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Report to the Chairman, Subcommittee on Mining and Natural Resources, Committee on Interior and Insular Affairs, House of Representatives

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MINERAL RESOURCES

Increased Attention Being Given to Cyanide Operations

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The Honorable Nick J. Rahall, II
Chairman, Subcommittee on Mining
and Natural Resources
Committee on Interior and Insular
Affairs
House of Representatives

Dear Mr. Chairman:

This report responds to your request that we review the environmental consequences of mining operations that use cyanide to produce gold and other minerals on federal land. Specifically, this report looks at the hazards of these operations to wildlife and the environment and the efficacy, implementation, and enforcement of existing laws and regulations governing these operations.

As agreed, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to interested parties and make copies available to others on request.

This review was performed under the direction of James Duffus III, Director, Natural Resources Management Issues, who can be reached on 275-7756. Major contributors are listed in appendix III.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

A surge in the price of gold during the 1970s and improvements in processes that use cyanide to extract gold from low-grade ore deposits have helped generate a new "gold rush." Since 1980, U.S. production has increased over 900 percent. Gold-producing operations using cyanide are located primarily in the arid western states. Concerned over the potential impacts of cyanide operations, the Chairman, Subcommittee on Mining and Natural Resources, House Committee on Interior and Insular Affairs, asked GAO to determine (1) the hazards of cyanide operations to wildlife and the environment on federal land and (2) the efficacy, implementation, and enforcement of existing laws and regulations governing these operations. To obtain this information, we reviewed cyanide operations on federal land in three states—Nevada, California, and Arizona.

Background

In the 1970s, the price of gold soared from about $35 an ounce to over $350 an ounce, and cyanide processing technologies were refined to permit the economical extraction of as little as 0.02 ounces of gold from a ton of low-grade ore. These technologies use cyanide solutions that are held in ponds ranging in size from less than 1 to over 500 acres. In 1989, the last year for which such estimates are available, cyanide was used to extract more than 80 percent of the 8.3 million ounces of gold produced in the United States. The public first became aware of the impact that cyanide operations can have on wildlife and the environment in 1986 when media reports called attention to large numbers of bird deaths from a cyanide operation on federal land.

As of January 1990, there were 119 active cyanide operations on federal land in Nevada, California, and Arizona—113 on land managed by the Department of the Interior's Bureau of Land Management (BLM) and 6 on land managed by the Department of Agriculture's Forest Service. Cyanide operations have also spread to other less arid states, including Montana, Idaho, Colorado, Oregon, Washington, and South Carolina.

As the government's principal land-managing agencies, BLM and the Forest Service are responsible for ensuring that mining operations on their land do not needlessly damage resources and do comply with federal and state laws. Interior's Fish and Wildlife Service is responsible for preventing the illegal killing of migratory birds, and the Environmental Protection Agency (EPA) is primarily responsible for protecting the quality of the nation's surface water. States have been delegated EPA's responsibility for protecting surface water and are also responsible for protecting both their ground water and their fish and wildlife.

Results in Brief

Cyanide operations can pose a hazard to both wildlife and the environment if effective precautions are not taken. Ponds containing cyanide solution attract wildlife, including migratory waterfowl. From 1984 through 1989, cyanide operators in Nevada, California, and Arizona reported more than 9,000 cyanide-related wildlife deaths, mostly of migratory waterfowl. About 8,500 of these deaths occurred at operations on BLM land and about 500 on Forest Service land. Although these deaths represent only a fraction of the bird deaths caused by hunting—less than 0.1 percent of the birds killed legally by hunters in the three states in 1 year—killing migratory birds without a license or a permit is a criminal offense under the Migratory Bird Treaty Act. Recently developed mitigation measures can prevent most cyanide-related bird deaths. GAO identified 31 inadvertent cyanide discharges from cyanide operations since 1984—29 on BLM land and 2 on Forest Service land. Federal and state officials believe that these discharges have resulted in minimal environmental damage because cyanide tends to break down quickly and discharges have usually occurred in remote, arid areas.

Federal and state statutes and regulations provide adequate authority to regulate cyanide operations and protect wildlife and the environment. However, in 1986, when the media reported large numbers of bird deaths at a cyanide operation on BLM-managed land in Nevada, no federal or state agency had in place a strategy specifically aimed at minimizing the potential adverse impacts of cyanide operations. Recently, federal and state oversight has increased. For example, BLM has implemented an agencywide cyanide management policy that includes design, reporting, and inspection requirements. Nevada, which has almost 90 percent of the cyanide operations in the three states we reviewed, now requires operators to establish protection measures at all cyanide ponds and report all wildlife deaths. However, the Forest Service, which has few cyanide operations on the land it manages, has not developed a specific cyanide policy because it believes that its existing land management authorities are adequate for regulating cyanide operations.

Principal Findings

Most Cyanide-Related Deaths Are Preventable

As of January 1990, 59 cyanide operators, including 53 in Nevada, had reported over 9,000 cyanide-related wildlife deaths. According to state of Nevada officials, 90 percent of the reported deaths were of birds, primarily of migratory waterfowl.

After experimenting for several years with various devices for frightening wildlife away from cyanide ponds, cyanide operators have found that either fencing and covering or diluting the cyanide solution can more effectively prevent wildlife deaths. However, these mitigation measures can cost hundreds of thousands of dollars to install and maintain.

Cyanide Discharges Appear to Have Had Little Environmental Impact

Cyanide discharges from active mining operations can result from faulty operating practices, leaking pond liners, overflows from ponds caused by storms, design flaws in pond construction, or human error. Cyanide discharges that contact ground water can contaminate water supplies, and discharges that contact surface water can kill fish and wildlife. Fortunately, cyanide tends to decompose quickly; discharges on federal land have usually been in arid areas; and, according to federal and state officials, few of these discharges have contacted ground or surface water. The discharges that have contacted ground water have usually been in remote areas and have not affected drinking water supplies. Consequently, agency officials believe that these cyanide discharges have resulted in minimal environmental damage. Nevertheless, the number of active cyanide operations on federal land has increased, and new operations have been established in other less arid states with ground water closer to the surface or with more surface water. GAO believes that these developments increase the risk that if cyanide discharges do occur, they could contact water supplies or endanger fish or wildlife.

A Cyanide Management Strategy Has Begun to Emerge

Existing statutes and regulations provide federal and state agencies with adequate authority to regulate cyanide operations on federal land and thereby protect wildlife and the environment. Federal land use legislation and regulations protect federal land, while other federal and state laws and regulations protect wildlife. In particular, the Migratory Bird Treaty Act protects migratory birds against unauthorized killing. Various federal and state laws protect surface and ground water.

Despite these authorities, neither federal nor state regulations required cyanide operators to report wildlife deaths before these deaths were publicized in 1986. BLM and the Forest Service did not require operators to report cyanide discharges to them, and inspections of cyanide operations had not been frequent enough to identify cyanide-related hazards requiring preventive measures or other corrective actions.

Federal and state oversight has, however, increased with the expansion of cyanide operations. For example, in August 1990, BLM issued a cyanide management policy covering all cyanide mining operations on BLM-managed land. This policy requires, among other things, (1) minimum acceptable design requirements, (2) mandatory operator reporting of all cyanide-related wildlife deaths and cyanide solution discharges, and (3) quarterly inspections of all cyanide operations by trained staff. Nevada has recently enacted legislation under which the state Department of Wildlife requires operators to establish protection measures at all cyanide ponds and report all wildlife deaths.

The Forest Service, with few active cyanide operations, has not formulated a policy specifically aimed at the hazards of cyanide operations on its land. An agencywide cyanide management policy would provide consistency across the Forest Service in dealing with the increasing numbers of cyanide operations that are likely, given current economic incentives, to be established on its land.

