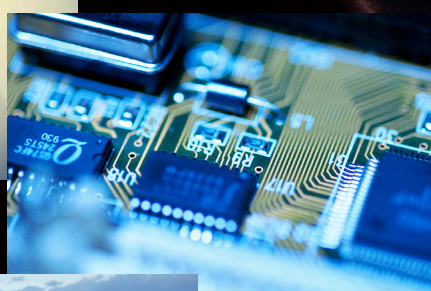
January 2013

Bokan Mountain Rare Earth Element Mine Economic Impact Study



Prepared for

Ucore Rare Metals, Inc

Prepared by

McDowell Group

Bokan Mountain Rare Earth Element Mine Economic Impact Study

Prepared for:

Ucore Rare Metals, Inc.

Prepared by:

McDowell GROUP

Juneau • Anchorage

January 2013

Table of Contents

Executive Summary

The purpose of this study is to assess the potential economic benefits in Alaska related to construction and operation of the proposed Bokan Mountain Heavy Rare Earth Mine ("Bokan Mine" or “Bokan”), located on Prince of Wales Island in Southeast Alaska, approximately 37 miles southwest of Ketchikan. This advance-stage exploration project is owned and operated by Ucore Rare Metals Inc. (“Ucore”).

Ucore’s exploration program to date has included 134 drill holes and 64,000 feet (19,662 meters) of core samples as well as collection of bulk samples for metallurgical studies and ore processing pilot-scale tests. In 2011 and 2012, environmental baseline studies were also conducted, in addition to initial engineering and mine planning work. The drilling program has identified resources of 5.3 million metric tons with an average grade of 0.654 percent total rare earth oxides (TREO). The TREO concentration includes 0.39 percent light rare earth oxides and 0.26 percent of the more valuable heavy rare earth oxides (HREOs). Work to date has established Bokan as one of the largest National Instrument (NI) 43-101 compliant HREO resources in the United States.

The Bokan Mountain rare earth element (REE) deposit is unusual among REE deposits worldwide due to the high proportion of heavy rare earth oxides (HREO) relative to light rare earth oxides. The Bokan deposit includes approximately 40 percent HREO/TREO. In comparison, the deposit at the Mountain Pass mine in California (the only active REE mine in North America) averages 1 percent HREO/TREO. Given the strategically critical nature of HREOs to U.S. national defense, transportation, communications, health care and supercomputing, Bokan’s high HREO content has drawn the active interest of the U.S. Defense Logistics Agency, and has been documented by the U.S. Department of Defense (USDOD), U.S. Department of Energy (USDOE), and U.S. Geological Survey (USGS).

Bokan is one of a very limited number of HREO deposits outside of China capable of production within the next 3-5 years. Beyond the size, grade, and strategic value of the resource, the Bokan project has a number of characteristics that enhance its potential for development. It has immediate access to deep water, a key advantage for low-cost shipping of materials to and from the mine. The proposed underground mining technique (long-hole stoping with tailings back-fill) will eliminate the need for permanent surface tailings disposal and result in a limited environmental footprint. Further, the full extent of the REE deposit at Bokan has not yet been determined. Additional exploration work is likely to identify resources beyond those already measured.

The project’s Preliminary Economic Assessment (PEA) calls for development expenditures of $221 million to construct a 1,500 metric-ton-per-day operation with an annual production of approximately 2,250 metric tons of rare earth oxides. The PEA indicates this investment and scale of operation would have an internal rate of return of 43 percent and a payback period of less than three years.[1]

The expected economic impacts in Alaska resulting from development and operation of the Bokan project are summarized below.

[1] Preliminary Economic Assessment of the Bokan Mountain Rare Earth Element Project, Near Ketchikan, Alaska, January 10, 2013. Tetra Tech, Vancouver B.C.

Employment and Payroll

CONSTRUCTION PHASE

- The construction phase is expected to last approximately 18 months to 24 months (for purposes of this economic analysis, a two-year construction phase is assumed).
- The $221 million mine-development project will directly generate an estimated $40 million in payroll for the construction-related workforce or approximately $20 million annually over a two-year construction period.
- An annual average construction labor force of 200 workers is expected. Peak employment could reach approximately 300 workers.
- Approximately 80 percent of the construction labor force will be Alaska residents (based on Alaska construction industry averages). At that percentage, Alaskans would earn approximately $32 million in payroll over the two-year construction phase ($16 million annually). Alaska resident employment would average roughly 160 workers.
- There will be additional indirect and induced impacts, also known as multiplier effects, associated with in-state spending by construction workers and those businesses providing goods and services to the project. Including multiplier effects, construction related payroll is expected to total $54 million ($27 million per year), with employment effects averaging 325 jobs in Alaska.

MINE OPERATIONS

- Current project planning indicates a mine life of 11 years. Because the full extent of the deposit has not been determined, additional exploration work could extend the mine's life well beyond that time frame.
- Once in full operation, the mine is expected to employ an average of 190 workers. The operations workforce would be housed on-site, working 2-weeks on, 2-weeks off shift schedules.
- The Bokan Mountain workforce will earn approximately $18 million in annual payroll. This indicates an annual per worker average of approximately $95,000, slightly lower than the 2011 statewide metal mining industry average of $100,020, which does not include camp support personnel (who earn less than workers actually engaged in mine and mill operations).
- It is expected that Alaska residents would account for 70 percent of the mine operations labor force, equal to the statewide metal mining industry average. At that percentage, approximately 135 Alaskan workers would earn just under $13 million in direct annual payroll. Regional transportation provisions and training opportunities could result in a higher level of Alaskan participation in the mine operations labor force.
- Including indirect and induced employment and income (the multiplier effects), mine operations related employment would average 340 jobs and $28 million in annual payroll in Alaska.

