

Overview

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Industry is continually adapting to new environmental, social and governance (ESG) legislation and the evolving international paradigm on sustainable development, first captured by the 1992 Rio Declaration and now represented by the 2015 Sustainable Development Goals. ESG legislation in most countries has become more complex and will continue advancing, aligning with national challenges and international vision.

Where enforcement of ESG legislation is weak, pressure to manage impacts persists. Lenders, investors, affected communities, employees and consumers are demanding this.

Standards and assurance, rating and reporting mechanisms have proliferated, aiming to provide stakeholders with insight on ESG risks and performance.

Leading examples are the new ICCM Performance Expectations and the regularly renewed Equator Principles and IFC Performance Standards.

Financial reporting authorities and stock exchanges are encouraging listed companies to demonstrate good ESG performance with codes and guidance that are becoming complex.

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Overview (continued)

The London Stock Exchange's recent publication of guidance on ESG reporting reflects the reality that ESG is now a core part of the investment decision process.

This guidance also highlights the interest of equity investors in climate change impacts and energy management.

Increasingly, ESG risks are materially influencing the value of mining and other assets. The main areas of ESG risk are the permitting of new projects, water and waste management, climate action, social licence to operate and closure.

Permitting is protracted in many jurisdictions; it can take several years to obtain permits to develop new mines.

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Jane, MSc, PrSciNat, is a Corporate Consultant and has 26 years of experience providing ESG consulting services to the mining industry in Africa, Europe and Central Asia. She is a specialist in environmental impact assessment, management and auditing. To date, Jane has been directly involved in planning over 30 mines and has undertaken environmental and social reviews of over 100 mining projects/operations.

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Biodiversity impacts are receiving more scrutiny in permitting processes, and procedures to demonstrate no net loss are becoming more complex.

Stakeholders' capacity to participate in and challenge permitting processes is strengthening.

While social licence fundamentals are becoming better defined, maintaining a social licence has become more demanding.

Compliance is also becoming a significant risk. It is no longer enough to acquire permits: compliance with the conditions of the approvals and agreements is receiving more attention. Fines for noncompliance are becoming costly and regulators are using their powers to stop operations until remedies addressing serious non-compliance are in place.

SRK understands the ESG challenges confronting our clients and this newsletter shows how we provide support to address these. It also showcases our technical depth in the mining sector.

While our focus is mining, SRK's environmental and social management practitioners also work extensively in other sectors, notably infrastructure for mining assets. Our African offices regularly consult with the energy, agribusiness and manufacturing sectors.

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Habitat loss in the Republic of Congo (Congo) from subsistence agriculture, logging and charcoal making has led to a decline in biodiversity of tropical rainforests. Add the challenges of a growing population, climate change and a struggling economy. SRK has undertaken an environmental and social impact assessment (ESIA) of the proposed Kola Potash Mine in a sensitive location in the Congo, between two protected areas, a national park and a nature reserve.

Kore Potash recognised the area's ecological importance and the requirement for detailed biodiversity baseline and impact assessment for the ESIA and wider project design. SRK worked with the client, project engineers, local and international non-governmental organisations (NGOs) and other stakeholders to identify means to avoid and reduce potential negative impacts on habitats and protected fauna. Among the questions addressed were 'how can an elephant safely cross a conveyor belt?' and 'should the construction schedule reflect turtle nesting periods?'

The ESIA created a platform and cyclical process (see figure) for all of these parties to think outside the box and share ideas.

Many innovative approaches were identified through the ESIA process, including:

- The overland conveyor belt carrying ore from the mine runs 35 km to the processing plant. Elevating the belt at two key locations, above known elephant migratory routes, creates 'animal underpasses'. These underpasses have noise insulating hooding, silent rollers and allow sufficient clearance for the largest mammals to not feel enclosed.

Effective use of the ESIA process to identify sustainable mining solutions



This would be the first use of a conveyor belt as an elephant underpass in a tropical habitat. Although animals can migrate freely, the remainder of the 35 km fenced conveyor corridor may deter poachers and illegal loggers from entering the national park.

- Renatura, a turtle conservation group, participated throughout the process will operate a turtle hatchling, nest and egg relocation program during construction to minimise the impact on turtles. Renatura operates in partnership with local communities, providing an indirect income source during the project in the conservation sector.
- A 2-nautical mile exclusion zone will prevent illegal fishing trawlers from operating in the area. This, in addition to the national park marine exclusion zone, will provide a crucial habitat for fish and the critically endangered Atlantic humpback dolphin. Community fishing boats will not be affected by the exclusion zone and will hopefully benefit from the improved fish stocks.
- Bubble curtains will be used during pile driving the steel piles required to construct the jetty and breakwater. This curtain will deter the Atlantic humpback dolphin and turtle species from entering construction zones. As part of this initiative, trained marine mammal observers will notify construction teams if species are observed within a defined radius of construction activities and all work will be stopped until the mammals clear the area. Monitoring technology will be used throughout construction and operation phases to record the number and behaviour of these critically endangered species, contributing crucial knowledge to the wider scientific community.
- Planting a forested corridor along the conveyor belt comprised of local fruit tree and shrub species will link isolated forest patches in the savanna dominated habitat. This will be essential for bird species and encourage animals to use the underpass routes but will also benefit communities who can maintain the corridor and utilise the produce to supplement their diets.

ALICE DAVIES

Alice, MSc, PIMEA, Senior Consultant, is a Practitioner Member of IEMA and has over 7 years of experience in the environment sector of the mining industry. She specialises in managing environmental and social impact assessments for large-scale mining and infrastructure projects in Europe and Africa. Alice is comfortable reporting within local environmental permitting requirements, good international industry practice and international financial lender requirements. She has a background in exploration geochemistry and an MSc in geochemistry.



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When implemented holistically, it is hoped these measures will halt the current habitat degradation and potentially improve the overall biodiversity of the area. This process fostered a productive and supportive relationship between Kore Potash and their stakeholders.

Effective ESIA management therefore played a key role in linking conscientious clients, open minded engineers and interested communities and NGOs to resolve difficult challenges with innovative and often mutually beneficial outcomes. Kore now has a unique opportunity to contribute to environmental conservation in the project area, with a vision to becoming the first sustainable mine in the Congo.

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Increasing attention is being focused on biodiversity impacts, deforestation and country climate change targets

Resettlement and mining activity in Ecuador



Family housing at the place of origin



Current home of the resettled family

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Relocating people or communities is generally related to an involuntary resettlement process, which implies a displacement that is physical (relocation or loss of housing), economic (loss of assets and/or sources of income) and/or sociocultural (loss of friends, neighbours, customs). This usually occurs when people and/or communities can't refuse the loss of their lands due to the change in their use, which means that they must leave them either through an expropriation process or through negotiated agreements.

However, sometimes resettlement can be voluntary. This was the case for a single family in Ecuador, whose housing, farming and grazing land were near a mining operation and away from roads that take them to the nearest town. The mining company, consistent with its policy of social responsibility and security, and the family jointly

evaluated relocation alternatives. The family, after several meetings with the company, expressed their desire to be resettled to a place that offers them greater facilities to carry out their daily activities, such as caring for their small garden and the domestic animals they own. They also prioritised being closer to communication channels that facilitate their access to health services, visiting friends, connecting with other residents, and attending the religious services of their community.

For this reason, the company asked SRK to prepare a resettlement plan for this family that meets their expectations of residing in a place where they can improve the social, cultural/religious and economic aspects of their quality of life. The company would then implement the necessary mechanisms so that the resettlement is positive for the family.

SRK developed the resettlement plan following the IFC Performance Standard 5 on Land Acquisition and Resettlement. Studies were carried out on the socio-cultural characteristics of the family as well as the place of resettlement. The property of the family was valued as well as the property in the place of resettlement. The house and other facilities were designed and conditioned in the new environment, to meet the needs of the family. Finally, a timetable for implementing the resettlement plan was drawn up. This culminated in December 2018 with the installation of the family in their new home.

Since the time the family was relocated, the company has continued to meet with them weekly and to monitor their well-being.