Recommendation

To better prepare the Forest Service to respond to the potential hazards of cyanide operations, GAO recommends that the Secretary of Agriculture direct the Chief of the Forest Service to develop and implement an agencywide policy specifically aimed at managing cyanide operations on Forest Service land. This policy should include (1) minimum acceptable design requirements, (2) mandatory operator reporting of all cyanide-related wildlife deaths and cyanide solution discharges, and (3) regular inspections of all cyanide operations by trained staff.

Agency Comments

GAO discussed the factual information in this report with BLM and Forest Service officials, who generally agreed with the facts as presented. The Forest Service, however, believes that its existing land management authorities are adequate for regulating cyanide operations. GAO continues to believe that, given the probability that the number of cyanide operations on Forest Service land will increase, the Forest Service should develop a consistent agencywide policy for cyanide operations. As requested, GAO did not obtain official agency comments on a draft of this report.

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Abbreviations

BLM	Bureau of Land Management
EPA	Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act of 1976
FWS	U.S. Fish and Wildlife Service
GAO	General Accounting Office
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act of 1969

Introduction

Gold is an important mineral in our high-technology society, with critical uses in computers, communications equipment, and jet aircraft engines, as well as its predominant uses in jewelry and as an alternative to currency. The United States is experiencing a new "gold rush": Gold production has increased over 900 percent since 1980. This gold rush has been made possible by a surge in the price of gold during the 1970s and by improvements in processes that use cyanide to extract gold and silver from low-grade ore deposits that previously had been uneconomical to mine. These ore deposits are located at both formerly mined and unmined sites in the western states, particularly Nevada, California, and Arizona. A large number of cyanide operations are situated on federal land claimed under the Mining Law of 1872 (30 U.S.C. 22 et seq.).

Mining authorities estimate that cyanide was used to extract over 80 percent of the 8.3 million ounces of gold and about 15 to 20 percent of the 60.8 million ounces of silver produced in the United States in 1989, the latest year for which data are readily available.[1] In most cyanide operations that produce gold, silver is produced as a by-product.

Cyanide Processes for Extracting Gold

Mining authorities agree that cyanide processing operations are the best available methods for extracting precious metals from low-grade ore. Heap leaching and milling are the two types of cyanide operations most commonly used to produce gold and silver.

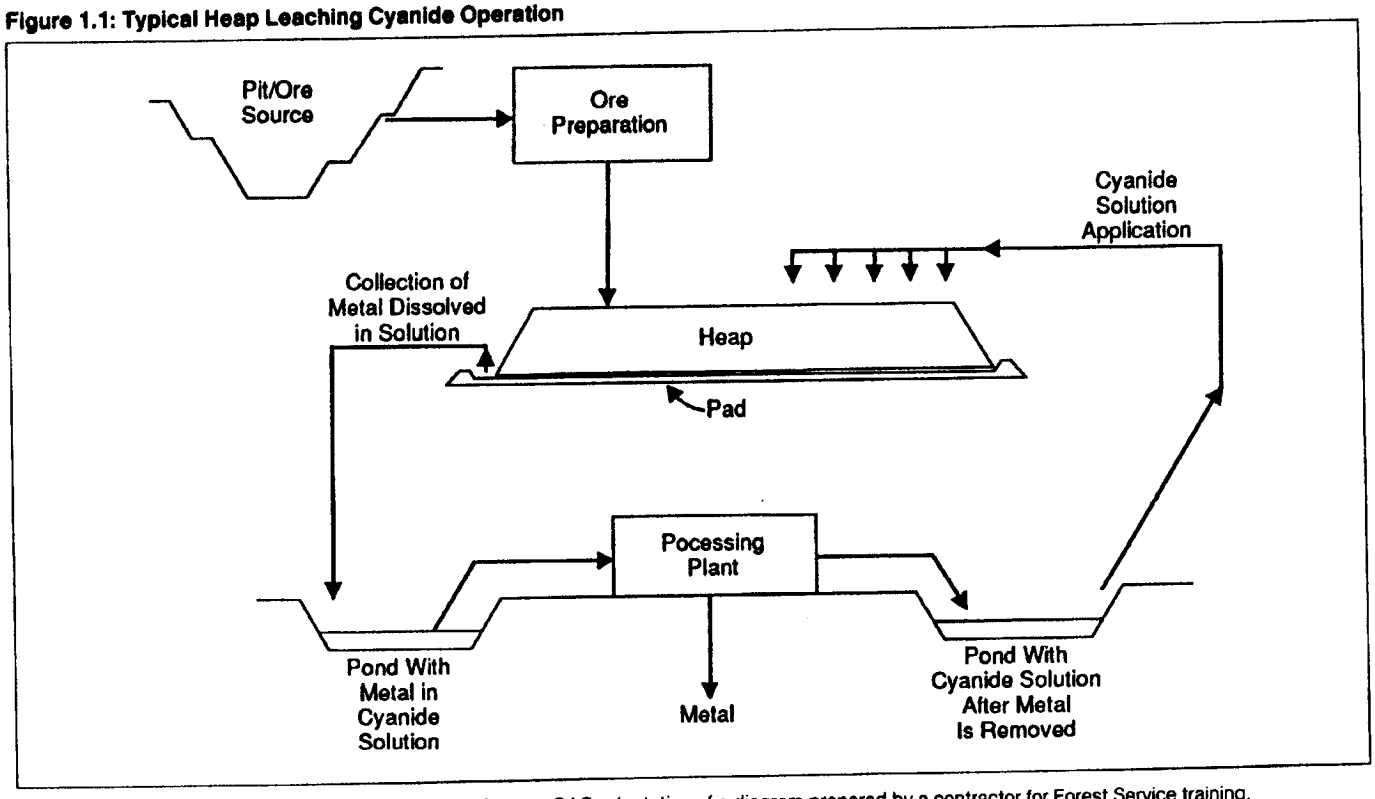
Heap Leaching Operations

In a typical heap leaching operation, low-grade ore is extracted from a large open-pit mine and placed in a large pile or heap. A diluted cyanide solution is applied to the heap's surface. As the solution seeps through the heap and dissolves (leaches) the gold and silver in the ore, it draws them into the cyanide solution. Beneath the heap, a synthetic liner catches the solution and channels it to a pond ranging in size from less than 1 to about 5 acres. This pond also has a synthetic liner. The liquid is then pumped to a processing plant where the gold and silver are removed, and the cyanide solution is returned to another lined pond before being pumped back to an ore heap for further leaching. Both the heap area and the ponds are usually constructed with a second liner—either synthetic or clay—underlying the synthetic liner. A leak detection system is installed between the two liners, and monitoring wells are

[1] All references to ounces are troy ounces. In troy units, a pound has 12 ounces.

usually located around the leach pads and solution ponds. Figure 1.1 illustrates a typical heap leaching operation.

Figure 1.1: Typical Heap Leaching Cyanide Operation



Source: GAO adaptation of a diagram prepared by a contractor for Forest Service training.

Some less frequently used heap leaching processes do not require exposed ponds, but rather contain the cyanide solution underground or in tanks, thereby preventing exposure to any wildlife.

Milling Operations

While low-grade ore is generally processed by heap leaching, somewhat higher grade ore is usually crushed to a smaller, more uniform size (milled) and then leached in tanks. Cyanide solutions are applied within the tanks to leach the gold and silver from the ore. The gold and silver are then removed from the cyanide solution. The remaining material, known as tailings, and the cyanide it contains are discharged from the plant to one or more large ponds called tailings ponds. The size of these

ponds can vary considerably, and some can exceed 500 acres. They are generally lined to prevent cyanide from contacting ground or surface water.

