



Hardrock Mining Systems

Context and Federal Role

Hardrock mining operations consist of four primary stages. These stages are mineral exploration, mine development, mineral production, and reclamation (generally removing mine structures and restoring disturbed lands). Some stages can take place simultaneously. [GAO-16-165](#)

Mining is managed on federal lands using two systems.

Two federal agencies—the Department of the Interior’s Bureau of Land Management (BLM) and the Department of Agriculture’s Forest Service—are responsible for managing hardrock mining activities on federal lands. The agencies use two systems to do so, depending on the type of lands:

- The location system is generally used on public domain lands, which account for 90 percent of federal lands.
- The leasing system is generally used on acquired lands, which account for 10 percent of federal lands. [GAO-21-299](#), [GAO-20-461R](#)

Most mining operations on federal lands are managed under the location system. As of 2018, 97 percent of

November 2021

Federal lands, which comprise one-third of the lands in the U.S., are a major source of hardrock minerals, such as gold, silver, and copper. There were 748 authorized hardrock mining operations on federal lands, as of September 2018.

Hardrock minerals play a major role in the U.S. and global economies and are widely used, including in smartphones and electric engines. However, mining hardrock minerals can create public health, safety, and environmental hazards. Questions have been raised about whether the systems used to manage hardrock mining on public lands adequately serve the nation’s interests.

hardrock mining operations were authorized under the location system, and 3 percent were authorized under the leasing system. [GAO-21-299](#), [GAO-20-461R](#)


There were differences in views about the systems among a broad range of stakeholders GAO interviewed in 2020. For example, the following are characteristics that these stakeholders generally described as advantages of each system:

- **Location system.** Industry stakeholders’ comments reflected a general emphasis on certainty and assurance that federal lands will be open and available for exploration, that operators will be able to develop the deposits they find, and that they will have ample time to accommodate the mine development process.
- **Leasing system.** Tribal government and public interest stakeholders’ comments reflected a general emphasis on equitably balancing mining with other land uses, the public having the opportunity to participate in land-use decisions, and mining not precluding other future uses of the land. [GAO-21-299](#)

Mining systems differ primarily in the first three stages: mineral exploration, mine development, and mineral production


Location system

This system, established in 1872, generally grants individuals’ rights to explore, develop, and mine on public domain lands (which typically were not previously in state or private ownership).




Mineral exploration

Operators may conduct certain exploration activities on public lands without agency approval.




Mine development

Rights conveyed through mining claims can exist in perpetuity as long as operators pay annual maintenance fees or acquire fee waivers.



Mineral production


Operators pay no federal royalties on the minerals produced but pay a one-time location fee and annual fees.



Annual fee Royalties


Leasing system

This system, adopted in the 1940s, allows individuals to lease hardrock minerals on certain acquired federal lands (which were granted or sold to the U.S. by a state or citizen).




Mineral exploration

Operators must obtain agency approval (permit, license, or lease) to conduct exploration activities.




Mine development

Leases are required for developing mines; leases have an initial 20-year term limit and may be renewable in 10-year increments.



Mineral production

Operators generally pay annual fees and royalties to federal and state governments on minerals produced.



Annual fee Royalties

Source: GAO analysis of laws, regulations, and Bureau of Land Management and the Forest Service documents. | GAO-22-105438

GAO identified three broad categories of challenges and opportunities for improving management of hardrock mining on federal lands

Environmental Stewardship

Challenges

- **Water quality impacts.** Mines can cause environmental degradation and hazardous conditions that may pose risks to human health and the environment, such as draining highly acidic water into soil and streams. For example, an environmental hazard includes mine waste releasing arsenic or lead into streams. [GAO-20-238](#)
- **Abandoned hardrock mines.** Federal agency data show there were about 141,000 abandoned hardrock mine features (e.g., an open tunnel) as of May 2019—of which over 60 percent are known to pose or may pose physical safety or environmental hazards. Federal agencies spent about \$2.9 billion from fiscal years 2008 through 2017 identifying, cleaning up, and monitoring abandoned hardrock mines. [GAO-20-238](#)

Opportunities

- **Water quality impacts.** By adopting newer technologies or approaches to mining, operators could help mitigate and minimize environmental impacts, according to public interest stakeholders. For example, operators could use newer techniques for storing mine waste and mining underground to reduce risk of water contamination. [GAO-21-299](#)
- **Abandoned hardrock mines.** Establishing federal funding sources for abandoned mine reclamation would help pay for mine cleanup, according to public interest stakeholders. [GAO-21-299](#)

Governance and Transparency

Challenges

- **Tribal consultation and public engagement.** Some tribal officials said that federal agencies do not always consult with them in a timely manner or incorporate their input. Some public interest stakeholders said that the public does not always have access to information and opportunities for input.
- **Competing uses of federal lands.** Some public interest and tribal stakeholders stated that under the location system, mining is given priority over other land uses, such as conservation or recreation. According to BLM, it last denied a mine plan in 2001.
- **Federal royalties.** A public interest stakeholder said royalties collected under the federal leasing system provide taxpayers a financial return for federally owned minerals. Others said the absence of federal royalty payments for minerals produced under the location system can be a financial advantage to operators.

Opportunities

- **Tribal consultation and public engagement.** Meaningful tribal consultation could help ensure agencies fulfill their obligation to tribes, according to some tribal officials. In addition, with more information and opportunities for comment, public engagement could increase, according to some public interest stakeholders.
- **Competing uses of federal lands.** By not giving mining priority, federal agencies could better balance competing uses of federal lands, according to some public interest stakeholders and tribal officials. Alternatively, the amount of federal lands withdrawn from hardrock mining could be reduced, according to some industry stakeholders.
- **Federal royalties.** By collecting federal royalties for all hardrock minerals produced, agencies could increase the federal government's and taxpayers' financial return, according to a public interest stakeholder.

For more information on these topics, see [GAO-21-299](#).

Administrative Resources

Challenges

- **Agency resources.** Industry and public interest stakeholders, as well as BLM officials, said agencies do not always have adequate resources to oversee mineral programs and conduct timely reviews of mine plans. Further, some industry stakeholders said not all agency staff have enough technical expertise in hardrock mining. [GAO-21-299](#), [GAO-16-165](#)

Opportunities

- **Agency resources.** Greater staff expertise and an appropriate level of staffing could improve overall agency management of hardrock mining, according to some industry and public interest stakeholders. [GAO-21-299](#)

GAO SUPPORT

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. This document is based on GAO audit products.

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#). Subscribe to our [RSS Feeds](#) or [Email Updates](#). Listen to our [Podcasts](#). Visit GAO on the web at <https://www.gao.gov>.

U.S. Government Accountability Office, 441 G Street NW, Washington, DC 20548

For more information, contact: Cardell Johnson, Acting Director, Natural Resources and Environment, JohnsonCD1@gao.gov, (202) 512-3841

Nikki Clowers, Managing Director, Congressional Relations, ClowersA@gao.gov, (202) 512-4400

Chuck Young, Managing Director, Public Affairs, YoungC1@gao.gov, (202) 512-4800

Key Contributors: Casey L. Brown, Keesha Luebke, Ulana Bihun, Elizabeth Jimenez, Rebecca Sandulli, Cynthia Norris, and Dan Royer.

Source: GAO (cover photo). (105438)