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Do's and don'ts for local content management

To maximise the benefits of mineral resource exploitation, most resource rich countries have local content legislation in place. Benefits can come in a variety of ways from increasing employment levels, creating a more inclusive economy or increasing government revenues from taxation. Levers to achieve these can include: local procurement and employment practices; community investment; local processing; and capacity building. How these are used varies by location and is inherently linked with other national policies such as education, innovation, infrastructure and finance. These complexities can impair the effectiveness of local content legislation. International organisations such as the Inter-Governmental Forum for Mining and Sustainable Development and the OECD are developing guidance on this. SRK UK has produced a top ten do's and don'ts for local content management that draws on current thinking and good practice. These points are aimed at both industry and governments hosting projects, and demonstrate the collaborative effort essential for achieving positive change.

Ten do's and don'ts for local content management:

1. Do define 'local' based on area of impact and regional characteristics as well as government and regulatory body requirements.
2. Don't regard local content solely as a purchasing or contracting issue, include procurement human resources and community relations teams in preparing a local procurement implementation and monitoring plan.
3. Don't assume that local people are only capable of basic or unskilled work. Determine what skills are available locally that can be used and or developed to support manpower and supply requirements of the project.
4. Do map the supply chain to identify opportunities for different suppliers based on size, capacity and location.

5. Do explore how to maximise your local economic impact through the supply chain and look at how local companies can fulfil contracts.
6. Don't assume that a local branch of a national or international supplier or contractor is the same as a local supplier.
7. Do include a requirement for all contractors to provide work and training opportunities.
8. Do liaise with local businesses and government to develop a set of transparent procurement and employment criteria that includes a weighting for sourcing manpower and supplies within the defined local area.
9. Don't wait until the project has started to identify local employment and supplier opportunities across the project's life, prioritise this as soon as possible.
10. Do work with local government and training providers to maximise skills development and training opportunities required to work on the project and elsewhere post closure.

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DARRYLL KILIAN

Darryll, Partner and Principal Consultant, has significant experience in environmental policy, planning and assessment, gathered over 26 years of environmental work with both public and private sector clients. His projects include country strategy development, strategic environmental assessment, management frameworks, and state-of-environment reporting. He regularly participates in due diligence audits and reviews for companies and lenders and serves as project partner on large IFC-standard environmental and social impact assessments.

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NATASHA ANAMUTHOO

Natasha, Senior Environmental Scientist, has over 12 years of experience in environmental management. She has been involved in numerous mining, petroleum and industrial assessments within Africa. Natasha's experience has allowed her to work on large-scale mining, energy and cement related projects for clients, such as Anglo-American Platinum, ENRC, NYA, AngloGold Ashanti and PPC Cement. She holds a B.Soc.Sc. Honours degree in Environmental Management from the University of Kwa-Zulu Natal and is a certified Environmental Assessment Practitioner South Africa.

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Integrating environmental and social safeguards in regional power projects



SRK developed an environmental and social management framework (ESMF) for the Southern African power pool (SAPP). The framework will facilitate the screening of key power projects in line with lenders' requirements. A key obstacle to energy access is the existing power grid. SAPP, which coordinates and plans electricity supply to consumers in twelve countries in the Southern African Development Community, is busy improving the grid. In 2009, SAPP identified priority projects including hydropower schemes, wind and solar plants and transmission interconnectors to improve the Southern African region's power grid.

By 2011 many of these projects needed more developmental work. In response, with financial assistance from the World Bank, SAPP set up a project advisory unit to accelerate implementation.

One of this unit's first tasks was to commission technical specialists to help prepare an ESMF, to act as a reference manual for the high level environmental and social screening of projects – to strengthen assessment, mitigation and management of risks and impacts.

Developing the ESMF required consulting with all relevant SAPP structures and stakeholders throughout Southern Africa. Between June and October 2016 and May and June 2018 the SRK team consulted with stakeholders in power utilities, independent power producers, government institutions, international financial institutions, civil society organisations and research institutions. SRK's team held workshops, in-country site visits, focus group meetings, face-to-face meetings, telephone interviews and public hearings.

The resulting framework provides a baseline for the SAPP region, an overview of regulations, and a method to identify, categorise and rate risks and impacts with procedures to assess environmental and social impacts assessment and prepare cost estimates for implementation. The framework is particularly relevant where project loans are required from international financial institutions that apply policies, standards and guidelines to safeguard environmental and social sustainability. Providing a practical solution, the ESMF incorporates a set of tools to guide personnel including checklists, examples of management plans, and lists of national, regional and international environmental and social requirements. SAPP power utilities and independent power producers will implement the ESMF on the ground to ensure alignment in screening and scoping priority power projects. The above-mentioned project advisory unit will co-ordinate and facilitate capacity building and training of personnel at SAPP power utilities and independent power producers.

In April 2018, SRK updated the ESMF and translated it from English to French and Portuguese to ensure that the ESMF was accessible to non-English speaking countries, namely Angola, Democratic Republic of Congo and Mozambique. The document was sent to all SAPP power utilities and independent power producers and is available on the SAPP and World Bank sites.

http://www.sapp.co.zw/sites/default/files/499745_Final%20SAPP%20ESMF%20Report_Final_20180919.pdf: (<http://documents.worldbank.org/curated/en/583041538426822183/pdf/SFG4655-REVISED-EA-P126661-PUBLIC-Disclosed-10-9-2018.pdf>)

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Prioritising mine waste planning in Europe

Mine waste management must be at the forefront of mine planning in Europe – particularly in the UK, EU member states and countries undergoing accession to the EU. This is not only motivated by legislation and standards, but also by communities neighbouring or overlooking sites who have the right to give input to relevant approval decisions.

Topping the list of reasons are strict water quality criteria for rivers and groundwater. The criteria are not only set at EU and national levels but also at river basin and sub-catchment levels. Together with the geochemistry of waste, these criteria will determine options for waste disposal. For example, whether using the waste in backfill is possible and whether lining or capping of surface facilities may be required.

If cyanide is used in mineral processing, then a highly reliable cyanide detoxification process must be used to treat tailings. The acceptable level of cyanide in tailings storage facilities in the EU is five times lower than the limit given in the International Cyanide Management Code. Cyanide limits in downstream courses are even stricter; the limit for cyanide in rivers in the UK is 20 times lower than in this Code. EU legislation also requires all waste to be formally classified.

Depending on the waste geochemistry, small amounts of seemingly benign material can sometimes trigger a 'hazardous' classification. While associated design and management requirements are relatively straight forward, the notion of a hazardous waste facility in a rural setting can create delays in the permitting process.

Another challenge is pressure to minimise both visibility and footprint areas of surface waste facilities. Landscape impacts and abundant sites of conservation importance must influence location selection and will constrain the scale of structures. Technologies that hugely reduce the size of facilities, such as dry-stacking, become more attractive under these

conditions. Design of waste facilities so they mimic surrounding landforms is essential in some jurisdictions.

Fear that mine waste facilities will fail is at an all-time high, so stakeholders need to have high confidence in the integrity of the facilities. Furthermore, it can't be assumed that recognised international standards, such as those of the Canadian Dam Association and Australian National Committee on Large Dams, will be sufficient to meet all required design criteria. Designers must ensure they understand EU guidance, applicable national legislation, as well as internationally recognised guidelines.

Finally, a mine waste facility's siting can influence the applicable legislation and taxes. If it is remote from the mine site, it may not be legally recognised as a mining facility. In this case, slurry disposal of waste may not be allowed, and high landfill taxes could apply. These taxes can be greater than 100 USD per tonne.

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Widening the environmental due diligence net: safety, labour and governance

Not that long ago, environmental consulting focused exclusively on the biophysical environment: air quality, water and biodiversity. But during the last decade, this has expanded to cover socio-economic issues, heritage, community health, climate change and gender.

International lenders often appoint SRK to undertake environmental and social due diligence (ESDD) studies and loan monitoring on projects and operations in mining, hydropower and thermal power generation. Increasingly, they require SRK to gauge performance, not just against standard metrics, but also on governance, safety, security, labour and working conditions.

When reviewing performance against these aspects, SRK has faced unusual circumstances as illustrated by some examples below.

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On large hydropower projects in Angola, SRK identified the landmine risks to a resettlement programme and recommended comprehensive demining before resettlement. SRK also recommended Emergency Response Plans for dam failure scenarios to gauge and improve first responders' and downstream communities' capacity to manage failure. SRK also recommended vigilant enforcement of road safety and traffic management measures where convoys of large trucks travel through rural settlements.

