sustainability issues already in use.

During the study it was noticed that there are several sustainable initiatives for tailings management so future studies could focus on how to all these tailings requirements work together and how to create a tailings management system that fulfils all the regulations in a facility level. The growing amount of different sustainability initiatives concerning the same issues but from slightly different angles or different context increases the confusion inside the companies as well as among stakeholders. Increased complexity of sustainability initiatives can also weaken how well these are implement to organizations and how good information from these can be provide to stakeholders. Thus, there could be a great possibility for the Finnish TSM standard to be overarching joint framework for mining sustainability issues if standard content could be developed more to cover widely sustainability topics. In addition, it was noticed that the most commonly referred sustainability model is a so-called model for ‘weak sustainability’. Future research could focus on how mining industry could implement a ‘strong sustainability’ model to its operations and so, to for example TSM standard.

As there are no own separate sustainability initiative for metal minerals such as copper or nickel, a future studies could also focus on what type of issues these initiatives should include if one could be created. Sustainability initiative that takes account one mineral all downstream and upstream processes could gain competition and put pressure even more to development of sustainability topics among metal mineral mining companies. These type of sustainability initiatives already exist for example for gold (Responsible Jewellery Council, RJC) and aluminium (Aluminium Stewardship Initiative, ASI).

REFERENCES

Azapagic, A., 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production*, 12(6), pp. 639-662.

Canada, T. M. A. o., 2017. *A Guide to the Management of Tailings Facilities*. [Online] Available at: https://mining.ca/wp-content/uploads/2019/02/MAC-Guide-to-the-Management-of-Tailings-Facilities-2017_0.pdf [Accessed 9 September 2020].

Carroll, A. B., 1991. The pyramid of corporate social responsibility: toward the moral management of organizational stakeholders. *Business horizons*, Volume 34 (4), pp. 39-48.

CDP Worldwide, 2020. *CDP*. [Online] Available at: <https://www.cdp.net/en> [Accessed 30 September 2020].

Eerola, T. & Sofia, Z., 2013. *Sosiaalinen toimilupa kannustaa kaivosyrityksiä yhteiskuntavastuullisuuteen*. [Online] Available at: https://www.academia.edu/19618815/Sosiaalinen_toimilupa_kannustaa_yrityksi%C3%A4_yhteiskuntavastuullisuuteen [Accessed 16 September 2020].

Eskola, J. & Suoranta, J., 1998. *Johdatus laadulliseen tutkimukseen*. Tampere: Vastapaino.
Esposito, M., 2018. *Driving the Sustainability of Production Systems with Fourth Industrial Revolution Innovation*. [Online] Available at: <https://www.weforum.org/whitepapers/driving-the-sustainability-of-production-systems-with-fourth-industrial-revolution-innovation> [Accessed 4 October 2020].

EU, 2018. *Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries*. [Online] Available at: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/best-available-techniques-bat-reference-document-management-waste-extractive-industries> [Accessed 23 August 2020].

European Commission, 2020. *Corporate Social Responsibility & Responsible Business Conduct*. [Online] Available at: https://ec.europa.eu/growth/industry/sustainability/corporate-social-responsibility_en [Accessed 3 August 2020].

Filer, C., 2002. *Implications of the "Mining, Minerals and Sustainable Development" Project*, Australia: Australian National University.

Finnish Environment Institute, 2019. *Tutkimusta ja kokeiluja kestävän kaupungistumisen edistämiseksi*. [Online]

Available at: <https://www.syke.fi/kaupungistuminen>

[Accessed 6 August 2020].

Fraser Institute, 2020. *Fraser Institute Annual Survey of Mining Companies, 2019*.

[Online]

Available at: <https://www.fraserinstitute.org/sites/default/files/annual-survey-of-mining-companies-2019.pdf>

[Accessed 2 August 2020].

Global Compact Suomi, 2020. *Global Compact Suomi*. [Online]

Available at: <https://www.globalcompact.fi/>

[Accessed 23 September 2020].

