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**Mine closure and reclamation –  
Managing mining legacies —**

**Part 2:  
Case studies and bibliography**

*Fermeture et remise en état des mines — Gestion des héritages  
miniers —*

*Partie 2: Études de cas et bibliographie*

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Reference number  
ISO/TR 24419-2:2023(E)

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Published in Switzerland

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## Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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This document was prepared by Technical Committee ISO/TC 82, *Mining*, Subcommittee SC 7, *Mine closure and reclamation management*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at <https://www.iso.org/members.html>

## Introduction

This document includes case studies and a Bibliography provided by working group members and has been separated from the standard so that development of the two documents proceeded in parallel. These resources provide supporting information and illustration of various aspects of the managing mining legacy standard. While expanding upon some of the content of the guidance of the standard, it cannot be assumed that a particular strategy that was applied in one context is directly applicable to another. Not every clause in the standard has a corresponding case study. Instead, clause activities are revealed in an integrated way as they occur in practice within these cases. In addition to descriptive case studies, there are some table-format case studies toward the end, that illustrate how inventories can be structured and developed. There is also a Bibliography for further reading elaborating upon certain aspects of the standard and expanding the resources available to those applying ISO 24419-1. This Bibliography is not fully comprehensive of all global regions but instead were important and relevant at the time of preparation of the standard. As management of mining legacies evolves, further resources are likely to emerge. It is up to the user to adapt and apply their understandings of the ISO 24419-1 and this document supporting Technical Report to local circumstances.

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# Mine closure and reclamation – Managing mining legacies —

## Part 2: Case studies and bibliography

### 1 Scope

This document is a supplementary document to the International standard for managing mining legacies (ISO 24419-1) that provides illustrative case studies and resources providing further reading. The content provided in this document covers various regions of the world as a supplement to ISO 24419-1. The purpose is to provide insight into specific case studies that show how practitioners have addressed mining legacy challenges in practice. This document does not provide instructions for managing mining legacies, but instead a resource with insights from other practitioners, thereby widening knowledge of what can be required to effectively manage mining legacies.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24419-1, *Mine closure and reclamation — Managing mining legacies — Part 1: Requirements and recommendations*

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### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24419-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

## 4 Design engagement process for the giant mine remediation project, Yellowknife Northwest territories, Canada

### 4.1 Aspect of managing mining legacies

This case study describes stakeholder engagement and consultation for management of a large mining legacy by the Canadian government to addressing the historic legacy whilst also developing a collaborative engagement process. See Reference [32].

### 4.2 Recognition of a problem that needed to be resolved

In 1999, the giant mine went into receivership and subsequently became an abandoned mine under the responsibility of the Government of Canada. The roughly 50 years period of gold mining resulted in significant disturbance to the land and water, and severe impacts on the health and lifestyles of local people, especially Indigenous groups. The project developed an initial remediation plan for the site in 2007 that failed to receive wide spread public support and a subsequent Environmental Assessment

raised significant public concerns. In 2014, the project team concluded that the remediation plan required a more meaningful engagement process with stakeholders in order to build public trust and obtain support for the management and remediation of the abandoned mine.

### 4.3 Steps involved and expertise/stakeholders involved

In late 2014, the project proposed a 2 years engagement process to stakeholders that involved a series of multi-day workshops. Stakeholders had a large role in developing the engagement process and ensuring the process would be meaningful to them. The series of meetings, reports and workshops addressed public education and preparation, stakeholder objectives, development of closure options, risk assessment and review, and finally the evaluation of options for the abandoned mine.

During the engagement process, the project recognized that the Indigenous and other local groups were not meaningfully engaged on what happened at Giant Mine for almost all of its operating life. More effective engagement could not address all the wrongs in a 50 years history, but it could contribute to reconciliation and a different future. Participants in the engagement process were asked to remember the past and its lessons, but to focus on how the Giant Mine surface could be managed in the future.

### 4.4 Evaluation of performance of this initiative

Since the completion of the engagement process in 2016, the stakeholder evaluation results have been used by the Government of Canada in selecting closure options for Giant Mine. Key decisions informed by the engagement included the selection of closure options for open pits, tailings areas, water management and future land use. Many of these options differed significantly from the initial closure plan and the decisions made based on engagement were communicated back to stakeholders.

A favourable outcome of the engagement process is that while the final plan could not reflect every stakeholder group's first choice for closure, there was an understanding of the many other perspectives that need to be considered in selecting closure options and the management of abandoned mines. The engagement process significantly increased stakeholder understanding of the mine and improved the project's relationship with stakeholders.