In our experience, governance and reporting procedures prepared by contractors for large projects, are fairly sophisticated, but project owners/operators have fewer resources and less governance expertise. To address these shortcomings, SRK recommends early organisational reviews, thorough capacity building and job shadowing programmes over several years to transfer skills from contractors to operators. SRK helps operators with reports and suggests report templates to expedite compliance.

Labour and working conditions can be challenging on projects staffed by expatriate workers and local workers. Often working conditions can differ markedly, favouring expatriate workers, or occasionally locals. SRK reviews performance against International Labour Organisation (ILO) standards intended to protect workers' rights, carefully advising engineering, procurement, and construction contractors, whose approach to labour can diverge from ILO standards.

As the scope of environmental and social reporting broadens, SRK's deep experience in Environmental and Social Impact Assessment, ESDD and lender requirements helps us manage risks on large projects in developing countries, related to traditional concerns but also working conditions, community safety and governance.

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Managing spontaneous combustion in coal overburden spoil piles

The Leigh Creek coal mine, located approximately 500 km north of Adelaide in South Australia, operated between 1944 and 2015. The coal at Leigh Creek mine is a low rank, sub-bituminous brown coal that is prone to self-heating and spontaneous combustion. Spontaneous combustion has occurred in the spoil piles throughout the decades of the mining operation. Consequently, the management strategies suitable for short-term control of spontaneous combustion were developed but were not specifically tailored for long-term closure.

Laboratory testing was undertaken to examine the spontaneous combustion propensity of some of the coal and overburden units mined at Leigh Creek. Tests indicated that while carbonaceous rocks retained a fuel load, in isolation, these did not have the capacity to reach thermal runaway. However, the potential existed for heat from another source, such as coal, to raise the temperature of these rocks to above the threshold for thermal runaway (>100°C).

A monitored trial of the spontaneous combustion rehabilitation strategy was included in the mine closure plan submitted to the regulator; the objective was to demonstrate the strategy's effectiveness. The strategy included reducing batter slopes of waste spoil piles and applying an inert cover of 1.2 m thickness. The trial was established in June 2017 in a location where

active combustion occurred immediately prior to rehabilitation treatment. Measurements of temperature and oxygen concentrations within the spoil pile over twelve months show that oxygen is consumed within 1 m of the outer surface of the waste, while maximum spoil pile temperatures have been decreasing, indicating a net heat loss from the trial spoil pile area (Figures 1 and 2). No spontaneous combustion outbreaks have occurred in the trial area since the trial commenced.

Samples of the small quantities of aged coal in the spoil piles had a 'Low-Medium' to 'Medium' rating of intrinsic spontaneous combustion (much lower than the equivalent fresh coal samples), and did not have sufficient reactivity to overcome the heat loss associated with moisture evaporation. Therefore, it is concluded that the coal in the spoil piles would not be likely to reach thermal

runaway via self-heating. Most non-coal spoil is carbonaceous mudstone. The carbonaceous mudstone presents a fuel load, but would require a heat source, or heat from the oxidation of coal, to raise temperatures in excess of 100°C, for thermal runaway to occur.

The monitoring results indicate that the resloping and covering have been effective in limiting the oxygen supply into the spoil and have allowed temperatures in most of the underlying material to decrease, thereby reducing the likelihood of ongoing spontaneous combustion.

A more comprehensive description of the work was presented at the Coal Operators' Conference 2019 (<https://ro.uow.edu.au/coal/719/>).

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Figure 1: June 2017
(units are °C)

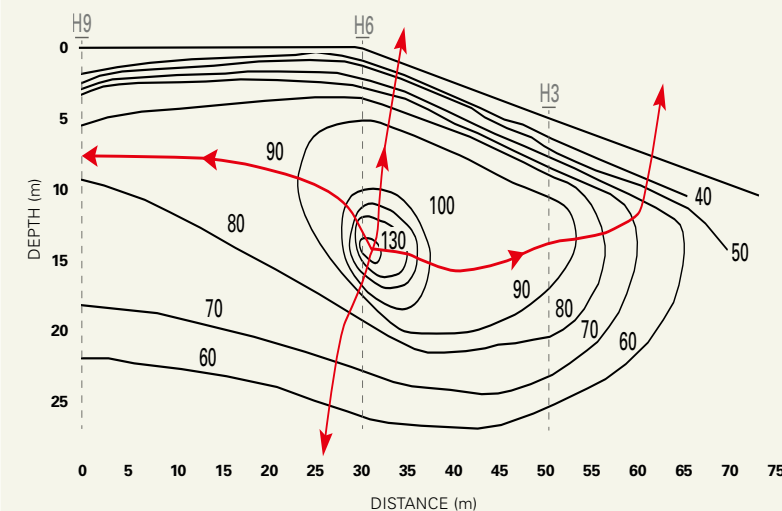
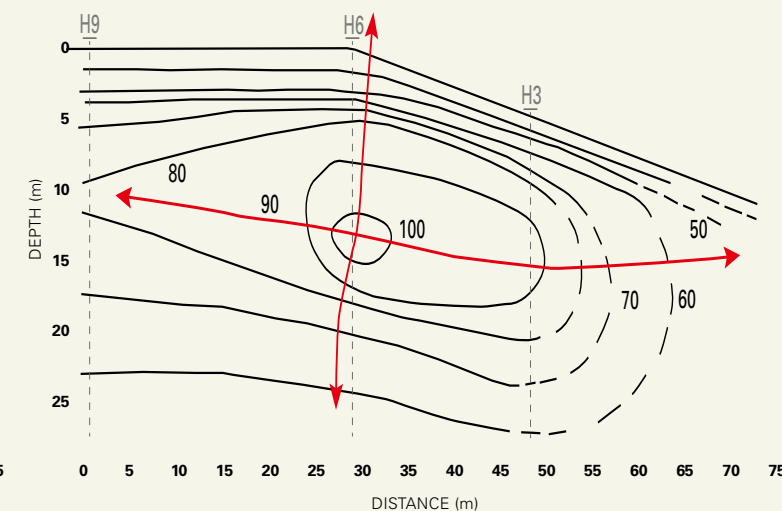


Figure 2: June 2018
(units are °C)



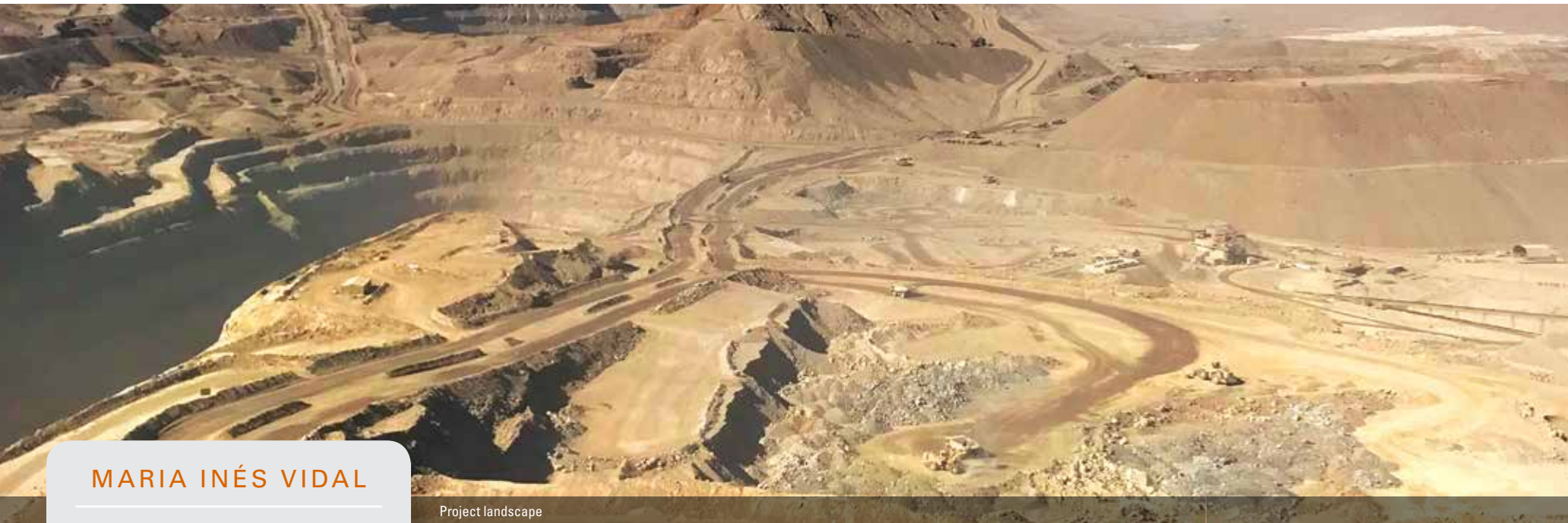
ANDREW GARVIE

Andrew has a PhD in physics and over 25 years of experience in the mining industry. His expertise lies in identifying the potential for acid and mine drainage and spontaneous combustion, recommending prevention and management strategies, and reviewing mine closure plans. Andrew combines field work, numerical modelling, and laboratory testing to guide decision making and provide evidence of the performance of management strategies. Andrew has addressed issues in waste rock dumps, tailings dams, pit walls, coal overburden piles and heap leach piles in various climates including arctic, temperate and tropical.