The Chemistry of Cyanide

Heap leaching and milling are relatively straightforward operations, although they rely on sodium cyanide, which has a fairly complex chemistry. In these operations, the solution containing sodium cyanide must be maintained under carefully controlled conditions. Otherwise, the sodium cyanide begins to decompose, making the solution both less useful for extracting gold and less hazardous. For example, when leaks or spills occur, contact with air and with various components in the soil tends to remove cyanide from solution and convert its toxic components through a variety of processes into other less toxic forms. Thus, the amount of cyanide from a leak or spill that could otherwise reach surface water or be transported through soils—the major potential pathway for cyanide to contaminate ground water—is reduced. If cyanide solution reaches surface or ground water, it may or may not present a problem, depending on its volume, composition, and concentration. If its volume is relatively small or the solution is sufficiently dilute, it could be harmless. In sufficient quantity or strength, it would pose a risk to animals or humans.

When wildlife drink from cyanide ponds, highly toxic hydrocyanic acid can form and react with iron in the blood to destroy the blood's ability to carry oxygen to the body. If the dose is strong enough, death could result rapidly. If not, the kidneys purge cyanide from the blood and the body recovers.

The Number of Mining Operations Using Cyanide Has Increased

Gold mining operations in South Africa started using cyanide in 1892. In the United States, similar operations began using it around the turn of the century. Heap leaching technology was developed in the 1960s, but not until the 1970s—when the price of gold increased tenfold from about $35 an ounce to over $350 an ounce—did the technology make it economical to extract as little as 0.02 ounces of gold from a ton of ore. As the technology continues to improve and if the price of gold remains favorable, the number of active operations is likely to increase.

Most of the large increase in gold production has occurred in Nevada, California, and Arizona. In 1989, Nevada produced about 60 percent of the gold in the United States, and California and Arizona together produced an additional 12 percent. According to an official in the Nevada

office of the Department of the Interior's Bureau of Land Management (BLM), about 90 percent of the gold produced in Nevada comes from public land. Similarly, most of the gold produced in California and Arizona is mined on public land. Cyanide operations are also appearing in some less arid states, including Montana, Idaho, Colorado, Oregon, Washington, and South Carolina.

As of January 1990, 119 active cyanide heap leaching and milling operations in the three states we reviewed were on public land, and another 5 operations had been proposed. Table 1.1 shows that most of the cyanide operations on federal land are located in Nevada. Of the 119 active cyanide operations, 113 are on land managed by BLM, and 6 are located in national forests managed by the Department of Agriculture's Forest Service.

Table 1.1: Number of Active Cyanide Operations on Federal Land in Nevada, California, and Arizona as of January 1, 1990

	Cyanide Operations		
State	**Active**	**Proposed**	**Total**
Nevada	105	1	106
California	8	2	10
Arizona	6	2	8
Total	**119**	**5**	**124**

Note: This table includes operations partially on federal land and excludes fully enclosed operations in which no cyanide is exposed to the environment.

Federal and State Agencies Responsible for Overseeing Cyanide Operations

The authority and responsibility for ensuring that cyanide operations do not endanger wildlife and other natural resources on federal land belong primarily to the federal land management agencies, but several other federal and state agencies play important roles. The two principal federal land management agencies—BLM and the Forest Service—manage about 270 million and 191 million acres, respectively, or about 64 percent of all federally owned land. In Nevada, California, and Arizona, 54 percent of the land is federally owned.

In addition, Interior's U.S. Fish and Wildlife Service (FWS) and the Environmental Protection Agency (EPA), as well as various state agencies, have significant responsibilities for protecting wildlife and the environment. FWS is responsible for enforcing the Migratory Bird Treaty Act and protecting migratory birds from the effects of cyanide operations. In addition to FWS, each of the three states has established an agency to

protect fish and game: the Nevada Department of Wildlife, the California Department of Fish and Game, and the Arizona Game and Fish Department.

EPA and the states share responsibility for protecting water resources. EPA is primarily responsible for protecting the nation's surface water under the Clean Water Act. As provided for in the act, it has delegated this authority to state agencies in Nevada, Arizona, and California. Each state also has primary responsibility for protecting the quality of its own ground water. The responsible state agencies for both surface and ground water are the Division of Environmental Protection in Nevada, the California State Water Resources Control Board, and the Department of Environmental Quality in Arizona.

BLM and Forest Service Organization

BLM and the Forest Service are organized similarly, both having four levels of management. The BLM Director and Forest Service Chief head their respective agencies. Both agencies' headquarters comprise a variety of program offices that issue policy and guidance for their respective programs. Each agency has a decentralized approach to management with three levels of field operations.

BLM field operations consist of state offices, district offices, and resource area offices. The 12 state offices, each managed by a state director, are responsible for providing statewide program direction, oversight, and coordination of resource programs for federal land under BLM's jurisdiction. Each state office has several district offices, each headed by a district manager. Each district office is responsible for two or more resource area offices. District offices provide oversight and support to their resource area offices. Resource area offices, each headed by a resource area manager, are the primary field locations for program operations. BLM's Nevada, California, and Arizona state offices collectively have 14 district offices and 36 resource area offices.

Forest Service field operations consist of regional, forest, and ranger district offices. The Forest Service has nine regional offices, each managed by a regional forester. A regional office has several forest offices, each managed by a forest supervisor. A forest office is responsible for three or more ranger district offices. Ranger district offices, managed by district rangers, are responsible for a portion of a forest. The three states included in our review, each located within the geographical boundaries of a different regional office, collectively contain 25 forest offices and 119 ranger district offices.

Objectives, Scope, and Methodology

The Chairman of the Subcommittee on Mining and Natural Resources, House Committee on Interior and Insular Affairs, asked us to determine (1) the hazards of cyanide operations to wildlife and the environment on federal land and (2) the efficacy, implementation, and enforcement of existing laws and regulations governing these operations.

Although used to process other minerals, cyanide is most commonly used to produce gold. Therefore, we selected the two largest gold-producing states—Nevada and California—for review. We also included Arizona, another large gold-producing state. These are also the states with the largest number of reported cyanide-related wildlife deaths. Although cyanide operations are being used to produce gold outside the western states—in South Carolina, for example—we limited our review to operations on federal lands in the West where most of the gold in the United States is produced. In the states we selected, we limited our review to operations with exposed cyanide solution ponds on federal land managed by BLM or the Forest Service. BLM and the Forest Service provided us with the number and status of cyanide operations, as of January 1, 1990, on federal land that they manage in the three states we reviewed.

To better understand cyanide operations, the potential environmental problems they present, and the effectiveness of methods used to overcome these problems, we asked BLM's Nevada State Office to arrange a tour of five large cyanide operations where a significant number of wildlife deaths had occurred and where corrective measures had been taken. Nevada was selected because it produces about 60 percent of the nation's gold and had reported the greatest number of cyanide-related wildlife deaths. We visited the cyanide operations listed in appendix I in November 1989.

During our visits to cyanide operations, we

- obtained background documents on each cyanide operation and copies of its wildlife death reporting records;
- discussed with company representatives and BLM officials who accompanied us the history of the operation, focusing on wildlife deaths and cyanide solution discharges;
- obtained information on the measures used to prevent wildlife deaths and cyanide discharges; and
- obtained information on methods used to monitor cyanide operations and their effectiveness and on the frequency with which the operations were inspected by federal and state inspectors.

In addition, to gain a broader perspective, we obtained information on wildlife deaths for the three states reviewed from officials of BLM, the Forest Service, FWS, and state wildlife agencies. (See app. II for the BLM and Forest Service offices contacted.)

To identify whether cyanide discharges occurred and to assess whether any identified discharges had environmental impacts, we contacted state water quality protection agencies and BLM and Forest Service offices, visited mine sites, and reviewed various documents. To determine state requirements for discharges and mitigation, we contacted EPA and the state water quality protection agencies.

We also obtained views on the environmental hazards of cyanide operations from mining industry representatives and environmental groups. Industry representatives included the California Mining Association and E.I. Du Pont De Nemours and Company—a cyanide producer. Environmental groups included the Wilderness Society, the Sierra Club, the Natural Resources Defense Council, and the Mineral Policy Center. In addition, we spoke with an expert at the University of Nevada's Mackay School of Mines in Reno.