Summary of Bokan Mountain REE Mine Economic Impacts

Economic Activity	Impacts
Construction Phase	
Estimated years of construction	2 years
Direct Impacts	
Annual average employment	200
Peak employment	300
Annual payroll	$20 million
Total construction phase payroll	$40 million
Multiplier Effects	
Indirect and induced statewide employment	125
Indirect and induced statewide payroll	$7 million
Total Impacts (direct, indirect, and induced)	
Total employment	325
Total annual payroll	$27 million
Total construction phase payroll (direct and indirect)	$54 million
Operations Phase	
Current life of mine projection	11 years
Direct Impacts	
Annual average statewide employment	190
Annual statewide payroll	$20 million
Multiplier Effects	
Indirect and induced statewide employment	150
Indirect and induced statewide payroll	$8 million
Total Impacts (direct, indirect, and induced)	
Total employment	340
Total annual payroll	$28 million

Source: McDowell Group estimates.

Introduction

Purpose and Scope of Work

The purpose of this study is to describe the operations and economic impacts of the proposed Bokan Mountain Heavy Rare Earth Mine ("Bokan Mine" or "Bokan") and ore processing facility. The Bokan project is an advance stage exploration effort targeting rare earth elements (REE). The project is located on Prince of Wales Island in Southeast Alaska, approximately 37 miles southwest of Ketchikan.

Location of Bokan Mountain Project

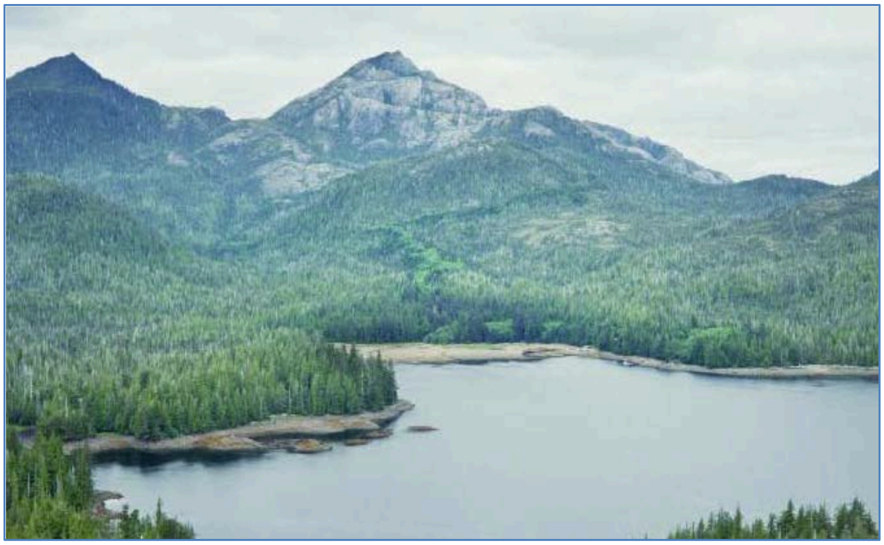
This report provides an overview of exploration and planning work conducted on the project to date, a description of the proposed mining and processing plan, an analysis of the potential regional economic impacts of the project, and an overview of global supply and demand for REEs.

The Bokan project is 100 percent owned by Ucore Rare Metals Inc. ("Ucore"). Ucore is a publically-traded corporation based in Bedford, Nova Scotia, Canada.

In Alaska, the company is registered as Ucore Rare Metals (Alaska) Inc. Though development of the Bokan project is the primary focus of Ucore, the corporation is also examining REE deposits in the Ray Mountain region in Central Alaska (northeast of Fairbanks along the Dalton Highway), as well as four uranium prospects in Canada. Uranium deposits in the Bokan Mountain area initially drew Ucore to the area; however, the Bokan project is purely a REE development effort, with no plans to develop nearby uranium resources.

The Bokan deposit is unique among REE deposits due to its unusual enrichment in heavy rare earth elements (HREEs). As described elsewhere in this report, HREEs are particularly valued for uses in "green" technology, high technology, transportation, and defense systems applications. In turn, the manufacture of wind-power generators, hybrid or full-electric drive vehicles, high-performance permanent magnets, motors and generators is sensitive to the ready availability of high-grade heavy rare earth oxides (HREO). Recent reports issued by the U.S. Department of Energy (USDOE) and U.S. Department of Defense (USDOD) rank HREEs such as Dysprosium (Dy), Terbium (Tb) and Yttrium (Y) as among the most critically important and supply sensitive-strategic metals to the U.S. at present. The critical and strategic nature of the resource, and concerns about stable supplies for the U.S., have been highlighted by the staged withdrawal of HREEs from international markets by China, the world's largest producer of HREEs and related value-added products.

Alaska's has a rich mining heritage, dating back to the 1800s. Today, the industry includes a mix of small-scale placer mining operations and large, world-class hard-rock operations. For example, Red Dog is one of the world's largest zinc producers, Greens Creek is one of the largest silver mines in the world, and Fort Knox, Pogo, and Kensington are large-scale hard-rock gold mines in Alaska. However, REE mining and production is, in some respects, different than other mining activity and will be new to Alaska. An important goal of this report is to introduce REE mining and production to Alaskans.



View of Bokan Mountain from Kendrick Bay

Sources of information used in this study include project description and mine planning documents provided by Ucore, a variety of sources providing information about REE markets and uses, Alaska Department of Labor and Workforce Development (ADOLWD) data concerning mining industry employment and wages in Alaska, and other sources.

This report begins with background information concerning the project and the mineral resource. Chapter 2 summarizes the project development plan, including construction costs and timelines.

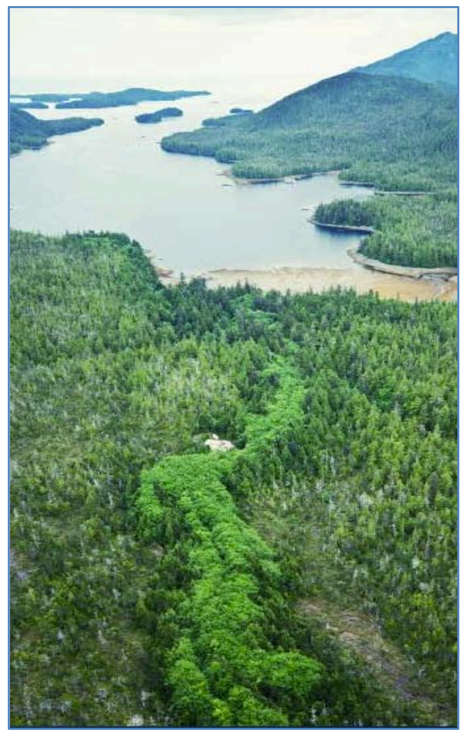
In Chapter 3, the proposed mining and ore processing plans are described. Chapter 4 describes the expected direct and indirect economic impacts in Southeast Alaska associated with construction and operation of the mine and related facilities. Finally, Chapter 5 provides a basic primer on REE properties, suppliers, markets, and end-uses.