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Applying materiality to environmental and social review in due diligence



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When conducting due diligence “materiality” always matters. In essence, materiality refers to what is really important or has great consequences. However, what can be considered material in environmental and social due diligence?

Various definitions of materiality reflect differing views on this. Each due diligence situation is unique. An item that is material for one entity may well be of little or no importance for another.

Environmental and social due diligence approaches must be adapted to the nature, scale and location of the asset, and then materiality criteria should be defined, based on experience, projects and similar environments and discussions between the consultant team and the client.

Environmental and social due diligence generally focus on material risks, that is, risks that can affect authorisations,

stop or delay projects and operations, result in reputational damage, and/or have a modifying effect on the financial value of assets.

Given these considerations, this article summarises the risk approach we have applied in developing an environmental and social due diligence, on behalf of potential lenders, for the expansion of two mining operations. The work included a review of the sustainability risks and an analysis of the gaps with respect to national and international standards.

To assess materiality of the sustainability risks, the criteria listed below were considered.

- Failing to fulfill the general aims of the existing Health, Safety, Environment and Community program, including: i) Timely permitting; ii) Security and integrity of HSEC information;

- iii) Execution of environmental obligations and compliance with regulations; iv) Execution of social commitments.

- Significant environmental and social incident.
- A significant regulatory action against the mining company.
- Widespread public protest against the mining company.

The materiality of risks was divided into categories of low, medium and high potential, which was a judgment based on the type of risk. The significance of non-conformances with standards was obtained by combining the likelihood and impact. An action plan to address risk and non-conformances was recommended.

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Samarco Fundão dam environmental recovery actions

At the end of 2015, Brazil witnessed the rupture of the Samarco Fundão dam. The largest monitoring and recovery program in the country's history was implemented to address the unprecedented environmental impacts. The Renova foundation was created to address socio-environmental issues and the restoration of the Doce River. In 2017, SRK Brazil was contracted by the Renova Foundation to undertake a peer review of environmental studies related to the environmental recovery actions along the Doce River, from the Fundão dam to its mouth. SRK has now been asked to support Renova in demonstrating the effectiveness of recovery actions on water quality, in all the watercourses impacted by tailings for the environmental agencies and public prosecutors.

The Renova Foundation, a non-profit entity, is subsidised by Vale S/A and BHP Billiton. SRK has reviewed tailings management studies, surface water monitoring, hydrology and hydraulics, ecotoxicity, environmental risk and geochemistry, as well as developing site-specific tools to improve reclaiming and reporting efficiency.

Among SRK Brazil's ongoing projects for Renova is a hydrology/hydraulic model that aims to increase the precision of previous work by another company on classifying impacted areas along the Doce River. The original classification was conservative. Now that support is being planned for the impacted

population, there is a need to be sure of who was truly impacted and who was not. The main goal of this work is to support the environmental agency as it implements an effective support program.

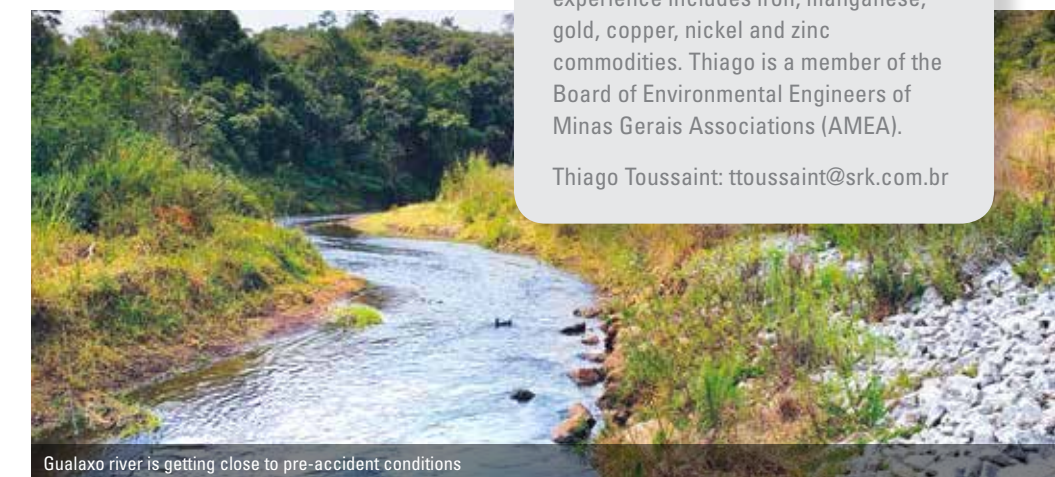
Other ongoing work is the quality assurance and quality control and compilation of a comprehensive database for soil, sediments and tailings laboratory results. Many different companies are undertaking characterisation studies for Renova. SRK is supporting Renova with integrating good quality data into a unified database. This will facilitate long-term tracking of progress and interpretation of data to determine the future focus of recovery efforts.

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The changing climate of climate change regulation

Unprecedented. The word has become overused when talking about climate. Unprecedented heatwaves, droughts, windspeeds and storm forces, and now it can describe political action. With 195 signatures on the Paris Climate Agreement, and only 191 undisputed sovereign states in the world, this is an unprecedented declaration of political intent. To tackle a global problem, we must speak in the global language – money. If carbon has a price, change will happen quickly; but how will signatories achieve this?

Taxing greenhouse gas (GHG) emissions is the quickest and easiest carbon pricing mechanism to enact, although setting the price is a delicate balance. Setting it too high risks carbon leakage, too low and no change occurs. Although often effective, tax is an unpalatable concept for business. The United Kingdom has had a non-domestic carbon tax since 2001. While some argue it reduces competitiveness, it has arguably been a success.

Elsewhere carbon taxes have not fared so well. In 2012 Australia launched a tax of A\$ 23 per tonne of CO₂ equivalent (tCO₂e), which in two years, reportedly reduced emissions by nearly 17 million tCO₂e. However, it was widely slated as economically damaging and it became a platform the government opposition party used for its “axe the tax” campaign. In 2014 the newly elected Australian Government became the first in the world to repeal a carbon tax. The eyes of the climate community are now on the newly implemented South African carbon tax, which though anticipated, has been widely opposed by large industries.

The Paris Agreement alludes to an alternative solution. The agreement set a limit of 2°C global warming, a value easily translatable into a cap on global carbon emissions. The agreement contains the option for signatories to use “internationally transferred mitigation outcomes”, essentially allowing nations that don’t emit much carbon to sell that capacity to those already emitting more. If everyone can agree that one allowance equals one tCO₂e, the stage is set for emissions trading schemes (ETS). Although governments won’t receive tax income, ETS give carbon a value and a market and encourage emitters to conserve or reduce its loss; like cash. To date 21 ETS are in operation globally, with five waiting in the wings and another nine under consideration.

Although mining has largely fallen under the inclusion thresholds of ETSs, in 2018 Kazakhstan launched their rejuvenated ETS, including mining operations that emit more than 20,000 tCO₂e annually. With schemes considered in mining jurisdictions, Canada, Brazil, Turkey and Australia, governments pricing carbon may well be inevitable. With recently acquired skills in carbon accounting, trading and compliance in the EU’s most established international ETS in the world, SRK UK is well prepared for the day these requirements reach our clients.