To address the second objective—the efficacy, implementation, and enforcement of existing laws and regulations—we examined federal and state laws affecting cyanide operations. The federal laws reviewed included the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4331 et seq.), the Federal Land Policy and Management Act of 1976 (FLPMA) (43 U.S.C. 1732), the National Forest System Organic Act of 1897 (16 U.S.C. 551, 553), the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.), and the Clean Water Act (33 U.S.C. 1251 et seq.). State laws reviewed included Nevada's Wildlife Protection Act and Water Pollution Control Act, California's Porter-Cologne Water Quality Control Act, and Arizona's Aquifer Protection Rules. We also examined agency regulations and policies implementing these laws and BLM notices of noncompliance issued to cyanide operators.

We conducted our work between August 1989 and April 1991 in accordance with generally accepted government auditing standards. We discussed the results of our review with BLM and Forest Service officials, who generally agreed with the facts as presented. The Forest Service, however, believes that its existing land management authorities are adequate for regulating cyanide operaions. As the Chairman's office requested, we did not obtain official agency comments on a draft of this report.

At Cyanide Operations Effective Precautions Can Mitigate Hazards

Since the early 1980s, the number of cyanide operations on federal land has been increasing. These operations present a potential hazard to both wildlife and the environment. Although reported wildlife deaths attributable to cyanide operations represent only a small fraction of the bird deaths attributable to hunting—from 1984 through 1989 in Nevada, California, and Arizona they totaled about 0.1 percent of the bird deaths caused by hunting in those states in a single year—most cyanide-related deaths are preventable, according to state officials. Furthermore, although federal and state officials believe that inadvertent discharges of cyanide have thus far resulted in minimal environmental damage in the three states reviewed, the long-term effects of cyanide that has seeped into the ground are not fully known.

While Most Cyanide-Related Deaths Are Preventable, Some Bird Deaths Continue

Cyanide ponds attract wildlife, including waterfowl, flying along normal migratory routes. From 1984 through 1989, more than 9,000 cyanide-related wildlife deaths were reported in the three states. About 8,500 of these deaths occurred at operations on BLM-managed land and about 500 occurred on Forest Service land. However, over time and through trial and error, cyanide operations and state and federal agencies have identified, and many operations have implemented, measures to prevent most cyanide-related wildlife deaths.

Cyanide Operators Have Reported Thousands of Wildlife Deaths

At the request of the Nevada Department of Wildlife, some cyanide operators in Nevada began voluntarily reporting cyanide-related wildlife deaths in 1984. In 1986, media reports called attention to large numbers of bird deaths at a cyanide operation on BLM-managed land near Gabbs, Nevada. On the basis of information provided by cyanide operators, the state of Nevada reported that during a 3-month period in 1986, 870 birds had died in the operation's tailings pond. Concerns arose again in 1988 when hundreds of bird deaths were reported at a cyanide operation along the Pacific Flyway for migratory waterfowl in western Arizona, and in 1989 when more bird deaths were reported at cyanide operations in southern California's Mojave Desert.[1]

As of January 1990, cyanide operators in the three states reviewed had reported at least 9,000 cyanide-related wildlife deaths, including those of birds from about 80 species and mammals from 17 species. According

[1] Although not within the scope of this review, a cyanide discharge occurred on October 28, 1990, near Jefferson, South Carolina. Between 10 and 12 million gallons of cyanide solution flowed from an eroded dam surrounding an overflow pond into a nearby river, killing about 11,000 fish.

to FWS and Nevada officials, about 90 percent of the reported wildlife deaths were of birds—mostly of migratory waterfowl. The vast majority of bird deaths occurred at the tailings ponds that attract migrating birds in arid areas where water is scarce. (See fig. 2.1.) Other reported wildlife deaths include those of deer, cows, bats, rodents, and reptiles. From the mortality reports we reviewed, we did not identify any deaths of birds or animals from endangered species, and agency officials told us none were reported.

Figure 2.1: A Large Cyanide Solution Tailings Pond in Nevada

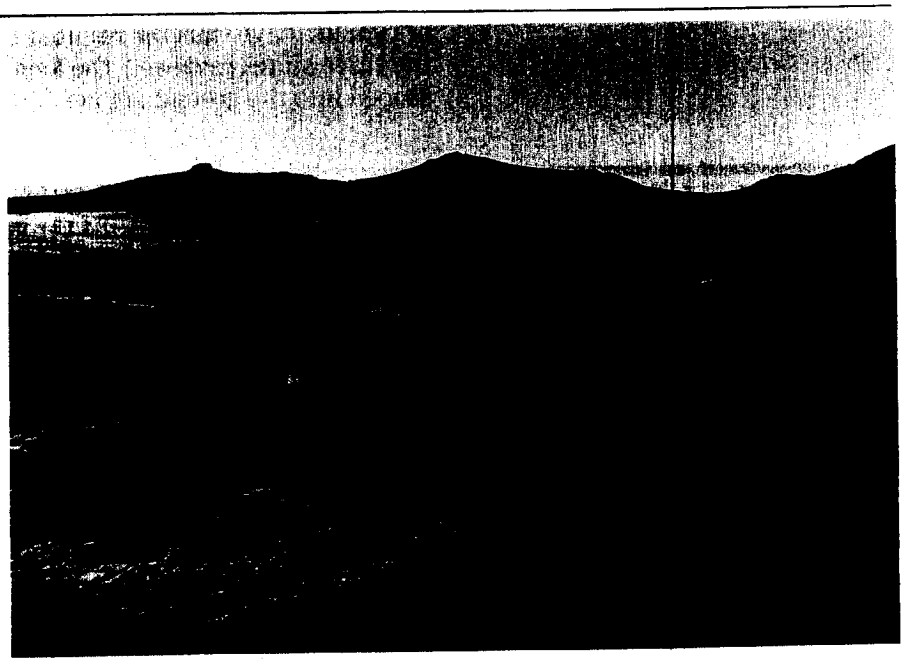
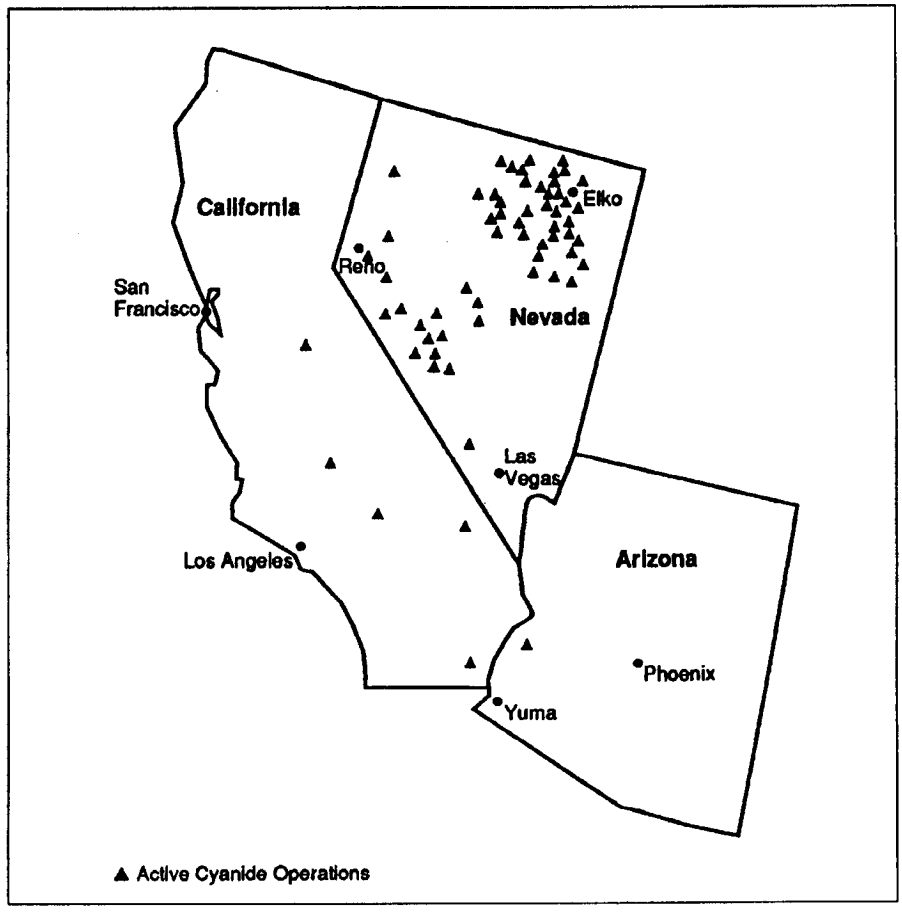


Figure 2.2 shows, for the three states we reviewed, the location of active cyanide operations on federal land that reported cyanide-related wildlife deaths. As shown, Nevada had 54 of the 60 such operations (90 percent), while Arizona had only 1.