Project Background

The Bokan Mountain-Dotson Ridge REE Project is located near the west arm of Kendrick Bay, on the southeast side of Prince of Wales Island. The property includes 512 unpatented and un-surveyed lode claims and four 160-acre state claims, all covering an area of approximately 15 square miles. The claims extend from tidewater in Kendrick Bay, over and around Bokan Mountain, to tidewater in Moira Sound. Bokan Mountain-Dotson Ridge claims lie within the Tongass National Forest on land designated for mineral development (the Kendrick Bay Minerals Prescription area).[2]

Mining activity is not new to the area. A boom in uranium exploration activity in the 1950s brought prospectors to Alaska, including Don Ross and Kelly Adams, who located a uranium deposit in the Bokan Mountain area. The Ross-Adams uranium mine operated intermittently from 1957 to 1971, producing about 94,500 tons of ore, initially from open pit operations then later by underground mining.[3] Climax Molybdenum Company, Bay West Inc., Standard Metals Corporation, and Newmont Exploration Ltd. all had interest in the property at various times prior to 1971. From 1971 to 1981, several companies conducted exploration work on the property, though no additional mining occurred.[4] The Bokan Mountain area received little exploration attention after 1981 until 2007 when Ucore initiated its assessment of the area's mineral development potential.

While potential commercial quantities and grades of uranium resources remain in and around the Ross-Adams mine, interest in the area shifted several years ago to REEs. REEs were first identified in the Bokan area during United States Geologic Survey mapping in the area in 1963. Ucore's assessment of the area, which initially focused on uranium, but by 2009 had shifted to REEs, has included airborne and ground total magnetic and radiometric surveys, ground induced polarization surveys, surface outcrop sampling, trenching, soil and stream sediment sampling, mapping, and an extensive helicopter-supported diamond core drilling program.[5]



Old access road to Bokan Mine

Ucore began core drilling in 2007. A total of 31,000 feet (9,550 meters) of core was drilled from 100 holes over the next four years. The drilling program found Indicated and Inferred resource of 5.3 million metric tons containing 0.0654 percent total rare earth oxides (TREO). These resource estimates are compliant with National Instrument 43-101 stipulations. Release of NI 43-101 compliment resource estimates is an important milestone in the assessment of a mineral property. NI 43-101 compliment reports are prepared by

---

[2] Mining Engineering, January 2012, Volume 64 No. 1.

[3] http://www.mindat.org/loc-199753.html.

[4] "Technical Report on the Exploration Program and Mineral Resource Estimate for the Bokan Mountain Property, Prince of Wales Island, Alaska." Aurora Geosciences (Alaska) Ltd. April 21, 2011.

[5] The most prospective high-grade rare earth mineralization at Bokan resides in a separate and distinct deposit from that of the historical uranium mine, with the latter being located at the Bokan Intrusive Complex (Bokan Mountain proper), and the former being located at Dotson Ridge, which is closer to Kendrick Bay to the southeast.

independent professional geoscientists or engineers (who have no interest in the property or the mining company) and are based on certain high-level professional standards. Bokan Mountain-Dotson Ridge REE resource is the largest NI 43-101 compliant HREE deposit on the US.[6]

The exploration program in 2011 included another 34 holes totaling 33,000 feet (10,112 meters) of core. The 2011 program brought total drilling on the project to 134 drill holes and 64,000 feet (19,662 meters) of core.[7]

Work in 2011 also included collection of bulk samples for metallurgical and ore sorting tests. Ucore contracted with a Ketchikan firm to crush a 20-ton bulk sample and prepare it for shipping to a metallurgical testing facility.[8] Environmental baseline studies were also conducted in 2011, as well as initial engineering and mine planning work.

Bokan Mountain REE vein outcrop

In summary, Ucore's drilling program and related analysis from 2007 through 2010 identified Indicated and Inferred resources of 5.3 million metric tons with an average grade of 0.654 percent total rare earth oxides (TREO). The TREO concentration includes 0.39 percent light rare earth oxides (LREO) and 0.26 percent of the more valuable heavy rare earth oxides (HREO). The resource estimate includes 1,268,156 metric tons indicated, 3,084,137 metric tons inferred, and 975,444 metric tons potential resource. The results of the 2011 program have not yet been incorporated into ore reserve estimates.

While no core drilling was conducted in 2012, additional bulk samples were taken. Environmental baseline research continued in 2012, as did preliminary mine planning. The Preliminary Economic Analysis (PEA), the first formal assessment of mine feasibility, was launched in 2012, with summary results released in late 2012. The PEA indicates a 1,500 metric ton per day operation, requiring an initial capital investment of $221 million, would generate positive return on investment. More details on the proposed mining and milling operation are provided in the following chapter.

Because of China's dominance in global supply of HREOs and the strategic value of those minerals in national security applications, the U.S. federal government has taken active interest of the Bokan project. The USDOD Defense Logistics Agency contracted with Ucore to conduct mineralogical and metallurgical testing on the Bokan deposit.[9] Bokan has also been documented by the USDOE and the U.S. Geological Survey (USGS).[10][11]

[6] http://ucore.com
[7] http://ucore.com/ucore-releases-2011-bokan-drill-results-pending-augmented-resource-calculation
[8] http://ucore.com/ucore-initiates-bulk-sample-in-preparation-for-production-scale-testing
[9] http://ucore.com/us-department-of-defense-contracts-with-ucore-for-metallurgical-spe-studies
[10] U.S. Department of Energy Critical Materials Strategy December 2011
[11] Dostal, J., et al. Geological Investigation of Rare earth Element and Uranium Deposits of the Bokan Mountain Complex, Prince of Wales Island, Southeastern Alaska. US Geological Survey Grant G09PA00039, 2009.