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Countries that were formerly part of the Soviet Union have environmental legislation with distinct interpretations of environmental management principles compared to the rest of the world. An example is the interpretation of the polluter-pays principle, which focuses on payments to government for pollution (emissions, discharges and wastes).

Challenges associated with this interpretation were that attention was not focused on technology to prevent pollution and payments to government were not routinely invested in environmental protection. In addition, the approach to impact assessment was not focused on understanding actual impacts on people and the environment. Furthermore, the pollution payments often did not materially impact profitability (excluding waste disposal). Kazakhstan and Russia are now introducing the concept of best available technology (BAT).

In Kazakhstan the government is in discussions with industry about how to align BAT with current pollution control paradigms or standards. Many mines argue that, if the pollution payment system is to continue in Kazakhstan, it should be applied so that it is not administratively burdensome and so some of the revenue is invested in environmental management, including developing industry guidelines supporting best practices.

SRK notes that evolving the BAT paradigm in Kazakhstan is not yet fully aligned with international best practices. The unique setting of each operation does not have to be well

Changing paradigms in legislation in Russia and Kazakhstan



defined and the selection of controls to manage impacts and risks are not based on robust impact and risk assessments proving these are BAT.

Russia started implementing BAT in 2014 by creating the Best Available Technology Bureau, which has developed information and technical reference books (ITB) taking into account Russian practice, settings and international BAT. All facilities were split into four categories (I – significant, IV – minimal negative environmental impact). The category defines the level of state control and the scope of environmental monitoring. Category I projects are subject to BAT implementation including mining and processing facilities.

Different technological standards are set for each industry based on the amount of marker substances in the emissions and discharges per unit of output/time. The technological standards were developed jointly by companies and

the Bureau, and it seems that some parameters, under the influence of the companies, were not added.

Starting from 1 January 2020, where BAT is implemented, a zero factor will be used to calculate the charge for the emissions and pollutant.

A hindrance to implementing BAT in Russia is the absence of supporting methodical legislation. This leads to different interpretations of laws by authorities in different regions. No road map has been created for implementing BAT by companies, but authorities already require results. New regulations, decrees and environmental permits are issued every week and companies cannot keep up with them. The environmental specialists are more engaged in preparing documents than actual impact assessment.

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Navigating constantly shifting environmental legislative requirements in the African context



Loss of land, crops and associated livelihoods at construction sites

Recently, African countries have begun strengthening the legal requirements for environmental and social compliance, including environmental impact assessment (EIA) provisions. They focus on good international industry practice and project design to limit risks and impacts. Experienced environmental assessment practitioners (EAP) are needed to help navigate the constantly shifting environmental legislative requirements. We can highlight key considerations when undertaking environmental assessments.

While the EAP can start based on the provided scope of work, the project will likely change as in-country environmental requirements are identified. Once the regulated environmental authorisation processes are underway, changes often result in additional cost and schedule implications.

It is necessary to screen the biophysical and social setting of the project to determine what legislation applies and identify key environmental and social

sensitivities. The required permitting plan may list applicable legislative processes, present terms of reference for specialist baseline investigations, and set out the stakeholder engagement strategy for the EIA process. Wherever possible, opportunities to undertake an integrated environmental authorisation process should be explored.

Specialists' baseline investigations should begin to assist with planning the environmental authorisation processes. This early warning could identify fatal flaws or no-go areas that could prevent or delay the project.

Despite thorough planning during the unregulated period, unexpected deviations often occur. However, flexibility in the permitting plan and frequent interaction with key stakeholders, specifically regulatory authorities, is required to adapt to the changes in the original scope of work or permitting plan.

If legislation changes, it is important to know about transitional arrangements

aimed at improving or enhancing the existing statutory requirements that may provide opportunities for the current environmental authorisation process.

It is essential that an EAP knows all applicable legislation for the project area thoroughly and is aware of upcoming legislation that may be implemented during the process.

In the African context, EAPs, play a central role as independent experts appointed by the project proponents to conduct an EIA process and prepare the necessary reports for decision-making by environmental regulators. In addition, by law EAPs must objectively conduct the EIA process, taking account of the views and concerns of all stakeholders. The EAP must have the suitable skills to balance proponent expectations for obtaining the requisite permit and applying the law.

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Water resources impact assessment: future-proofing and good governance

Water resources are a critical component of mine environmental and social impact assessment. While project-specific issues vary, broad agenda items typically include water security, impact on resources (in quantity and quality terms) and regulatory constraints, to name a few. Associated risks, whether real or perceived, must be addressed.

The profile around water in mining is increasing, and comprehensive, integrated and engaged assessment of water aspects is a key criterion for a project's success. Mines of the future will need to be transparent in their approach to water management and be "good neighbours" at a very practical and local level; adopting open and transparent policies and protocols for all to see.

The foundations for a comprehensive, integrated and engaged water resource assessment lie in robust characterisation of these terms:

- Comprehensive – while an understanding of the project at a catchment basin scale is essential, how the water aspects of the project at site-scale interact with and impact upon receptors at a much larger scale should also be addressed.
- Integrated – water resources must not be considered in isolation but by how they interact, on the one hand, with the design and engineering parameters of the project and, on the other, with disciplines such as social studies and ecological baselines.
- Engaged – the issues and sensitivities around water require close engagement with all stakeholders. Issues and concerns must be captured, understood and investigated.

The characterisation process must develop from thorough, carefully designed baseline studies to detailed, quantitative prediction and evaluation of impacts. Using numerical and stochastic models for hydrological,

hydrogeological and hydrogeochemical assessment, and for developing the site-wide water balance is commonplace now but models must be well designed and executed to meet the objectives: they must answer the questions posed, realistically and in detail.

Addressing the predicted impact on a local river or aquifer, or on a water supply source in broad terms is not sufficient. Models must address the potential interactions between river and aquifer, for example, and address potential impacts to water sources in realistic detail, and incorporate transient changes during the mine development and the varying natural environment parameters.

A comprehensive, integrated and engaged water resources study is key to ensuring a positive and successful assessment. Further, this approach sets the governance structure for the mining project to manage water responsibly, transparently and sustainably into the future.

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Strategic environmental assessment is common sense

Strategic environmental assessment (SEA) refers to a systematic assessment of the environmental implications of policies, plans or programs. Determining the impact policy decisions or alternatives, would seem common sense.

SRK has conducted several SEAs at policy and planning levels. Each of the SEAs have been designed specifically to meet the client's needs. Simply put, SEAs can be customised to most efficiently answer the key question being asked by the client. It is this outcome that makes SEA so effective.

There is an unfortunate preconception that SEAs are lengthy and expensive. However, SEA can be designed to respond to a specific need and can be undertaken at any level of detail as dictated by the required outcome.

It is also important to understand that in environmental planning there is a two-way impact. A policy or plan may have an impact on the environment, but the environment is just as likely to have an impact on the effectual implementation of a policy or plan. The latter is more likely to be a fatal flaw given that many impacts to the environment can be mitigated by selecting appropriate alternatives. Impacts of the environment, such as flooding, resource availability and topography, however, are less easily mitigated. It is therefore critical that policies and plans take into account not just the impacts on the environment but the impacts of the environment on them.

Understanding the environmental implications of policies, plans or programs will allow them to be adapted so that they are robust, sustainable

and achievable. It will also prevent resources being spent on detailed planning only to discover a plan was flawed from the outset. SEA could be described as an early-warning tool that can assist in identifying the preferred alternative from an environmental or social perspective. It will protect against reputational risk and identify risks that may undermine the successful implementation of a policy, plan or program.

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"Common Sense is not so common" - Voltaire

Moving beyond compliance: observations from environmental and social reviews

SRK finds many mines focus on meeting the minimum requirements of national legislation but struggle to comply with permit conditions, rather than good international industry practice. A legal-compliance focus often does not address risks. Mid-tier companies and emerging and junior miners tend to be more reactive than major mining companies. Many mines do not recognise the value of constructive stakeholder relationships and the foresight this brings in the identification of high-level risks.