The revised Giant Mine Closure Plan was resubmitted for regulatory review and resulted in public support being voiced for the plan by stakeholders. Regulatory approval for the remediation of the Giant Mine is expected in August 2020, over 20 years since the site was abandoned by its last owner.

### 4.5 Key learnings for others

The Giant Mine demonstrated the importance of incorporating meaningful stakeholder input into all aspects of an abandoned mine, from planning, option selection, through to long-term care, in order to ensure stakeholder concerns are addressed. This is particularly important where there is a difficult historical legacy, that if left unaddressed, can make moving the project forward and securing regulatory and other approvals difficult.

## 5 Mining legacy program performance evaluation and reporting — British Columbia (BC) Canada

### 5.1 General

Performance reporting on a mining legacy program is part of the Crown Contaminated Sites Program in BC, Canada. This program was restructured following on Auditor General report that recommended improvements to accountability and transparency and overall performance of the program. This case study is largely drawn from Reference [12]. Later performance reports on the BC program indicate that about 80 % of the sites in this program are mining legacies – see References [10] and [11].

## 5.2 Recognition of a problem that needed to be resolved

The purpose of the Auditor General's audit was to assess whether the Province had an adequate program for managing its contaminated sites and whether it was adequately accounting for its performance. Specifically, they examined whether the provincial government had:

- established an adequate governance framework;
- gathered appropriate information to develop management plans and to support resource allocations; and
- accounted adequately for its overall performance.

## 5.3 Steps involved and expertise/stakeholders involved

The BC auditor general conducted an audit of the BCCCSP and found the program was inadequate. Following up on the audit, recommendations were made ([Clause 5](#)) and the program was restructured. A link is provided to performance reports of the BCCCSP to show how the recommended actions were implemented. See References [10] and [11]. Every two years a performance report like this is published. Historic reports provide further insights.

## 5.4 Evaluation of performance of this initiative

Key findings of the audit copied:

The Province does not have an adequate program in place for managing its contaminated sites and is not adequately accounting for its performance. Significant improvements are required in three main areas.

First, the foundation needed for a sound program is lacking. Ministries and agencies are not being guided by clear direction from government, and roles and responsibilities are not clearly defined. While some progress is being made, it varies from organization to organization. Some are well underway in incorporating a contaminated sites policy into their portfolio; others are only at the early stages of doing this.

Second, there are significant gaps in the information ministries and agencies need to develop management plans and to make resource allocation decisions. As a result, few management plans are in place and no government-wide plan exists.

Third, without a clear, coordinated program for guiding contaminated site management activities, ministries and agencies are unable to account in a meaningful way on their progress in dealing with the risks and liabilities posed by contaminated sites.

## 5.5 Key learnings for others

The important role of independent auditing of programs is demonstrated. The improvements made ensure that managing mining legacies is more effective at reducing liability as well as being transparent. Performance is reviewed and made public in an accessible easy to read form that improves the reputation of governments managing these sites. A research report includes more detail on this and other programs reviewed as part of a Churchill Fellowship. See Reference [6].

# 6 Remediation of the abandoned mines in the South Alligator Uranium field, Northern Territory, Australia

## 6.1 Aspect of managing mining legacies

Knowledge sharing between all stakeholders.

## 6.2 Background

Work was carried out between 1999 and 2007 in various phases. Commonwealth Government was responsible for getting work done with Federal Parks Agency as lead but other agencies from Federal and Northern Territory Governments involved. Original survey work was undertaken in 1986 but consultation with Aboriginals did not get organised until 1990s.

## 6.3 Recognition of a problem that needed to be resolved

In 1952/3, exploration for uranium commenced in the upper valley of the South Alligator River, Northern Territory, Australia. Prior to 1962 more than 50 exploration sites and 17 small mining sites and three processing sites were operated. Then, all work stopped, and sites were abandoned. In 1986 a survey took place to inventory sites. This was to gain knowledge of rehabilitation requirements prior to the area being designated stage 3 of the World Heritage Listed Kakadu National Park. Stage 3 was incorporated in 1988 and the lease from the traditional land owners required that all mining sites be remediated by 2015 at the expense of the Commonwealth Government and to the satisfaction of the traditional land owners.

## 6.4 Steps involved and expertise/stakeholders involved

In 1992 a programme of hazard reduction work was carried out to mitigate radiation and physical safety risks for tourists and other visitors to the valley. There was little consultation with the landowners. In 2000 work began to consult with landowners on what they wanted to see in terms of rehabilitation and for experts to prepare options for discussion. Consultations were extensive and had frequency that did not over stress landowners but enabled regular progress to be made on the planning for rehabilitation. Meetings were held on that incorporated site visits during the dry season; wet season meetings were less frequent and were held in a variety of locations including nearby motels and communities. The style of meeting was arranged to be less formal than usual but with a structure determined by the landowners that was in sympathy with their traditional governance mechanisms.