Figure 2.2: Active Cyanide Operations on Federal Land in Nevada, California, and Arizona With Reported Wildlife Deaths



Note: This figure includes only those operations totally or partially on federal land with reported wildlife deaths as of January 1990.

Most Cyanide-Related Wildlife Deaths Are Preventable

Over time, cyanide operators have used a number of measures to prevent wildlife deaths. Initial efforts to protect birds focused on scaring them away from cyanide operations with hazing devices or techniques, such as propane cannons, pennants, floating alligators, decoy owls, music, and other recorded sounds. However, federal and state regulatory officials and cyanide operators told us that hazing is an ineffective long-term solution. For example, a mine representative stated that migratory birds quickly become accustomed to the sound of propane cannon explosions and cease to be frightened away.

Despite their ineffectiveness as long-term methods for preventing bird deaths, hazing techniques were still being used, as of January 1990, by

some Nevada and California cyanide operations with histories of bird deaths. For example, in Nevada, one operator was still using music, propane cannons, pennants, and floating alligators, and another was using decoy owls and an alarm system to scare birds away from their cyanide ponds. Likewise, a few operators in California were still using cannons and pennants similar to those shown in figure 2.3.

Figure 2.3: Cannons and Pennants Used to Scare Birds Away From a Cyanide Solution Pond

Trial and error have shown that preventing wildlife deaths requires either (1) restricting access to the cyanide solution by fencing the perimeter and covering the surface of cyanide ponds with netting or other materials or (2) diluting the solution to nonlethal levels with water or by chemical detoxification.[2] These mitigation measures can cost hundreds of thousands of dollars to install and maintain.

For smaller ponds, netting has been the technique of choice. FWS surveyed 45 cyanide operations in Nevada and concluded that netting can prevent most cyanide-related bird deaths. All five operations that we visited in Nevada had netted their smaller ponds. Mine representatives told us that operators rarely cover large tailings ponds with netting because wind can rip the nets or the nets can sag into the cyanide solution. As an alternative, most cyanide operators who have experienced bird deaths in their tailings ponds have taken steps to neutralize the cyanide solutions in the tailings ponds to nonlethal levels.

Two of the cyanide operations that we visited in central Nevada neutralize their tailings ponds to prevent cyanide-related deaths. The first, located near Winnemucca, installed a dilution system for its tailings pond in August 1988. The more highly concentrated cyanide solution entering the pond is mixed with and diluted by the weak solution already in the pond. According to operation representatives, this mixing is intended to result in a nonlethal solution throughout the pond. During the 5 months before starting this system, the operator found about 16 dead birds per month in this pond. An official of the operation told us that in the 16 months since dilution began, eight dead birds were found. While neutralization has reduced bird deaths, the dilution system continues to have problems. In May 1991, the resident agent of FWS told us that over 100 birds were killed in cyanide solution ponds at this operation during the past year.

The second cyanide operation, located near Battle Mountain, opened a tailings pond in June 1989. Because few wildlife deaths had occurred at this operation's heap leaching pond, neutralization was not initially required. However, shortly after the pond opened, more than 800 birds died at the site during a 3-month period. After the operator installed a neutralization system, 17 birds died in 6 months. During the first 3

[2]Agency officials told us that solutions of 50 or fewer parts-per-million of cyanide are generally nonlethal, while solutions of 100 or more parts-per-million are clearly lethal to birds. Various factors, such as the bird species and their condition when they arrive at the site, may also influence how susceptible the birds are to the cyanide solution. FWS is studying the effects of cyanide on wildlife—particularly on waterfowl.

quarters of 1990, wildlife deaths at the tailings pond were 10, 36, and 95, respectively. In September 1990, the operator implemented another neutralization process, and the Nevada Department of Wildlife reported that in the 6 months since its implementation, no documented losses have been reported.

Cyanide Discharges Appear to Have Had Little Environmental Impact

We identified 31 inadvertent cyanide discharges from cyanide operations in Nevada, California, and Arizona—29 on BLM-managed land and 2 on Forest Service land—since 1984. Federal and state officials believe that these discharges have resulted in minimal environmental damage because cyanide tends to break down into harmless substances when not closely controlled and, to date, these discharges have usually occurred in remote, arid areas. The few discharges that have contacted ground water have usually been in remote areas and have not affected drinking water supplies. However, the number of active cyanide operations on federal land has increased, and new operations have been established in other less arid states. This expansion of cyanide operations increases the risk that if cyanide discharges do occur, they could reach surface water, thereby presenting hazards to fish and wildlife, and/or contact ground water, thereby adversely affecting water supplies.

Discharges Have Occurred for Many Reasons

Although cyanide operators have an economic incentive to prevent leaks of cyanide solutions, particularly of those solutions that contain the gold and silver they intend to recover, 31 inadvertent discharges of cyanide solution had occurred since 1984 in the three states we reviewed. These discharges resulted from such things as faulty operating practices, leaking pond liners, storm overflows from tailings ponds, design flaws, and/or human error. For example, at an operation on BLM-managed land in California's Mojave Desert, a faulty operating practice combined with a design flaw resulted in a discharge. In January 1988, the operator was conducting a test to improve process efficiency. In this test, the operator constructed small ponds on top of the heap. One of the small pond's walls broke, and a mud slide containing about 24,000 gallons of cyanide solution spilled; about 10 percent of this solution spilled onto the ground. A BLM official told us that the operator cleaned up the spill. State and federal officials do not believe that the spill caused any long-term damage.

A spill also occurred at a cyanide operation on BLM-managed land in Nevada. At this operation, heap leaching was being conducted during the winter, and the cyanide solution froze. During a warm rain, the cyanide solution melted, causing a heavy run-off. Although the operator

built an emergency unlined pond to contain the run-off, the pond wall broke, and over 225,000 gallons of solution spilled onto the desert. BLM officials told us that no damage was identified. Nevertheless, the Nevada water quality agency fined the operator $25,000 for this unauthorized discharge and for not using the best available control technology or best management practices.

A small spill also occurred at a cyanide operation on Forest Service-managed land in Nevada. Erosion had flattened a berm around a heap leaching pad. Cyanide solution spilled from a broken pipe and flowed over the flattened berm to form a small pool at the edge of the pad. The operator reported that two cows had died from cyanide poisoning after drinking from the pond. In their investigation of the incident, Nevada's Division of Environmental Protection concluded that the fence was too close to the heap leaching pad. Forest Service officials also concluded that the fence was probably inadequate to keep out wildlife and that a source of water was needed to replace two springs that had been lost when the operation was established. The operator moved the fence, agreed to provide a water source, and removed the contaminated soil.