Where companies have adopted international standards, the commitment to transition from compliance-only to

beyond-compliance practice grows. These companies are generally motivated by building brand, managing their reputation and distinguishing themselves from their competitors, while maintaining their social licence, increased efficiency and profitability. Some mining companies develop integrated and well-communicated strategies. To move along the sustainability continuum they need to implement a comprehensive stakeholder engagement plan throughout the life-of-mine.

To truly understand the situation and actively engage stakeholders, ongoing monitoring and proactive management is

key. The growing risk of losing their social licence to operate may be the leading business risk for mining.

Mining companies will need stronger corporate support and improved operational structures and systems to achieve environmental and social performance goals.

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Reprocessing legacy tailings impoundments

When historically under-regulated tailings facilities (by today's standards) can be reprocessed to extract residual minerals and then re-built to today's modern codes, following international best practices, the value to the nearby communities can be substantial. For companies, balance-sheet liabilities are turned into cash-generating assets. For neighbouring communities, there can be both employment opportunities and environmental benefits from the new physical and chemical stability of the impoundments.

SRK has performed a multidisciplinary characterisation on a pair of active and inactive tailing storage facilities to support a cost-benefit evaluation of reprocessing the tailings. This involved assembling a comprehensive workplan for the intensive sampling and laboratory test work. The geological and metallurgical sampling was integrated along with geotechnical and geochemical investigations.

If properly implemented, significant cost savings can be realised by assimilating the geotechnical, geochemical, and geological (re-processing) components into a single field investigation programme.

Installation of wells and piezometers into completed boreholes further enables long term monitoring with a minimal cost increase.

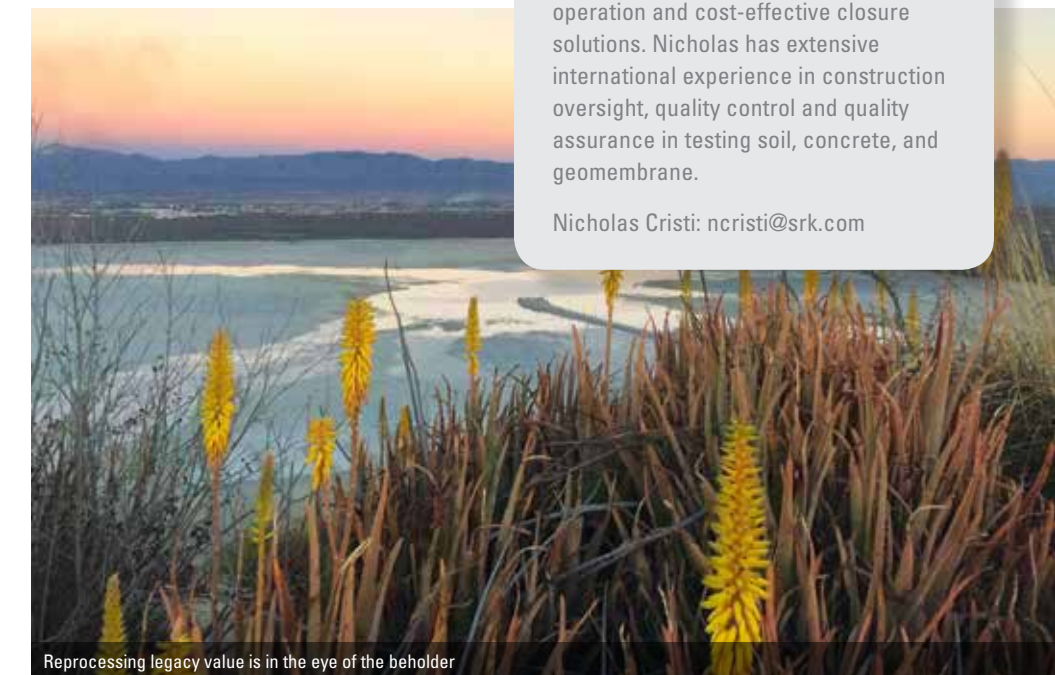
A favourable feasibility study for the recovery of minerals from historically placed mine tailings can be a key driver for turning these financial and environmental liabilities into assets that may eventually pay for their reprocessing and more.

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NICHOLAS CRISTI

Nicholas, PE, Consultant, Civil Engineering, Mining and Construction, is a bilingual engineer with over 8 years of professional multidisciplinary experience in civil and mining engineering, working on a wide range of international projects. He is keenly familiar with the design and construction of stable, economical and legally compliant tailings facilities and leach pads, with a focus on practical operation and cost-effective closure solutions. Nicholas has extensive international experience in construction oversight, quality control and quality assurance in testing soil, concrete, and geomembrane.

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Use of lead isotopes to identify contaminants in atmospheric particles

Lead isotope ratios were determined in atmospheric aerosol collected at two field locations in Arizona. The lead isotopic ratios found in the fine particles at the Hayden site are similar to those of the Ray mine, which is a major ore contributor to the Hayden smelter. This suggests that lead in the fine particle

fraction at Hayden may originate as condensation of smelter vapors. Topsoil samples at the Hayden site show total concentrations of Pb and As decreasing with distance from the smelter. Isotopic ratios for the sample closest to the smelter (650 m) and from topsoil at all sample locations, extending to more than 1 km from the smelter, were similar to those found in fine particles in atmospheric dust. The results validate the use of lead isotope signatures for apportioning the source of metal and metalloid contaminants transported by atmospheric particulate.

The results obtained in this work demonstrate that lead isotope analysis can be used for apportioning the source of metal and metalloid contaminants from mining operations.

On the other hand, isotope ratios at a soil depth of 100 mm decrease with distance from the smelter. These results are consistent with a contaminant deposition pattern from windblown particles from the smelter site to surrounding soils.

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Dr Omar Felix, PhD, REP, PE, Environmental Engineering Consultant, has broad experience in the field of atmospheric pollution, specialising on aerosols generated by mining operations. He is an expert in the design of experiments and data analysis of total concentrations of dust and toxic contaminants. Omar has worked in Mexico and the USA, and knows the regulations established in both countries. He has worked in programmes supervised by the EPA, like the superfund program, where he helped develop analytical techniques for determining atmospheric particles and contaminants. He has experience elaborating on conceptual closure plans as well as executing geochemical and geotechnical studies for efficiently closing mining facilities.

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Aerosols generated at a smelter site in Arizona

Development of a national resettlement framework for the Guinean government



Children playing in a village in the Siguiri Region of Guinea

Young woman collecting vegetables (above), Children posing for a photo in a wheelbarrow (right)

The rapid expansion of various industries, in particular mining, in the West African country of Guinea has led to an increase in resettlement projects. However, without suitable legislation and a clearly defined, and enforced framework, resettlement happens in an ad hoc fashion, often with unsustainable outcomes for the affected people.

Following external scrutiny and criticism from Human Rights Watch, the Government of Guinea has initiated a process to develop a national resettlement framework. Given its importance, funding and technical support were provided by the Deutsche Gesellschaft für Internationale Zusammenarbeit. SRK's recognised expertise in the resettlement field and our recent experience in West Africa lead to our appointment to develop the framework.

The primary purpose of the framework is to define a common approach to managing involuntary displacement. The framework provides a practical guide to resettlement planning and systematically leads the user through a series of twelve steps in the resettlement process. It also identifies areas that can add value to resettlement such as adopting a development approach, building lasting partnerships, learning and sharing. The framework is designed to apply to both public and private projects, across all economic sectors. The process will culminate in a government decree, making the framework legally binding and enforceable.

At the project's onset, SRK's team undertook a comprehensive stakeholder engagement programme. This approach ensured a multi-sectoral buy-in and support from stakeholders ranging from national government to private companies, multilateral lender groups,

community based organisations and directly affected communities. Intensive engagement took place with stakeholders in the capital city, Conakry, and regional locales where industrial and mining activities are concentrated.

This project shows how resettlement is increasingly on the radar of national governments, civil society organisations and funding institutions. Developing a multi-sectoral framework is a ground breaking achievement for Guinea, and can help regulate future resettlement, guiding it towards a more sustainable developmental outcome.