Global Reporting Initiative, 2020. *Global Reporting Initiative*. [Online]

Available at: <https://www.globalreporting.org/standards/getting-started-with-the-gri-standards/>

[Accessed 9 September 2020].

Global Tailings Review, 2020. *Global Industry Standard on Tailings Management*.

[Online]

Available at: https://globaltailingsreview.org/wp-content/uploads/2020/08/global-industry-standard_EN.pdf

[Accessed 2 September 2020].

Government of Canada, 2019. *Government of Canada*. [Online]

Available at: <https://www.tradecommissioner.gc.ca/canadexport/0003604.aspx?lang=eng>

[Accessed 19 October 2020].

GRI, 2010. *Sustainability Reporting Guidelines & Mining and Metals Sector Supplement*, s.l.: GRI.

ICMM, 2020. *Mining Principles*. [Online]

Available at: <https://www.icmm.com/mining-principles>

[Accessed 3 October 2020].

IFC, 2020. *Our Governance*. [Online]

Available at:

https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/about+ifc_new/IFC+Governance

[Accessed 28 September 2020].

International Institute for Environment and Development, 2009. *Mining, Metals and Sustainable Development (MMSD)*. [Online]

Available at: <https://www.iied.org/mining-minerals-sustainable-development-mmsd>

[Accessed 16 September 2020].

ISO, 2010. *Guidance on social responsibility (ISO 26000)*. First edition ed. Switzerland: Finnish Standards Association SFS.

Jussila, M., 2010. *Yhteiskuntavastuu. Nyt..* s.l.:Infor.

Kestävän kaivostoiminnan verkosto, 2017. *Kaivosvastuu*. [Online]
Available at: <https://www.kaivosvastuu.fi/verkosto/jasenet/>
[Accessed 16 October 2020].

Kestävän kaivostoiminnan verkosto, 2017. *Kaivosvastuu.fi*. [Online]
Available at:
https://www.kaivosvastuu.fi/app/uploads/2017/03/Kaivosvastuujarjestelma_EN_13-03-17.pdf
[Accessed 26 August 2020].

Kestävän kaivostoiminnan verkosto, 2020. *Arviointityökalut*. [Online]
Available at: <https://www.kaivosvastuu.fi/arviointityokalut/>
[Accessed 28 August 2020].

Kickler, K. & Franken, G., 2017. *Federal Institute for Geosciences and Natural Resources*. [Online]
Available at:
https://www.bgr.bund.de/EN/Themen/Min_rohstoffe/Downloads/Sustainability_Schemes_for_Mineral_Resources.pdf?__blob=publicationFile&v=6
[Accessed 30 August 2020].

Kokko, K. et al., 2013. *Hyvä kaivos pohjoisessa*. [Online]
Available at:
<https://lauda.ulapland.fi/bitstream/handle/10024/59504/Hyv%c3%a4%20kaivos%20pohjoisessa.pdf?sequence=3&isAllowed=y>
[Accessed 21 August 2020].

Lempiäinen, S., 2019. *Kaivosyrityksen yhteiskuntavastuu ja rooli alueen kehittämisessä: Tapauksena Hannukaisen kaivoshanke*, s.l.: Oulun Yliopisto, Maantieteen tutkimusyksikkö.

Minefacts, 2020. *Minefacts*. [Online]
Available at: <https://www.minefacts.eu/geologia-ja-kaivostoiminta>
[Accessed 8 August 2020].

Ministry of Economic Affairs and Employment of Finland, 2013. *Action Plan for Development of Sustainable Extractive Industries*. [Online]
Available at:
https://tem.fi/documents/1410877/2851374/Suomi_kestavan_kaivannaisteollisuuden_edellakavijaksi_-_toimintaohjelma.pdf/3bcf1791-f551-444d-b8ea-ab8832829c0d/Suomi_kestavan_kaivannaisteollisuuden_edellakavijaksi_-_toimintaohjelma.pdf
[Accessed 2 October 2020].

Ranängen, H. & Lindman, Å., 2017. A path towards sustainability for the Nordic mining industry. *Journal of Cleaner Production*, Volume 151, pp. 43-52.