Impacts of Discharges Appear Minimal

Mining industry representatives and government officials agree that cyanide tends to break down quickly into harmless substances when exposed to air and to various components frequently found in soil, such as minerals and microorganisms. Similarly, precipitation or other contact with water can quickly dilute cyanide solutions to nonlethal levels. According to one mining consultant, cyanide discharges could take as long as 50 years to seep 30 feet into the ground. In many arid areas, ground water is hundreds of feet below the surface. In these cases, the cyanide would probably have broken down into harmless components or have been diluted before the spilled solutions reached the ground water.

Given these characteristics of cyanide, and the fact, according to state and federal officials, that most spills to date have occurred in remote arid areas, past cyanide discharges are unlikely to have created long-term hazards. But if spills occur at the increasing number of cyanide operations in less arid states, they are more likely to reach surface or ground water. For example, in December 1988, cyanide solution from a tailings pond at a Nevada operation reached ground water and raised the cyanide concentration at the measuring point to 6 parts-per-million, compared to the maximum safe concentration of cyanide in drinking water of 0.2 parts-per-million. According to state officials, the ground water at this location was only 10 to 15 feet below the surface. The

operator pumped the contaminated water back into the tailings pond. An official in Nevada's Division of Environmental Protection told us that the spill did not adversely affect the water supply for the nearest existing community located 10 miles away.

The Nevada tailings pond incident highlights a concern that when leaks occur below ground, cyanide may persist in unacceptable concentrations as it migrates from the spill source. One mining expert, who has researched the effects of cyanide, cautioned us that the long-term effects of cyanide that has seeped into the ground from below-ground sources, such as leaks from tailings ponds, are not fully known. Forest Service officials told us that additional research is needed on the behavior of cyanide underground. The U.S. Bureau of Mines is conducting research to assess these effects.

Agencies Have Adequate Authority to Protect Wildlife and the Environment From Cyanide, and Federal and State Oversight Has Increased

Federal and state agencies have adequate authority to regulate cyanide operations and protect wildlife and the environment. However, in 1986, when the media first focused attention on the potential hazards of cyanide operations to wildlife and the environment, no federal or state agency had in place a strategy specifically aimed at minimizing the potential adverse impacts of cyanide operations. As the number of active cyanide operations has grown and such operations have been established in other less arid western states, federal and state oversight has increased. Nevada has recently enacted legislation providing authority for the oversight of cyanide operations, and BLM has issued a comprehensive cyanide management policy for the land it manages. The Forest Service has not developed a policy specifically aimed at the potential hazards of cyanide operations on its land. The Forest Service believes that its existing land management authorities are adequate for regulating cyanide operations.

Federal and State Agencies Have Adequate Authority

Federal and state agencies have adequate authority to regulate cyanide operations and protect wildlife and the environment from their potential hazards. BLM and the Forest Service have the primary responsibility and authority for protecting resources on federal land, but in practice the authority and responsibility for ensuring that cyanide operations do not kill wildlife or degrade water quality are diffused among several federal and state agencies.

BLM and the Forest Service Have Primary Authority for Protecting Federal Land

The Federal Land Policy and Management Act of 1976 (FLPMA) requires Interior to prevent unnecessary and undue degradation of the public lands. The National Forest System Organic Act of 1897 gives the Forest Service similar authority to protect national forests, as well as to protect fish and game.

To ensure that the land they manage is adequately protected, BLM in 1980 and the Forest Service in 1974, respectively, issued surface management regulations governing hardrock mining,[1] including cyanide operations on federal land. These regulations require operators to submit and obtain approval for plans of operations before starting to

[1]Hardrock minerals include gold, silver, copper, iron, and lead.

mine.[2] The plans describe the intended mining activity and the mitigation techniques operators propose to minimize damage to the environment. Before BLM and the Forest Service approve the plans, they require operators to apply for and usually to obtain all required federal and state permits. BLM and the Forest Service have the authority to prevent cyanide operations that do not comply with federal laws and regulations from starting, and to seek court ordered closure of, operations if the operators do not comply with the requirements in their operating plans or with general agency requirements.

In addition, the two federal land management agencies rely heavily on the environmental analysis process established to comply with the National Environmental Policy Act of 1969 (NEPA). This act requires federal agencies to identify the impacts of their major actions that may significantly affect the quality of the human environment. Before approving any mining activity, BLM and the Forest Service generally prepare an environmental analysis for proposed cyanide operations and submit the analysis for review and comment to the federal and state agencies having environmental oversight or regulatory responsibilities. If significant environmental impacts are found, the federal agencies are required to prepare a more detailed environmental impact statement. BLM and the Forest Service use the comments received on the environmental analysis to help identify concerns that must be addressed in an operator's plan of operations. The specific methods of mitigation are left up to the operator as long as the responsible federal land management agency agrees that they are appropriate.

Under the authority of its surface management regulations, on August 6, 1990, BLM established a policy for managing cyanide operations on its land to ensure that these operations do not cause unnecessary or undue degradation. The policy sets out a broad range of principles to guide BLM, including (1) minimum acceptable design criteria, such as specific construction practices; (2) coordination among state and federal agencies; (3) financial guarantees to ensure reclamation of mining operations; (4) mandatory reporting by operators of wildlife deaths and cyanide discharges; (5) regular BLM inspections; (6) training for BLM employees involved in the surface management of cyanide operations; and (7) procedures for closure and reclamation. It also encourages applied research on reclamation and environmental issues at selected mine sites. BLM had previously adopted several elements of this policy. In October 1989, BLM

[2]For mining operations involving 5 acres or less, BLM generally requires a "notice" that is less detailed than a plan.

required its personnel to inspect all active cyanide operations at least quarterly. On August 14, 1990, BLM implemented a bonding policy that requires all cyanide operators to post a bond for the full amount of BLM's estimate for reclamation costs.

The Fish and Wildlife Service and State Agencies Protect Wildlife

FWS is responsible for enforcing the Migratory Bird Treaty Act (MBTA). Under the act, causing the death of migratory birds without a license or permit is a criminal offense.

In addition to FWS, each state that we reviewed has designated an agency to protect fish and game. In Nevada, the Department of Wildlife and other agencies, in cooperation with the Nevada Mining Association, developed the Wildlife Protection Act (NRS 501.181, et seq.). The act became effective in October 1989 and is intended to ensure that wildlife deaths do not occur as a result of cyanide or other substance poisoning. The act requires any person maintaining certain artificial bodies of water, such as cyanide ponds, to obtain a permit. As provided by the act, the Nevada Board of Wildlife Commissioners adopted regulations for issuing, renewing, and revoking such permits. Under this authority, the Department of Wildlife requires that heap leaching ponds be covered and that mill tailings ponds be made nonlethal. Operators of existing cyanide operations were given until April 1990 to take similar measures. Operators who violate their permits or fail to obtain one are subject to criminal prosecution.

California's and Arizona's fish and game agencies have no authority specifically aimed at preventing wildlife deaths caused by cyanide operations. Instead, they rely on their general authorities to issue citations to those killing game species—birds and animals—without a license.

Except for Nevada's Department of Wildlife, the wildlife protection agencies are in a much weaker position than BLM and the Forest Service to protect wildlife. Neither the Arizona and California agencies nor FWS has the authority to require that cyanide operations be designed or operated so as to prevent wildlife deaths. However, their authority to prosecute violators may help deter cyanide-related deaths.

The Environmental Protection Agency and State Agencies Protect Water Resources

EPA and the states share authority for protecting water resources. The Clean Water Act makes EPA primarily responsible for protecting surface water. The act allows EPA to delegate its surface water protection authority to the states but requires EPA to review state performance to ensure that state programs are meeting federal requirements. EPA has delegated this authority to state agencies in various states, including Nevada, Arizona, and California.

Each state has primary responsibility for protecting the quality of its own ground water. In Nevada, ground water is protected by the Water Pollution Control Act, in California by the Porter-Cologne Water Quality Control Act, and in Arizona by the Environmental Quality Act. These state laws also provide authority for the states to exercise the water protection authority delegated to them by EPA under the Clean Water Act.