This chapter describes the mining and processing operation that will be developed to extract REEs from the Bokan Mountain-Dotson Ridge deposit. It includes a description of facilities and infrastructure, the mining plan, and the steps involved in producing rare earth oxide concentrate from the raw ore.

The Mining and Ore Processing Plan

The proposed mine will be a 1,500 metric ton per day underground mining operation. It will operate 360 days per year, over an anticipated 11-year mine life. Annual production will ramp up from approximately 200,000 metric tons during the first year of operations to 470,000 tons per year, and then level off at approximately 540,000 tons annually.

Development of mine, mill and ancillary facilities and infrastructure will require an investment of $221 million (including a $25 million contingency). On-site facilities and infrastructure will include:

- access roads
- power plant
- water treatment facility
- camp (mine site staff bunk houses and kitchen facilities)
- mine dry including shift change rooms
- processing complex (primary and secondary crushing facilities, on-site rare earth oxide (REO) separation plant)
- administrative office complex, maintenance shop, warehouse, and fueling station
- waste rock stockpile, tailings storage facility, and paste fill plant

A labor force of approximately 200-300 workers will be required to develop the mine and related infrastructure and facilities. A permanent labor force of 175 workers will be required to operate the mine. Most employees will work a 2-weeks on, 2-weeks off schedule, working 11-hour shifts. Additional details about the mine workforce are provided in the following chapter.

As indicated above, the mine will extract approximately 1,500 metric tons of material daily using conventional underground mining equipment and techniques. The ore will be trucked to a primary crushing facility located near the mine portal, where it will be crushed and sorted. Using "dual energy X-ray transmission" (DEXRT) sorting technology, approximately half of the initial mill feed will be rejected as waste. The remaining REE-rich material will be subject to further crushing and grinding, then fed into a magnetic separator. By rejecting additional low-value waste material, magnetic separation will reduce the volume of REE-bearing material by half again. In other words, X-ray sorting and magnetic separation will concentrate the REE's contained in the mine's output of 1,500 tons per day down to about 375 tons of material (with four times the concentration of REEs).

This enriched concentrate will then be subjected to a leaching process, where heated nitric acid dissolves the REEs into solution. A slurry containing the REE-enriched solution and waste solids is filtered, with the solution moving to a rare earth oxide separation circuit and the solids to the back-fill paste plant (for "back-fill" placement underground).[12]

The on-site process of recovering the REEs will continue as the "pregnant" (REE-rich) solution is introduced to a solid phase extraction (SPE) process. The SPE process will involve sequential separation of various elements, beginning with thorium, uranium, and iron (which are considered nuisance materials in the REE extraction process). Subsequent SPE treatment will separate the rare earths into various sub-classes of two or more REEs. The final steps in the SPE process separate individual rare earth chlorides, from which purified individual rare earth oxides can be precipitated.

The DEXRT and SPE processes notes above are innovative technologies that Ucore is introducing to the REE sector. DEXRT is an ore sorting technology that utilizes X-ray media for the identification of valuable mineralization. It was originally developed for the separation of plastics from metals in recycling applications. It was later applied in diamond mining for the detection and separation of diamonds from host material.

SPE has a variety of chemical process applications, but is new in the extraction of HREEs. SPE offers the potential for faster, less expensive, and cleaner separation of REEs, compared to traditional solvent exchange technologies utilized in China and elsewhere. In addition, by utilizing SPE, high-value individual REOs can be produced at the mine site. Most currently producing REE mines must ship bulk concentrates to a remote solvent exchange facility for separation. On-site extraction of individual REOs offers the potential for high-value downstream manufacturing in Alaska, which would otherwise be located in the Lower 48 or abroad.

In addition to advanced-technology work funded by Ucore at facilities in Germany (DEXRT) and Montana (SPE), the University of Alaska Fairbanks College of Engineering and Mines is also engaged in research to test the efficiency of using froth floatation technologies for REE extraction. Froth floatation is a common technique for separating rare earths from other minerals. That research is funded by the State of Alaska's Department of Commerce, Community and Economic Development (ADCCED).

At Bokan, this multi-stage process of separating the REEs from the host ore will produce approximately six tons of rare earth oxides daily from 1,500 tons of ore. Annual production would total 2,250 metric tons of rare earth oxides, including (among the highly valuable HREEs) 95 metric tons of dysprosium oxide, 14 tons of terbium oxide, and 515 tons of yttrium oxide.

These purified individual rare earth oxides will be shipped to buyers who will refine the rare earth oxides into metals, manufacture meal alloys, and then finally manufacture the alloys into of a variety of devices and components, such as permanent magnets.

[12] Nitric acid not consumed in the leaching process is recovered from the REE-enriched solution and returned to the leach circuit prior to the solution's treatment in the rare earth oxide separation circuit.

The REE Value-Chain and Industry Cluster

As described above, the process of extracting commercial value from a deposit of REEs includes several steps:

1. Mining and production of concentrate
2. Rare Earth Oxide separation
3. Rare Earth metal manufacture
4. Upgrade into metal alloys, magnet powders
5. Magnetic materials manufacturing

Each successive step in the process adds more value to the REE product. The technology being developed today for the Bokan project will allow Alaska to take the first two steps along this "value chain," through production of rare earth oxides.

Beyond this, there may be an opportunity to develop a vertically integrated industry "cluster", with interdependent components related to metal making, alloys, powders and magnet materials, as described above. While there is little doubt that a producing HREE mine on U.S. soil will spur ancillary industries, the challenge for Alaska is to capture as much of the value chain as possible within the state, and in proximity to the mine. In addition, SPE technology may have applications in the purification of recycled REE materials, an emerging REE growth sector. While the economics of REE-related manufacturing and recycling in Alaska are beyond the scope of this study, Alaska's proximity to mature markets in North America and to emerging growth markets along the Pacific Rim is an advantage other suppliers do not have.