Responsible Mining, 2018. *IRMA Standard for Responsible Mining*. [Online]
Available at: https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018.pdf
[Accessed 26 September 2020].

Ruokonen, E., 2020. Preconditions for successful implementation of the Finnish standard for sustainable mining. *The Extractive Industries and Society*, 7(2), pp. 611-620.

Sairinen, R., 2018. *Collaboration*. [Online]
Available at: <http://www.collaboration.fi/2018/05/24/sosiaalinen-toimilupa-vihelijaisten-kaivos-ja-ilmasto-ongelmien-tyokaluna/>
[Accessed 4 August 2020].

Shinglespit Consultants Inc, 2018. *Social License*. [Online]
Available at: <http://sociallicense.com/definition.html>
[Accessed 4 August 2020].

Suomela, P., 2020. *Turun Sanomat*. [Online]
Available at:
<https://www.ts.fi/lukijoilta/5021503/Vastuullisesti+tuotettujen+metallien+alkupera+on+tie+dossa>
[Accessed 2 August 2020].

Suomen YK-liitto, 2017. *Suomen YK-liitto*. [Online]
Available at:
https://www.ykliitto.fi/sites/www.ykliitto.fi/files/media/Agenda2030_pikkukirjanen_2017.pdf
[Accessed 23 September 2020].

Tenberg, M. et al., 2017. *Barentsin alue muuttuu - miten Suomi sopeutuu?*. [Online]
Available at: https://tietokaytoon.fi/documents/10616/3866814/31_barentsin-alue-muuttuu-miten-suomi-sopeutuu-2-.pdf/cebfd69d-a0cb-4265-a983-e2f529c629d4?version=1.0
[Accessed 8 August 2020].

The Finnish Innovation Fund Sitra, 2015. *Suomen ensimmäinen kaivosten yhteiskuntavastuuraportti*. [Online]
Available at: <https://www.sitra.fi/uutiset/suomen-ensimmainen-kaivosten-yhteiskuntavastuuraportti/>
[Accessed 12 October 2020].

The Finnish Network for Sustainable Mining, 2016. *Finnish sustainability standard for mining translated into English*. [Online]
Available at: <https://www.kaivosvastuu.fi/finnish-sustainability-standard-for-mining-translated-into-english>
[Accessed 7 October 2020].

The Ministry of Employment and the Economy, 2010. *Finland's Minerals Strategy*. [Online]

Available at:

http://projects.gtk.fi/export/sites/projects/mineraalistrategia/documents/FinlandsMineralsStrategy_2.pdf

[Accessed 6 August 2020].

The World Bank, 2020. *Minerals for climate action: The mineral intensity of the clean energy transition*. [Online]

Available at: <http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf>

[Accessed 30 August 2020].

The World Economic Forum (WEF), 2015. *Voluntary responsible mining initiatives - a review*. [Online]

Available at:

http://www3.weforum.org/docs/Voluntary_Responsible_Mining_Initiatives_2016.pdf

[Accessed 27 August 2020].

UN Global Compactin kymmenen periaatetta -koulutus. 2020. [Film] Suomi: Keskuskauppakamari.

United Nations, 1987. *UN Sustainable Development goals*. [Online]

Available at: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

[Accessed 15 August 2020].

United Nations, 2020. *The 2030 Agenda for Sustainable Development*. [Online]

Available at: https://ec.europa.eu/environment/sustainable-development/SDGs/index_en.htm

[Accessed 5 August 2020].

World Bank Group, 2017. *The Growing Role of Minerals and Metals for a Low Carbon Future*. [Online]

Available at:

<http://documents.worldbank.org/curated/en/207371500386458722/pdf/117581-WP-P159838-PUBLIC-ClimateSmartMiningJuly.pdf>

[Accessed 4 October 2020].

Öster, H., 2016. *Suomen Akatemia*. [Online]

Available at: <https://www.aka.fi/fi/akatemia/media/Ajankohtaiset-utiset/2016/tutkimus-vie-kohti-kestavaa-kaivostoimintaa-ja-materiaalitehokkuutta/>

[Accessed 4 August 2020].