The state agencies administering these laws require cyanide operators to apply for a permit before they begin operations. To obtain a permit, cyanide operators in Nevada, for example, must meet certain requirements, such as the minimum design and construction standards that the state has developed to ensure that hazardous substances, including cyanide, will not be discharged into the environment or that discharges will comply with state standards. The states have also established monitoring and reporting requirements for the discharge of hazardous chemicals, including cyanide, to surface and ground water. Operators that violate discharge requirements are subject to various penalties.

Requirements Were Not in Place to Prevent Wildlife Deaths and Cyanide Discharges

When media reports called attention in 1986 to large numbers of cyanide-related bird deaths, cyanide operators had not been required to report wildlife deaths to state or federal agencies or cyanide discharges to the federal land management agencies. In addition, responsible agencies had different inspection practices. Regular inspections are necessary to provide timely and accurate information to responsible agencies on the impact of cyanide-related hazards on wildlife. Given the limited reporting and inspections before recent increases in federal and state oversight, an accurate estimate of the number of wildlife deaths and cyanide discharges was not possible.

Lack of Reporting Requirements

When media reports highlighted large numbers of bird deaths at a cyanide operation in Nevada in 1986, no federal or state agency required reporting of cyanide-related wildlife deaths. Although Nevada's Department of Wildlife had initiated a voluntary reporting program in 1984, few operators had reported cyanide-related deaths. California and Arizona, as well as BLM and the Forest Service, had no similar voluntary reporting requirement. Because reporting was voluntary or nonexistent, there was little assurance that the full extent of wildlife deaths was known.

Since the enactment of the Clean Water Act, the states have required that discharges of pollutants be reported, but BLM and the Forest Service did not require operators to report discharges to them. Instead, the land management agencies generally relied on the state agencies to provide them courtesy copies of discharge reports. This voluntary process did not always work.

Frequency of Inspections Varied

Agencies have different inspection practices. For example, before October 1989, BLM policy required all mining operations that caused surface disturbance—including cyanide operations—to be inspected at least once a year. BLM officials told us that they inspected cyanide operations at least once a year but were unable to make as many visits as they would like to have made. The Forest Service did not have a minimum requirement for inspection frequency—all operations causing surface disturbance, including cyanide operations, were required to be inspected periodically. The Forest Service allows each ranger district to decide how often these operations should be inspected. FWS and the state wildlife and water protection agency officials told us that they generally try to make regular inspections of active cyanide operations but are not always able to do so.

A Cyanide Management Strategy Has Begun to Emerge

Federal and state oversight has increased with the number and wider geographic distribution of active cyanide operations. During 1990, BLM reviewed the effectiveness of its land management program for ensuring the safety of cyanide operations, and in June 1990, we briefed BLM on the results of our evaluation. On August 6, 1990, BLM issued a cyanide management policy covering all cyanide operations on BLM-managed land. The Forest Service, which so far has had few cyanide operations on its land, has not developed such an overall national cyanide management policy. Nevada, in cooperation with the Nevada Mining Association, has recently enacted legislation under which operators must obtain

permits for all cyanide ponds and report all wildlife deaths. Arizona and California, however, have not initiated similar comprehensive actions for cyanide operations.

A cyanide management strategy, at a minimum, should include such key elements as design criteria, operator reporting requirements, inspection requirements, staff training requirements, and agency coordination procedures.

Design Criteria

A key element of a cyanide management strategy is design criteria that specify minimum acceptable requirements, including specific construction practices and design objectives and philosophies. In the states we reviewed, Nevada's Department of Wildlife was the first state agency to develop specific design criteria for cyanide operations. In 1989, Nevada issued statewide guidance on design criteria and began requiring all new cyanide operators to fence and cover all ponds containing lethal doses of cyanide before obtaining permits to operate. Forest Service and California and Arizona officials told us that although they do not have minimum acceptable design criteria, they do require operators to fence and cover or neutralize ponds on a case-by-case basis.

BLM's 1990 cyanide management policy provides a comprehensive approach for designing cyanide operations. To ensure environmental protection, it requires that these operations use the best practicable technology. The policy specifies design criteria, such as the requirement that cyanide solution transfer and containment structures be fenced and covered so as to prohibit access. BLM's policy also includes design objectives, such as prevention of unauthorized discharges of cyanide. This objective requires operators to design their operations so as to contain fluids that would be generated in the worst 24-hour storm that might occur in a 100-year period.

Operator Reporting

Another key element of a cyanide management strategy is required reporting of all cyanide-related wildlife deaths and cyanide solution discharges. To date, state reporting requirements have varied. In 1984, Nevada asked operators to report cyanide-related wildlife deaths voluntarily, and in December 1989, it initiated mandatory quarterly reporting for all operations. According to state officials, California and Arizona, which have far fewer active cyanide operations, still do not require cyanide operators to report wildlife deaths.

Before August 1990, responsibility for determining whether and how to gather information on cyanide-related wildlife deaths on BLM-managed land was delegated to BLM's state offices. The BLM Nevada State Office required cyanide operators to send BLM a copy of each quarterly wildlife death report required by the state. Beginning in the summer of 1989, the BLM California State Office required all cyanide operators on BLM-managed land to report monthly on wildlife deaths. Although the BLM Arizona State Office had no general reporting requirement, it required the state's only active cyanide operator with known cyanide-related wildlife deaths to begin monthly reporting in March 1988. BLM's 1990 cyanide management policy provides for uniform reporting. It requires all operators using cyanide to report any wildlife deaths promptly to the local BLM office and to the appropriate state agency.

Responsibility for deciding whether to require operators to report cyanide-related wildlife deaths remains decentralized within the Forest Service. Consistent with the agency's management approach, individual ranger districts decide whether and how cyanide operators must report wildlife deaths.

Before 1990, the states required cyanide operators to report cyanide discharges, but BLM and the Forest Service generally did not. The states required reporting as part of the authority delegated to them under the Clean Water Act. To comply with the act, cyanide operators must either design facilities that do not discharge pollutants into the navigable waters of the United States or obtain permits providing for the discharge. If unauthorized discharges occur, the operators must report them to the appropriate state agencies. State agencies often provide BLM and the Forest Service with courtesy copies of the reports that operators have filed. However, the geologist from BLM's Nevada State Office told us that the informal process had not been working very well. He said that he was aware of some instances in which spills had occurred and the state agency had not notified BLM. For example, the 225,000-gallon cyanide solution spill discussed in chapter 2 occurred at a Nevada cyanide operation on March 10, 1989. In the notice of noncompliance that BLM issued to the operator, BLM noted that it had learned of the spill from a newspaper 6 days after the spill had occurred.

BLM's August 1990 cyanide policy requires that any spill or discharge of cyanide solution be reported immediately to the local BLM office and to the appropriate state agency. The Forest Service does not require that cyanide discharges be promptly reported to it. The Service allows field

officials to deal with such matters as reporting requirements on a local level.

Agency Inspections

Field monitoring inspections are essential to ensure compliance with approved plans of operation. Specifically, inspections can help ensure that safety measures called for in the approved plans have been properly installed, are being maintained, and are working. For example, during a January 1990 visit to a cyanide operation 6 miles from a wildlife refuge, BLM officials found that netting installed over a pond to keep out birds had collapsed into the pond. Similarly, during a February 1990 tour of another cyanide operation in Nevada, a Nevada Department of Wildlife official found that snow had collapsed the netting over three cyanide ponds into the ponds.