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Mining on traditional owner land and the impact of stakeholder engagement



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Scenes of typical violent protests

In South Africa, if mining projects are located on traditionally owned land and/or the mining companies are partially owned by the traditional authority, it is imperative that communication between the traditional leaders and communities is aligned. Mining companies have to balance the needs of multiple stakeholders.

Examples of some difficult situations that arise are given below:

- Traditional hierarchy: A traditional entity is led by a king, who owns a portion of the mining company operating on their land. The communities are governed by local traditional councillors. Theoretically, communication should run from the communities through the councillors to the king. If this channel is skewed, communities may use the mining companies to attack the traditional leadership and municipal officials, to realise the social change.
- Traditional land issues: When traditional entities own land where mining activities take place, it can be extremely difficult to approach these communities and seek their input into projects.

Communities tend to regard the land as theirs as part of a traditional authority, disregarding the hierarchy.

Rising demands about the roles mines should play in society compound these challenges. The government increasingly expects mining companies to fulfil social needs such as providing basic services, education and health care. Local communities also expect mining companies to deliver improvements to social infrastructure, services and livelihoods.

Under these circumstances, it is important that there is transparency. Communities must be confident that their interests are understood and being addressed.

For mining projects, the environmental and water permitting process provides a stakeholder engagement platform that traditional communities do not normally have.

It is essential to understand the stakeholder profile and the relationship between the communities and the traditional authority. Expectations should

be laid out and clearly defined before the engagement process begins.

Issues and conflicts are increasingly framed by human rights issues. It is important that companies address human rights concerns raised during their operations and endeavour to improve the livelihoods of affected communities.

Legacy issues cannot be avoided in the stakeholder engagement process. These should be intensely investigated so they do not derail the engagement process and to identify opportunities to manage or resolve these legacy issues.

SRK adopts a structured and strategic approach that allows for smooth exchange of information between parties. SRK profiles the stakeholder environment which informs aspects of the management strategy that needs to be adopted.

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Using stakeholder mapping as a tool for a social licence to operate

With continuing job losses and deteriorating profitability in mines, the potential for conflict between mines and communities increases. Communities and stakeholders expect the mine to provide sheltered employment and benefits. Previous mine commitments are questioned, as is the legitimacy of stakeholders engaged in these commitments.

Stakeholders within communities are changing and evolving; new stakeholders are developing, and old stakeholders want to retain their leadership. This happens especially where leadership is equated to receiving benefits from the operations, while resources remain limited. Continuous changes make it difficult for the mines to keep their fingers on the pulse and to engage proactively.

Against this background, stakeholder mapping is a useful tool for navigating the stakeholder maze. The aim is to minimise the element of surprise in stakeholder behaviour, enabling the mines to identify warning signs and assess patterns in stakeholder behaviour early, and to ensure that engagement is inclusive, consistent, informed with local intelligence, relevant and responsive. Stakeholder mapping should continue throughout the mine's life cycle and post closure.

This mapping process allows the community and the mine to understand their issues; in turn, this better informs the decisions around who to engage with and the strategies to apply – and helps to resolve issues quickly and more effectively. This process further makes room for a network analysis of stakeholders, in understanding the community power- and decision-making dynamics and associated vulnerabilities.

A thorough mapping of stakeholders can create an environment for constructive engagement, resolving issues as they arise, and building long-term relationships. In SRK's work with clients and stakeholders, we analyse

the stakeholder issues and identify what current mechanisms are available for capturing and resolving them. This knowledge platform assists clients in developing their own standardised practises, templates, guidelines and documents.

Stakeholder mapping and thorough engagement allows a more proactive engagement with stakeholders, laying legacy issues to rest, and progressing from a complaints session to a mature and respectful communication between stakeholders. Achieving this outcome requires a frank, honest and open discussion about what stakeholders expect from the mine and from each other – and some agreement about how to define and manage those expectations. This also enables the mine to clarify key messages, to align across the whole company and to communicate clearly in every engagement forum.

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Integration of environmental impact assessment and mine closure planning

Environmental impact assessment (EIA) and mine closure planning became formally integrated in Western Australia in 2011 when amendments to the Mining Act 1978 necessitated a mine closure plan to be submitted by proponents along with their EIA documents. These amendments force early consideration of mine closure in line with international best practice and will raise the level of closure planning compliance. Internationally, it is generally held that early closure planning will reduce costs and improve closure outcomes thereby reducing financial, environmental and social liabilities.

There are many international examples where poor mine closure planning has had significant adverse environmental and social effects. These issues have driven the need for widespread mine closure reform.

Recent interview-based research with experienced mine-closure professionals and regulators (Getty & Morrison-Saunders, 2019) highlights factors promoting effective mine closure plans. Early discussion on closure allows for efficient scheduling, design and planning of resources and also identifies key risks and opportunities, knowledge gaps and fatal flaws. It broadens understanding of mine closure across different levels to ensure closure plans are effectively incorporated into the mine life.

Early closure planning also allows opportunities for early investigations and trials, which in turn provide time for adaptive management and maximises rehabilitation success.

Examples of a cultural shift towards inclusive mine closure planning were described in the research, such as closure key performance indicators for mine managers and collaborative research efforts between companies.

The cultural change and discussion are steps towards the vision of integrated mine closure fostered by industry best practice (ICMM, 2019), although respondents indicated it was yet to be fully embedded in Western Australia.

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Rebecca is an Environmental Management professional with 10 years of experience in the mining industry. Her experience as an environmental advisor includes mine closure, environmental management plans and environmental approvals. Rebecca has designed, implemented and managed exploration programs for greenfields, mine definition and multi-stage projects in Australia and Canada. Her experience in technical reporting includes scoping, pre-feasibility and feasibility study levels according to international reporting guidelines, JORC Code and NI 43-101. Rebecca has strong project management and risk assessment skills.

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All projects and policies have a financial impact by creating wealth at the household or national level, though this can occur at the expense of ecological resources that provide ecosystem services and support livelihoods. This tendency leads markets to privatise gains (which accrue to project owners) and socialise losses. Conversely, environmental studies focus on biophysical and social impacts, while economic benefits to society are often overlooked.

SRK's environmental and resource economists give the economic implications of projects the attention they deserve. These impacts manifest themselves in many ways. Conventional economic impacts arise from the creation or loss of income and jobs, state revenue and investment, and the potential effects of large projects on macroeconomic performance.

SRK calculated that the Tanzanian section of the East African crude oil pipeline will provide an economic stimulus equivalent to 2.1% of Tanzanian GDP and direct, indirect and induced employment for 21,120 Tanzanians during construction. The project will also increase the fiscal deficit as the government takes an equity stake during operation, but tariff revenues will eventually outstrip project-related expenditure.

Resource economics differs from conventional economics because markets seldom exist for environmental goods and services and where these markets do exist, they are often imperfect. Valuing these services requires a different set of tools. By recognising and quantifying the economic value of

Economic impact assessment: the other impacts



The informal economy, including the sale of agricultural products, and fish underpins local livelihoods in Zanzibar

environmental goods and services their value can be included in a balanced analysis of project impacts. SRK has successfully applied mechanisms to value environmental goods and services to include them in analysing the projects' net impacts. The economic value forgone by not logging in a forest area subject to a mining application was estimated as 2.5% of the economic value of mining, on top of which increased GHG released by mining would have a present social value (cost) of US\$23.7 million.

Economic benefits analysis of a project can be conducted at any stage to quantify project benefits on surrounding communities and the host economy, as we did in Zanzibar. The client had obtained regulatory approvals but continued to face resistance. SRK determined that a project of the nature and scale proposed would increase economic growth and expand the

formal labour market in Zanzibar by up to 3%. SRK presented the results of that analysis to support interactions with communities and authorities.

Such analysis can identify methods to optimise a project, and be used for marketing.

Economic and resource economic studies paint a more holistic picture of project impacts and benefits and can help:

- Identify the project's net contribution to income and job creation;
- Quantify the monetary value of affected environmental resources and impacts; and
- Design adequate compensation strategies where livelihoods are adversely affected.

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Ashleigh, Senior Environmental Scientist, has over 11 years of experience. Her core expertise lies in project managing, auditing and due diligence/technical reviews. Her experience also spans the mining and governmental sectors in South Africa, Namibia, Malawi, Zambia, DRC and Zimbabwe. She has a thorough understanding of the project life cycle and how to provide an interface role between the technical engineering teams and environmental advisors on projects.