Disposal of Mine Tailings

A key environmental concern associated with any mine development is tailings treatment and disposal. The Bokan Mountain project is unique in that all mill tailings will be deposited underground, known as "back-filling." Mill tailings will be mixed with cement to a form a paste that will be back-filled into mined-out areas in the underground workings.

The mine will have backfill requirements of approximately 1,000 tons per day, significantly more than the 735 tons of tailings produced daily. Waste rock separated from the ore (by the X-ray sorting process) during the initial milling process may be used to meet the mine's remaining back-fill needs.

Economic Impacts of Mine Development and Operations

This chapter describes the employment, payroll and other economic benefits stemming from construction and operation of the Bokan Mountain REE Mine. The analysis includes direct employment and payroll, as well as estimates of indirect and induced employment effects. This chapter also describes the potential benefits of additional value-added processing of REE products in Alaska.

Mine Development Employment

While detailed construction workforce data is not yet available, it is possible to estimate employment based on anticipated labor costs. Based on construction cost information provided in the 2012 PEA, labor costs of the two-year construction timeframe would total about $60 million. This estimate of labor cost includes wages paid to workers and all labor-related overall costs. To derive actual payroll, employer costs such as FICA, Medicare, Alaska Unemployment Insurance, and Worker's Compensation must be subtracted (combined assumed to account for 15 percent of labor cost) as do the cost of health insurance and retirement benefits (assumed to account for 17 percent of labor cost during the mine's construction phase). Based on these assumptions gross wages paid to workers would account for approximately 68 percent of total labor cost, or approximately $40 million, or approximately $20 million each year over the two-year construction period.

With this estimate, coupled with certain assumptions about average annual wage rates paid to the construction work force, it is possible to estimate the number of workers employed during the construction phase of the project. The construction phase labor force will include a variety of highly skilled and semi-skilled workers as well as professional/technical personnel, camp support workers, administrative personnel and others. Wages across these sectors vary widely, depending on skill and experience requirements.

North Slope construction worker wages can serve as a proxy for estimated wages earned at the Bokan project, based on a similar rotation schedule, remote camp operations, and level of skill required. These workers earned an average of $95,000 in 2010, according to the Alaska Department of Labor and Workforce Development (ADOLWD). Among all Prudhoe Bay workers (which includes a mix of oil field services workers, professional/technical people, drivers and operators, camp support personnel, security workers, etc.), annual average payroll was $95,112 in 2010. It is worth noting that Kensington mine development work in 2010 had average annual wages of approximately $98,000. Assuming some wage inflation since 2010, for purposes of this analysis, it is assumed per-worker annual gross payroll for the construction phase of the Bokan project will average $100,000.

Based on this average wage, construction-phase employment would average approximately 200 jobs over two years. In reality the number of people employed on the project would peak at a higher level, perhaps as high as 300 workers, during the summer construction season, based on employment during the construction of other mining operations in Alaska. For example, at the peak of the Kensington Mine construction phase, 387 workers were employed on the project.[13]

Operations Phase Employment

The Bokan PEA does provide an estimate of mine operations employment. Once in full production, the mine will employ 175 workers. Mining operations will employ 107 workers, mill operations 43, and administration 25. On-site employment will also include workers employed by contractors providing a range of services to Ucore. The largest source of contract service employment would be in camp services (including food service, janitorial, housekeeping, laundry, etc.). For purposes of this study on-site contract employment is estimated at 15 jobs, bringing total on-site employment to 190 jobs.

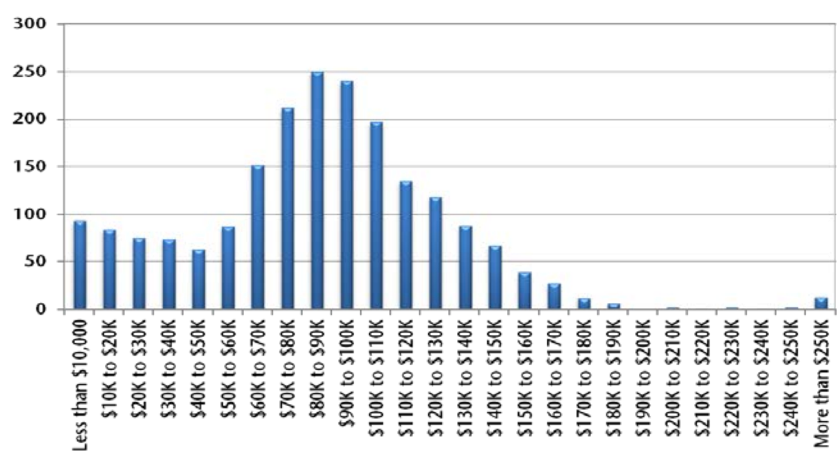
Operations Staffing

Position	Employment
Mine Operations	**107**
Mill Operations	**43**
Administrative and General Operations	**25**
Contractors (catering and housekeeping)	**15**
Total	**190**

Source: Bokan Mountain PEA and McDowell Group estimates.

Wages in Alaska's mining industry are among the highest in the state, second only to the oil and gas industry. In 2011, the average monthly wage in Alaska's metal mining industry $8,335, equating to an annual salary of $100,020, according to ADOLWD data. The all-industry average monthly wage in Alaska in 2011 was less than half of the metal mining industry average, at $4,071 (annualized to $48,852). As illustrated in the following chart, wages for specific jobs at metal mines vary widely from the industry average. Mine managers and other professional staff will earn more than the average, camp maintenance and other support personnel will earn less.

Distribution of Alaska Metal Mining Annual Wages, 2010*



* Includes only workers with wages in all four quarters of 2010. Source: ADOLWD.

[13] *Kensington Mine Construction Economic Impact Analysis*. Prepared by McDowell Group for Coeur Alaska, May 2007.