## 6.5 Evaluation of performance of this initiative

Work progress was slow in terms of obtaining data but this often related to the timing of meetings to obtain approval for studies and the delay in obtaining funds from government. Once designs had been completed there were further delays until funds to undertake civil engineering works (such as construction of the containment for all radioactive residues) could be made available. Landowners were offered work and training opportunities during the construction phases as well as being employed to provide cultural advice on access to sites and issues of possible presence of sacred sites.

## 6.6 Key learnings for others

The involvement of traditional aboriginal landowners was essential to the long-term success of this programme. The development of a process for meetings that was sympathetic to the traditional governance mechanisms of the aboriginal people was a vital part of the process and has been repeated elsewhere successfully. The lack of clarity in funding was a major cause of delays in implementation. Designs were completed, however these waited for four years before government finance could be found to support their implementation. Patience was essential at all stages in dealing with both the landowners and governments.

## 7 Valuing traditional knowledge within the rum jungle rehabilitation project, Northern Territory, Australia

### 7.1 Aspect of managing mining legacies

The former rum jungle uranium mine is a mining legacy site located on Aboriginal owned land. This case study describes the value of stakeholder input into decision making. The content is derived from two key sources. See References [1] and [2].

### 7.2 Recognition of a problem that needed to be resolved

The Rum Jungle ore body was discovered in 1949. Mining was undertaken between 1952 and 1963 and processing operations ceased in 1971. The sulphide rich waste mined at Rum Jungle generates substantial volumes of acid and metalliferous drainage. An aesthetic clean-up of the site was completed in 1973.

The Finnis River Land Claim No.39 was lodged on 20 July 1979. Rum Jungle formed part of the area subject to the claim. An inquiry into the land claim identified that the Kungarakan and Warai people were the traditional Aboriginal owners of Rum Jungle and other areas subject to claim.

In the years that followed Rum Jungle became iconic due to the significant impacts from ongoing oxidation of sulphide minerals releasing large concentrations of copper and other heavy metals into the downstream receiving environment. This resulted in rehabilitation works being undertaken at the site during the 1980's. The Kungarakan and Warai people were not consulted about these works and remained very unhappy with the state of the site.

To address this, in 2009, the Northern Territory and Commonwealth governments commenced rehabilitation planning at the site.

### 7.3 Steps involved and expertise/stakeholders involved

Work began to identify which Kungarakan and Warai people spoke for this land. This involved engaging anthropological expertise to understand all the family structures and sacred sites.

Structured meetings were organised where the outcomes and learnings of technical investigations and potential rehabilitation options discussed, and rehabilitation objectives developed. Initially this was a very confrontational environment, as there had been a long history of unfulfilled promises and not being included in decision making.

As the project developed meetings were moved from being held in town to on Aboriginal country and as it became apparent that site access restrictions that had been in place over the previous 50 plus years had created a loss of connection to land. Site visits were organised to start to re-establish these connections.

Kungarakan and Warai were also included in presenting site inductions. They shared valuable cultural knowledge of the site. They were also key participants in options analysis workshops which identified a preferred rehabilitation strategy for the site.

### 7.4 Evaluation of performance of this initiative

At the end of stage 1 of the project in 2013, the Kungarakan and Warai had been involved in all of the key decisions which informed the selection of a rehabilitation strategy. Their desire to see the site return, where practical to its pre-mining topography and allow for sustainable traditional land uses fitting in seamlessly with other rehabilitation objectives developed for the site.

Throughout stage 2 (2013 – 2016) the increased knowledge of the site both culturally and technically supported the development of detailed designs. More importantly as we shared information, we became more equal as stakeholders in this process.

The two-way process by honestly and transparently sharing information is the most powerful way to build respect, trust and loyalty.

## 7.5 Key learnings for others

Stakeholder engagement is at its most effective when all parties feel like they are equals in the process. Understanding that cultural knowledge of a site is just as valuable as technical investigations allows for this to occur.

Working collaboratively creates better outcomes, with a result that is greater than the sum of all of the individual inputs.

If no one is really sharing anything of significance it is most likely not because there is nothing important to say, but rather it will be a lack of trust in either the people or the process. The development of trusting relationships takes patience, time, commitment and accountability.