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Regulators are not omnipotent!



Regulators are not omnipotent! Many of the mining operations SRK visits are focused solely on confirming compliance with regulatory requirements. For example, statements from audited operational sites in Europe and central Asia. These jurisdictions generally have long histories of strict, robust regulation. Both mining companies and surrounding communities therefore rely on regulators to establish what is required for management and monitoring, and to confirm compliance. This approach has limitations.

First, the actual effects on the surrounding communities and environment are often not adequately characterised:

- Takes place at sites specified by the authority and this may not reflect the greatest risk of pollution or presence of vulnerable receptors;
- Includes only stipulated parameters and so elements that may be naturally elevated in the environment and/or have the potential to harm receptors are not captured (quality control/assurance is also limited);

- Focuses on outputs (such as quality/volume of emissions or, in the case of social, quantum spent on community projects) rather than the negative or positive consequences on the receptor; and
- Looks at day to day compliance rather than long term trends that might identify potential problems early.

Unless the company is proactively collecting and interpreting additional data, it may have limited defence against claims other than adherence to its permits and/or legislation.

Second, interpreting, applying and enforcing legislation and permits between and within the regulators can vary, leaving the company with conflicting requirements. This is exacerbated where the capacity of regulators is stretched or savvy stakeholders are influencing government players.

Third, regulatory authorities may focus on emotive or easy to manage areas (such as waste management) rather than the more difficult 'material' issues (such as groundwater contamination or critical habitat). This can result in lack of

regulation in certain areas or over control in others.

So, what is the solution? Adhere to regulatory requirements or, if these are not appropriate, re-negotiate with the relevant authorities. Good international industry practice requires this. However, SRK suggests companies go beyond strict regulatory requirements by implementing a proactive management system. In other words, the system should provide the tools to actively understand a company's effects, how to manage them and how operations can continuously improve. A company taking ownership of its impacts and showing how these are proactively managed is in a stronger position when it comes to satisfying regulators, local communities and shareholders. This makes good business sense; it minimises environmental and social risks to the continued operation adding value to the mining asset. Money is saved in the long run and operational effectiveness is improved in the short term.

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Strategic planning support for the environmental sector in Uganda

Uganda has enjoyed an exponential socio-economic transformation over the past two decades due to political stability and support from developing partners and the Ugandan people. Rapid economic growth has, however, had a negative impact on the environment to such an extent that environmental degradation has resulted in a recent decline of this economic growth. The environmental degradation and pollution can be attributed to inadequate environmental governance.

While Uganda does have strong environmental institutions in place, as well as good policies, plans and environmental legislation, a lack of funding and resources (including staff) to implement these policies and laws has compromised environmental governance. Therefore, more comprehensive interventions with long-term objectives are required which will guide coordination of the efforts in the environmental sector. To assist in meeting this requirement, SRK and a local Ugandan partner were appointed by the United Nations Development Programme in 2018 to compile a strategic environmental plan for the Ugandan government to guide environment and natural resource management for the next ten years.

The design of the strategic environmental plan was informed by extensive consultation with key stakeholders including government institutions at national and regional level, civil society organisations and development agencies. Once approved, this plan will be implemented by structures within the Ministry of Water and Environment.

The strategic environmental plan sets out strategic objectives based on a comprehensive analysis of the current governance structure for environment and natural resources management in Uganda. It also highlights areas of institutional weakness that require strengthening as well as opportunities for synergistic partnership. The plan identifies key strategic areas where development partners can assist the government in implementing identified management priorities. The implementation of the plan will help guide the identified government priorities for environment and natural resource management so that these can be adequately resourced and monitored.

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Uganda boasts a wealth of wildlife

The benefit of stakeholder engagement before you think it is necessary!

Many companies miss out on significant benefits to their projects by not developing and implementing a stakeholder engagement management plan early enough in their project's evolution.

With the exception of consultations completed to meet regulatory requirements for exploration permits and meetings requested by community leaders, it is common practice to delay stakeholder engagement until the initiation of the environmental assessment of a project. A plausible explanation for this is that stakeholder engagement falls outside of the expertise of the professionals driving the technical aspects of the

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Mark, PGeo, has over 25 years of experience as an Environmental Manager in the exploration and mining sectors. He participates in and manages feasibility studies and environmental assessments for mining clients. With experience in various commodities and a focus on environmental management, compliance and stakeholder engagement, Mark has worked on exploration projects, operating, inactive and abandoned mines. His expertise lies in environmental assessments, management, and auditing concerned with due diligence, project permitting, licensing, public and regulatory consultation. Mark has co-authored many National Instrument 43-101 compliant reports as a Qualified Person.

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project up to the feasibility stage. The consequence is that valuable stakeholder inputs are obtained late and are much more difficult to integrate into the design of the project.

Stakeholders are looking for the opportunity to provide input to the design of the project at all levels, but generally, this input is focused on environmental protection. As an example, it is not uncommon for stakeholder groups to have strong opinions on where effluent is discharged, based on existing uses of the environment. However, making a change of this magnitude to the project design at a late stage is difficult. It needs to be technically vetted and if the change is significant enough, it could delay and/or restart the regulatory process. The results are a reluctance to entertain change and a perception from stakeholders that their opinion isn't really wanted.

The optimal time to initiate stakeholder engagement is at the completion of a project's preliminary economic assessment (with positive results) so the engagement runs concurrently with the prefeasibility study. This start time allows for considering and possibly integrating stakeholder feedback into the project's design. It allows ample time for relationships based on trust and respect to develop and it provides these communities with valuable time to develop strategies with and without the operator's support – time to develop capacity that increases their ability to be ready to capitalise on future opportunities if the project proceeds to production.

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Implications of dust speciation on remediation of legacy mine sites



Giant Mine dust samplers overlooking Yellowknife, Northwest Territories

Mine tailings are fine-grained and usually have high concentrations of metals and metalloids, making tailings storage facilities reservoirs of contaminant-bearing dust-sized material. Although there is a general understanding of the risks posed by tailings dust, there are still major gaps in our knowledge concerning the chemical form or speciation of dust. This is an especially important consideration at mine sites located near populations where contaminant-bearing dust can have lasting impacts on the surrounding environment and can pose serious health risks on local residents.

One such site is the Giant mine, an abandoned mine in the Northwest Territories of Canada. A gold mine that was in operation from 1948 to 1999, where roasting was used to liberate submicroscopic gold from arsenopyrite ore. Oxidation of the ore generated arsenic-bearing iron oxides and arsenic

trioxide as byproducts. In the early days of operations, arsenic trioxide was emitted uncontrolled into the atmosphere and was co-deposited with the tailings on site. Arsenic trioxide is the most toxic and bioaccessible solid form of arsenic.

Presently, the tailings at Giant are left vulnerable to high velocity winds after the snow melts in late spring, when it is too cold to apply a dust suppressant at the surface. This poses a significant risk as two populations (Yellowknife and Ndilo) are located less than 5 km downwind of the mine site. Community concern regarding arsenic-bearing dust from Giant prompted a study to investigate the tailings dust, focused on characterising the arsenic speciation or dust content.

The findings from this study show that despite the high concentration of arsenic in the tailings dust, arsenic trioxide is a very rare constituent in the dust. However, the soils near the Giant mine tailings contain abundant arsenic trioxide from

historic roaster emissions and exhibit very high concentrations of arsenic that are often similar in scale to the tailings. The fact that arsenic trioxide can persist in these surface soils suggests that they might actually pose a greater risk to the community than the tailings themselves, and yet the soils are not actively monitored by the remediation project.

Legacy mine sites such as Giant pose unique challenges when it comes to characterising and containing toxic material from the site; the extent of contamination may not be well understood.

Environmental contamination is not always obvious, particularly where it concerns fine-grained particulate; thus, it is important to fully understand metal(loid) speciation and mobility before considering and employing long-term remediation strategies.

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Alexandra, MSc., is a Staff Consultant. She is an Environmental Geochemist with a background in geology and soil science. During her graduate studies she focused on arsenic mobility in dust from tailings and gained experience with a breadth of geochemical analytical methods, field study design, and mine-stakeholder relations.

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