One reason average monthly wages are high in the mining industry is the significant amount of over time pay associated with shift work, such as the 2-week on, 2-week off schedule planned for Bokan. Such a shift might typically include 60 hours of overtime pay ("time and a half" pay) per four-week period.

The Bokan workforce will earn approximately $18 million annually, based on prevailing wages in Alaska's metal mining industry and McDowell Group estimates of wages paid to contract personnel. This suggests an annual per worker average of approximately $95,000, slightly lower than the statewide metal mining average, which does not include camp support personnel (who earn less than workers actually engaged in mine and mill operations).

Alaska Resident Participation

The residency of the mine development and operations labor forces is an important economic impact consideration. Induced economic impacts (those related to expenditure of payroll dollars) are directly related to workforce residency. Both construction and operations phases of the Bokan Mountain project are likely to have somewhat greater non-resident labor participation than the Alaska state-wide private sector average of 22.7 percent. Some of the construction work at Bokan will be specialized and mining industry specific. Contractors providing specialized construction services are less likely to be Alaska-based. In terms of mine operations, Bokan will be competing for skilled miners and technicians in a highly competitive labor market, including workers who prefer to reside in Lower 48 states while employed in Alaska.

For the construction phase of the Bokan Mountain Project, non-resident employment would not be substantially different than the Alaska construction industry average. Overall, nonresidents accounted for about 20 percent of Alaska's construction industry workforce in 2010. Development of the Kensington Mine near Juneau had a workforce that was 80 percent Alaskan.[14] For purposes of economic impact analyses, it is assumed nonresidents will account for approximately one-fifth of the mine construction workforce.

Non-resident employment during mine operations at Bokan Mountain would also be expected to match the statewide industry average. According to ADOLWD, in 2010 (the most recently published data available), 30.3 percent of the workers in Alaska's metal mining industry were nonresidents. Workforce residency data for individual mines (available only up through 2009) is provided in the following table.

Alaska Nonresident Workers, by Selected Mining Employers, 2005-2009

	% NR 2005	% NR 2006	% NR 2007	% NR 2008	% NR 2009
Sumitomo Metal Mining (Pogo)	32%	38%	42%	40%	37%
Hecla Greens Creek Mining Company	28	32	33	27	25
Teck Alaska Incorporated (Red Dog)	18	20	18	19	21
Fairbanks Gold Mining Inc. (Fort Knox)	10	10	9	10	10

Note: NR denotes "nonresident." ADOLWD provides company specific employment in ranges only.
Source: ADOLWD.

[14] *Kensington Gold Mine Impact Analysis Update*, prepared by McDowell Group, Inc. for Coeur Alaska, March 2011.

Remote underground mines (such as Pogo) have the highest level of nonresident labor participation. Pogo has a permanent workforce of about 350 and is in eastern central Alaska, significantly removed from any population centers. Greens Creek (currently with about 375 workers) has a significant portion of its employees who commute daily from Juneau. Fort Knox is a large surface mine with a daily-commute workforce that resides in Fairbanks. Red Dog, a remote surface mine located in the Northwest Arctic Borough, has a nonresident workforce that is lower than would otherwise be the case because of NANA's ownership of the property and related shareholder hire provisions. Both those mining operations have between 400 and 500 employees.

In any case, skilled miners are in high demand, as are experienced tradesmen, and with multi-week shift work it is possible for residents of Pacific Northwest states to maintain their Lower 48 residency while being employed at Alaska mines. For purposes of this study, it is assumed the Bokan operations labor force will approximately match the statewide industry average of 30 percent non-Alaska resident.

Indirect and Induced Employment (Multiplier) Effects

The direct employment figures presented above (for the construction and production phases) do not include all of the jobs in Alaska that would be linked to the Bokan Mountain project. Non-payroll spending in support of mine operations and spending by mine employees creates additional economic activity in Alaska, sometimes described as the "multiplier effect." Multiplier effects include:

- Indirect impacts, including jobs and income in businesses providing goods and services to the mine. Indirect effects also include the economic activity that results from payment of taxes to state, local and federal government.
- Induced impacts, including the jobs and income created as a result of mine employees spending their payroll dollars in the economy.

The magnitude of indirect effects in Alaska will depend on the extent of in-state spending on goods and services. Many of the materials required to operate a mine are not manufactured in Alaska; for example, drilling supplies, explosives, and chemical reagents used in ore processing. Purchases of other goods may or may not affect the Alaska economy. Fuel, for example, might be supplied by in-state providers; however, the large quantities required for mine operations may require purchases from Lower 48 suppliers. Food for workers housed at the mine site could either be provided by Alaska wholesalers or shipped directly from Puget Sound.

Alaska produces virtually none of the goods and materials that businesses and households consume. The vehicles, equipment, food, clothing, building materials, electronics, and furniture used/consumed in Alaska are all imported into the state from Lower 48 (or international) suppliers. As such, Alaska multipliers are generally low compared to other states.

Induced effects depend on the income and demographics of the workforce. High per worker wages mean greater disposable income and typically greater spending in the local economy. (The mining industry pays wages more than twice the all-sector average in Alaska.) Independent of income, demographic characteristics of the workforce-related population, such as the number and age of dependents, can affect the need for other workers in a community, such as teachers and health care workers.

Precisely measuring the indirect and induced impact of any component of the economy requires econometric modeling beyond the resources available for most economic impact studies. However, by using models it is possible to broadly measure the magnitude of total direct, indirect and induced economic effects. IMPLAN (the most widely-used U.S. input-output model for analyzing the economic impact of industrial and commercial development projects) provides local and statewide multipliers for the mining industry (as well as numerous other sectors of the economy).[15]

Multipliers provide a measure of the relationship between basic industry activity (mining, for example) and activity in an economy's service and support sector. Multipliers show the number of indirect and induced jobs or payroll dollars created in the support sector for each direct job or direct payroll dollar. Jobs are measured in terms of annual average full and part-time employment. The total (peak) number of jobs affected by a mine will be larger than the annual average.

Multipliers provided by the IMPLAN model require modification to account for non-Alaska resident participation in the project workforce. Most income earned by non-resident workers is not spent in Alaska and therefore has limited in-state multiplier effect.