## 8 Difficulties encountered during the closure of mines prompted improvements to legal instruments, Mali

### 8.1 Context of case study

From the colonial period to the present day, Mali has acquired several legal instruments to manage mining, among which, there are five (5) generations of Mining Code (1970, 1991, 1999, 2012 and 2019) and environmental protection texts. This case study illustrates the recognition of inadequate regulatory requirements in Mali and how they were addressed.

Officially, there have been no permanent closures of industrial mines to date in Mali. However, some mines have observed more or less long shutdowns. They include the Kalana, Syama and Morila mines described here from which learnings have been gained regarding how to strengthen regulations. Further information on this case study can be accessed from *Chief of the Environmental Information Department at the Environment and Sustainable Development Agency (AEDD and Malian Agency for Standardization and Quality Promotion (AMANORM))*.

### 8.2 The Kalana Mine

Entering production in 1985, this mine observed two shutdowns, from 1991 to 2004 and from 2018 to 2019. The causes were the low gold content, associated with the high cost of production. As difficulties arose, it was found that:

- the content of the memorandum of understanding between the Mine and the country had never been disseminated to other stakeholders;
- environmental safeguarding measures (rehabilitation of quarries, mud park management) and social measures (income-generating activities) which were provided for by the protocol, were not discussed with the other stakeholders; and
- neighbouring communities were not prepared for the two operating shutdowns.

Communities were therefore severely affected by the negative consequences, in particular by: (i) loss of jobs and financial resources; (ii) deterioration in the purchasing power and standard of living of workers and populations; (iii) the exodus of labour to urban centers and new mining sites; (iv) the intensification of social conflicts around land use and access to natural resources, at the time when the dismissed mine workers were seeking to return to agricultural production on land reduced due to their use by the mine or their assignment to it; (v) loss of hope and confidence in the administration and in mining projects.

### 8.3 The Syama mine

Entering production in 1990, the SYAMA Mine was put on hold in 2001 following difficulties encountered by its operating company. During this shutdown period, the environmental and socio-economic impacts resulting from the extractive activity were noted. They were due to the shortcomings noted in the planning of the project, especially regarding environmental issues and community development.

Unfortunately, neither the mining company nor its minority partners, nor the Government of Mali, have undertaken any activity to rehabilitate the mining site.

### 8.4 The Morila mine

The Morila mine started operating in 2000. It is scheduled to close in 2020. To prevent difficulties that have arisen on certain mining sites, the Government of Mali has set up an inter-ministerial commission to close the mine, the members of which were appointed by a decision of the ministry responsible for mines. The role of the Commission is to examine and adopt activity reports and documents relating to the closure of the mine.

This approach aimed to fill the legal void in the Mining Code in force which did not provide for measures in terms of mine closure and Corporate Environmental and Social Responsibility.

The Commission has drawn up a plan for the gradual closure of the mine and has carried out a feasibility study for an agricultural project entitled, "Agro-industrial center of Morila" which will replace the mine in 2020.

### 8.5 Key learnings from these examples for others

The common point between these three (3) mines is the fact that at the time of the launching of their exploitation, the legal instruments regulating environmental and social questions did not exist or, at least, were not national requirements.

The Malian Government did not require strict compliance with environmental standards as a prerequisite for the exploitation of mineral resources.

One of the most worrying difficulties is undoubtedly the fact that populations had little access to reports and data on the state of their environment. Civil society had no effective means of measuring the extent of the problems raised by mining, preventing them, reducing them or promoting any positive change.

Henceforth, the Mining Code of Mali constitutes the Basic Law which governs mining in the country. It includes measures relating to the protection of the environment, hygiene and the health and safety of workers.

## 9 Government strategy for rehabilitation of abandoned asbestos mines in South Africa

### 9.1 Context of case study

South Africa was a major global producer of asbestos from the early 1900s. However, the demand for asbestos declined during the 1970s and numerous asbestos mines were either abandoned or closed during the 1980s in accordance with the regulated (but comparatively poor) standards of the time. Asbestos mining was banned in South Africa in 2001 and a total ban on the production, import and use of asbestos followed in 2008. Concern around the poor state of the abandoned mines and the associated health risks led to a National Asbestos Summit being conducted in November 1998. An outcome of the summit was the development of a 'Standard protocol and guidelines for the rehabilitation of derelict and/or ownerless asbestos mine residue deposits in South Africa'. This guideline directed the diverse efforts of several state departments to guide the state funded rehabilitation of asbestos mines, the replacement of asbestos roof sheeting, and other related efforts. The original guideline was later expanded into a 'National Strategy for the Management of Derelict and Ownerless Mines in South Africa'. In line with