Inspections are also important as a backup to self-reporting because several factors can discourage operators from self-reporting. Reporting wildlife deaths and cyanide solution discharges can result in the imposition of mitigation measures that can cost hundreds of thousands of dollars initially to install and hundreds of thousands of dollars annually to maintain when, for example, cyanide solutions must be diluted to nonlethal levels. In addition, criminal penalties, fines, and the possibility of being shut down all serve to discourage voluntary reporting of wildlife deaths and cyanide solution discharges. For example, after voluntarily reporting about 900 bird deaths in a tailings pond in 1989, one operator was fined $250,000 for violating MBTA and agreed to pay another $250,000 to the Nature Conservancy for preservation of migratory birds and their habitat. Similarly, another cyanide operator was fined $40,000 for violating MBTA and agreed to pay an additional $50,000 to a nearby wildlife management area after reporting over 1,400 bird deaths in 1989.

In October 1989, BLM began requiring that all active cyanide operations be inspected at least quarterly. This requirement was incorporated into BLM's 1990 cyanide management policy. BLM's increased inspections have been accompanied by increased enforcement. Before January 1, 1989, BLM had issued four notices of noncompliance for cyanide operations in the three states—all for operations in Nevada.[3] By contrast, BLM has issued seven such notices in the following 17 months, including one in

[3]Notices of noncompliance specify a violation, identify the corrective measures required, and set a deadline for completing these measures. If the corrective measures are not completed by the deadline, the agencies can seek a court injunction to shut down the operation. They can also seek a court-imposed fine.

Arizona. In contrast to the BLM approach, the Forest Service permits local officials to determine the frequency of inspections. The Forest Service has not issued any notices of noncompliance involving cyanide in the states reviewed, according to Forest Service officials.

The state agencies in Nevada, California, and Arizona do not have minimum inspection requirements. State officials said that although they would like to inspect each site regularly, they have not succeeded.

Staff Training

Adequate inspection and enforcement depend, in large measure, on trained staff. Cyanide operations and the potential hazards they present to wildlife and the environment are relatively new, and each cyanide operation is different. BLM's cyanide management policy commits BLM to ensuring adequate training in safety and management practices for all of its employees involved in the surface management of cyanide operations. The policy calls for training in cyanide operations to be provided in BLM's inspection and enforcement course for hardrock minerals and in its surface management courses. BLM is also establishing a core team of cyanide experts to identify and address cyanide management issues and provide technical advice as necessary. While the Forest Service conducts training courses in cyanide operations, it has not established the formal training requirements set out in BLM's cyanide management policy.

Coordination Among Federal and State Agencies

Because many laws and agencies regulate cyanide operations, good interagency coordination is essential. Such coordination, however, has not always existed, and information on wildlife deaths and cyanide solution discharges has not always been shared. However, this situation is changing. BLM and the state wildlife agencies in the states we reviewed have agreed to share wildlife death reports from cyanide operators.

BLM's cyanide policy recognizes that BLM is responsible for surface management of cyanide operations in conjunction with other federal and state agencies, and it directs BLM to maximize coordination with federal and state regulatory agencies to avoid duplication and increase effectiveness in monitoring operations. It also requires the BLM state offices to develop memoranda of understanding with the appropriate federal and state agencies, including FWS. This directive is already being implemented. In Nevada—where most wildlife deaths and discharges have occurred—BLM, the Forest Service, and the state water quality protection agency signed an agreement in September 1990 calling for increased cooperation, document sharing, and quarterly meetings.

Conclusions

Federal and state agencies have adequate authority to regulate cyanide operations and protect wildlife and the environment from their potential hazards. As the number of active cyanide operations has grown, so too has federal and state oversight. Because BLM and the Forest Service have the authority to approve plans of operations and their regulations establish inspection and enforcement responsibilities, these agencies are in a good position to ensure that cyanide operations on federal land are designed, built, and operated so as not to kill wildlife or damage the environment. Before 1986, when media reports called attention to the large number of bird deaths at cyanide operations, responsible federal and state agencies had not developed specific policies aimed at preventing and responding to the potential hazards of cyanide operations on their land. Most of the cyanide operations in the three states that we reviewed and most of the wildlife deaths and cyanide discharges occurred on BLM lands. Given this operational history and the increased number of cyanide operations on federal land, BLM adopted a cyanide management policy in 1990 to ensure consistency in the management of cyanide operations and other similar operations that use toxic leaching solutions on its land. This policy will help ensure that effective mitigation measures are used, that wildlife deaths and cyanide spills are reported promptly, and that regular inspections are performed by qualified staff. Prompt reporting will permit timely corrective actions as well as feedback for future requirements, and regular inspections will both identify potential problems and ensure compliance with approved operating plans. The cyanide management policy that BLM has adopted appears to be an appropriate response to the potential hazards that cyanide operations present to wildlife and the environment.

The Forest Service, with few active cyanide operations, has not formulated an agencywide policy specifically aimed at cyanide operations. It believes that its existing land management authorities are adequate for regulating such operations on its land. In exercising these authorities, it imposes mitigation measures on a case-by-case basis, has not centralized reporting requirements, and has not established a minimum required frequency for inspections. An agencywide cyanide management policy addressing these issues would provide consistency across the Forest Service in dealing with cyanide operations. Such a policy could become increasingly important, given the probability that the number of operations will increase.

Recommendation

To better prepare the Forest Service to respond to the potential hazards of cyanide operations, we recommend that the Secretary of Agriculture

direct the Chief of the Forest Service to develop and implement an agencywide policy specifically aimed at managing cyanide operations on Forest Service land. This policy should include (1) minimum acceptable design requirements, (2) mandatory operator reporting of all cyanide-related wildlife deaths and cyanide solution discharges, and (3) regular inspections of all cyanide operations by trained staff.

Cyanide Operations Visited in Nevada

Mine Operators	Mine Name	Location
Amax Gold Inc.	Sleeper	Winnemucca
Echo Bay Minerals Co.	McCoy/Cove	Battle Mountain
FMC Gold Co.	Paradise Peak	Gabbs
Gold Fields Operating Co.	Chimney Creek	Golconda
Round Mountain Gold Corp.	Smokey Valley Common	Round Mountain

BLM and Forest Service Offices Contacted

BLM office	
State office	**District and resource area office**
Arizona State Office, Phoenix, Ariz.	Phoenix District Office, Phoenix, Ariz.
California State Office, Sacramento, Calif.	California Desert District Office, Riverside, Calif.
	Susanville District Office, Susanville, Calif.
Colorado State Office, Lakewood, Colo.	None
Idaho State Office, Boise, Ida.	None
Montana State Office, Billings, Mont.	None
New Mexico State Office, Santa Fe, N. Mex.	None
Neveda State Office, Reno, Nev.	Battle Mountain District Office, Battle Mountain, Nev.
	Shoshone-Eureka Resource Area Office, Battle Mountain, Nev.
	Tonopah Resource Area Office, Tonopah, Nev.
	Carson City District Office, Carson City, Nev.
	Elko District Office, Elko, Nev.
	Elko Resource Area Office, Elko, Nev.
	Winnemucca District Office, Winnemucca, Nev.
	Paradise-Denio Resource Area Office, Winnemucca, Nev.
Oregon State Office, Portland, Oreg.	None

Forest Service office	
Region	**National forest, ranger district, and zone office**
Southwestern Region 3, Albuquerque, N. Mex.	Arizona Zone Office, Phoenix, Ariz.
Intermountain Region 4, Ogden, Utah	Toiyabe National Forest, Sparks, Nev.
	Humboldt National Forest, Elko, Nev.
	Ely Ranger District, Ely, Nev.
	Mountain City Ranger District, Mountain City, Nev.
Pacific Southwest Region 5 San Francisco, Calif.	North Zone Office, Placerville, Calif.

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.

Robert W. Wilson, Assistant Director
Robert Cronin, Assignment Manager
Jennifer Clayborne, Evaluator
Hector Rojas, Mining Engineer

San Francisco Regional Office

William B. Agnew, Assistant Regional Manager
D. Patrick Dunphy, Evaluator-in-Charge
Neil Lloyd, Evaluator
Jon Silverman, Reports Analyst

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