Multipliers capture only "backward linkages." That is, they capture only jobs associated with purchases of goods and services by a mine (for example) and its employees. Multipliers do not capture "forward linkages," or those downstream jobs associated with adding value to a mine's product, metal refinery jobs for example, or metal-related manufacturing jobs.

Mine Construction Multiplier Effects

IMPLAN generates a number of construction industry multipliers. For purposes of estimating indirect and induced effects of Bokan Mountain construction activity, an average of three sectors is used, including "Construction of new nonresidential commercial and health care structures," "Construction of new nonresidential manufacturing structures," and "Construction of other new nonresidential structures." Employment multipliers in these sectors of the construction industry range from 1.62 to 1.84 (average of 1.73), while payroll multipliers range from 1.37 to 1.53 (average of 1.45). The induced component of each of these multipliers was adjusted downward to account for nonresident participation in the construction workforce, resulting in employment and payroll multipliers of 1.62 and 1.35, respectively. Based on these multipliers, the construction phase of the Bokan Mountain project would have a total employment effect of approximately 325 jobs and $27 million in annual payroll ($54 million total over two years).

[15] IMPLAN (IMpact Analysis for PLANning) was originally developed for the U.S. Forest Service by the University of Minnesota to assist with land and resource management planning. IMPLAN is now owned and managed by Minnesota IMPLAN Group, (MIG) Inc.

Bokan Mountain Project Construction Employment Impacts in Alaska, 2-Year Annual Average (Direct, Indirect, and Induced)

	Direct	Indirect & Induced	Total
Employment	200	125	325
Labor Income (Payroll)	$20 million	$7 million	$27 million

Source: McDowell Group estimates.

It is important to note estimates of indirect and induced employment associated with a construction project reflect the number of jobs affected by construction activity, not necessarily the number of new jobs created in the local economy. The full multiplier effect of any significant new industrial activity can take several years to completely materialize. In the case of a two or three year construction project, while all of the modeled direct, indirect and induced payroll predicted will be new money in the economy, not all of the jobs will be new additions to the local economy. In other words, the existing service and support sector would partially meet the needs of the construction project and its labor force through a combination of new hires and extended work hours for existing workers. For mine operations, the modeled and actual employment effects would be the same, as mine operations would extend over many years, allowing the support sector to fully develop around the needs of the mine and its workers.

Mine Operations Multiplier Effects

Alaska's hardrock mining industry has a statewide employment multiplier of around 2.0. This means that for every job at the mine, there is another job in the support sector attributable to the mine, for a total multiplier of 2 (e.g. a mine in Alaska employing 200 workers will account for a total of 400 jobs in the Alaska economy). The broader the economic landscape over which impacts are being measured, the larger the multiplier. National-level mining industry employment multipliers are much larger than in Alaska. Local-level multipliers are necessarily lower than the statewide figure.

IMPLAN indicates statewide mining industry employment multipliers of 2.2 for "Mining copper, nickel, lead, and zinc" and 2.0 for "Mining gold, silver and other metal ore." As with construction phase multipliers, the induced component of the multiplier must be adjusted downward to account for nonresident participation in the operations workforce. Assuming the gold and silver mining multiplier would be the best match for Bokan's underground operation, a modified employment multiplier of 1.8 is used to calculate total statewide direct, indirect and induced employment effects of the Bokan Mountain project.

Statewide mining industry payroll multipliers are 1.82 for "Mining copper, nickel, lead, and zinc" and 1.60 for "Mining gold, silver and other metal ore." With an adjustment for nonresident workers, a payroll multiplier of 1.4 is used to calculate total statewide direct, indirect and induced labor income (and payroll).

Based on the multipliers described above, the total direct, indirect and induced employment effect of the proposed mine is 340 jobs, accounting for $28 million in annual payroll.

Bokan Mountain Operations Employment Impacts in Alaska (Direct, Indirect, and Induced)

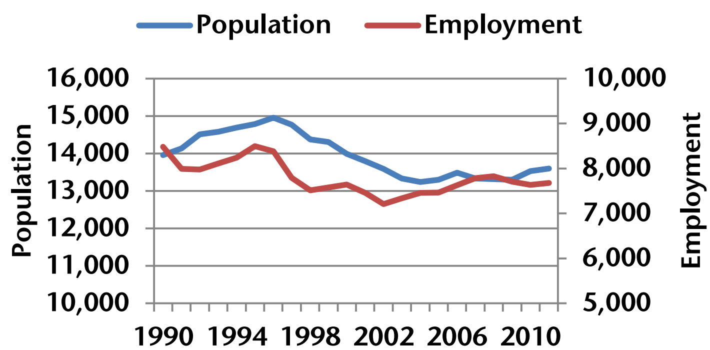
	Direct	Indirect & Induced	Total
Employment	190	150	340
Labor Income (Payroll)	$20 million	$8 million	$28 million

Source: McDowell Group estimates.

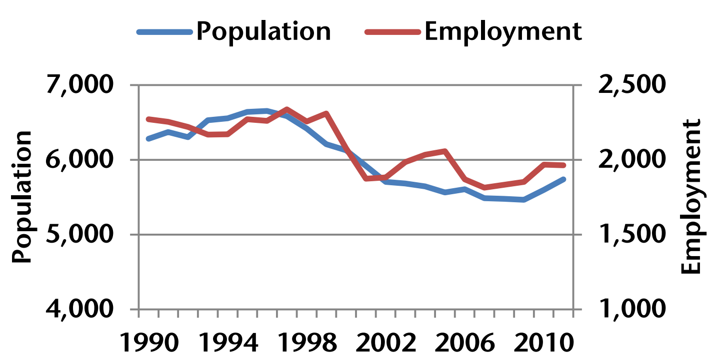
Southern Southeast Alaska Economic Baseline

Development of the Bokan Mountain project will occur within a region that has experienced significant economic decline over the past 20 years as a result of decreasing timber industry activity. Population and employment in the Ketchikan Gateway Borough and the Prince of Wales-Outer Ketchikan Census Area, though recovering somewhat in recent years, remain well below the peak levels of the 1990s.

Ketchikan Gateway Borough Population and Employment, 1990 to 2011



Prince of Wales Island/Outer Ketchikan Population and Employment, 1990 to 2011

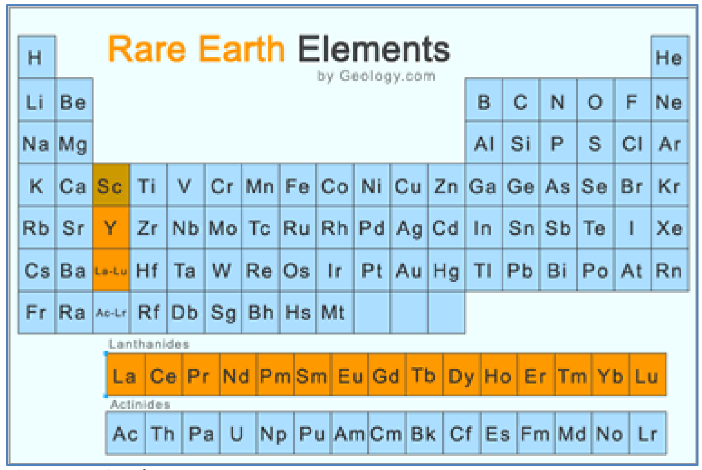


Source: Bureau of Economic Analysis

Note: Caution is urged in interpreting Prince of Wales Island/Outer Ketchikan data after 2009. In 2009, a part of the Prince of Wales-Outer Ketchikan Census Area was annexed by Ketchikan Gateway Borough and part (Meyers Chuck Area) was included in the new Wrangell City and Borough. The remainder of the Prince of Wales-Outer Ketchikan Census Area was renamed Prince of Wales-Hyder Census Area.

About Rare Earth Elements (REE)

Rare earth elements (REEs) are a group of 16 naturally occurring metals including yttrium and scandium, and 15 elements within the chemical group called lanthanides: lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. Scandium is found among rare earth deposits though some researchers do not consider it to be an REE.[16]



Source: Geology.com

As with all the elements in the periodic table, REEs are grouped together because they share similar physical and chemical properties. REEs are characterized by their ability to readily discharge and accept electrons, which makes them highly effective for electronic, optical, magnetic, and catalytic uses.

The lanthanides are divided into two groups: light rare earth elements (LREEs) and heavy rare earth elements (HREEs). The first five lanthanides, with atomic numbers 57 to 62, are the LREEs (La, Ce, Pr, Nd, Pm, Sm). The other REEs, atomic numbers 63 to 71 as well as yttrium, are the HREEs (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu). Although yttrium (Y) has a lower atomic weight, its properties are most similar to those of HREEs. [17]

Despite their name, REEs are not actually rare. In fact, they are relatively abundant in the Earth's crust. The average concentration of REEs range from 150 to 220 parts per million, higher than that of many other metals such as copper (55 ppm) and zinc (70 ppm). However, unlike most commercially mined metals, REEs are rarely found in concentrated mineral deposits where mining and extraction is economically viable, hence the name.

Uses of REEs

REEs have a wide range of uses and are increasing in demand as new technologies expand. In 2011, over half (59 percent) of worldwide consumption of REEs was in mature markets such as catalysts, glassmaking, lighting, and metallurgy. Lanthanum and cerium are the most commonly used REEs in mature markets, accounting for 80 percent of consumption. Rare earth oxides are required for refining crude oil into various petroleum products. Demand in this markets will grow as refining oil produced from shale deposits and tar sands requires relatively more REEs in the refining process

[16] http://geology.com/articles/rare-earth-elements/
[17] http://www.tasmanmetals.com/s/RareEarth.asp

New, high-growth markets, such as battery alloys, ceramics, and permanent magnets, account for the remaining 41 percent of global REE consumption.[18] Dysprosium, neodymium, and praseodymium make up 85 percent of REE usage in these high-growth markets. In the past two decades the demand for REEs has expanded dramatically with the growth of cellphone, computer, and DVD markets. Many rechargeable batteries, important in the production and use of cell phones and laptops, are manufactured with REEs. However, while demand for REE's is increasing in a variety of high-tech markets, it is green technology applications (hybrid cars, next-generation wind turbines) that are expected to drive double-digit market growth.

Uses of Rare Earth Elements

REE	Use
Scandium	high intensity lamps, aerospace components
Light REEs	
Lanthanum	hybrid engines, metal alloys
Cerium	auto catalyst, petroleum refining, metal alloys
Praseodymium	magnets
Neodymium	auto catalyst, petroleum refining, hard drives in laptops, headphones, hybrid engines
Promethium	nuclear batteries
Samarium	magnets
Heavy REEs	
Europium	red color for television and computer screens
Gadolinium	magnets
Terbium	phosphors, permanent magnets
Dysprosium	permanent magnets, hybrid engines
Holmium	glass coloring, lasers
Erbium	phosphors
Thulium	medical x-ray units
Ytterbium	Infrared lasers, steel alloys
Lutetium	catalysts in petroleum refining
Yttrium	red color, fluorescent lamps, ceramics, metal alloy agent

Source: http://www.fas.org/sgp/crs/natsec/R41347.pdf

Dysprosium is the most valuable REE in the Bokan deposit. It is used to make electronic components smaller and faster. In its oxide form it is used in small high-capacitance capacitors for electronic applications. Dysprosium is also used to enhance the ability of neodymium-iron-boron (NdFeB) high-strength permanent magnets to maintain their magnetic properties at high temperatures.[19]

REEs are also critically important in the production of national defense technology such as night-vision goggles and precision-guided weapons. They are vital in making the very hard alloys used in armored vehicles and projectiles that shatter on impact.[20]

---

[18] http://pubs.usgs.gov/sir/2011/5094/pdf/sir2011-5094.pdf
[19] http://www.molycorp.com/resources/the-rare-earth-elements/dysprosium
[20] http://geology.com/articles/rare-earth-elements/

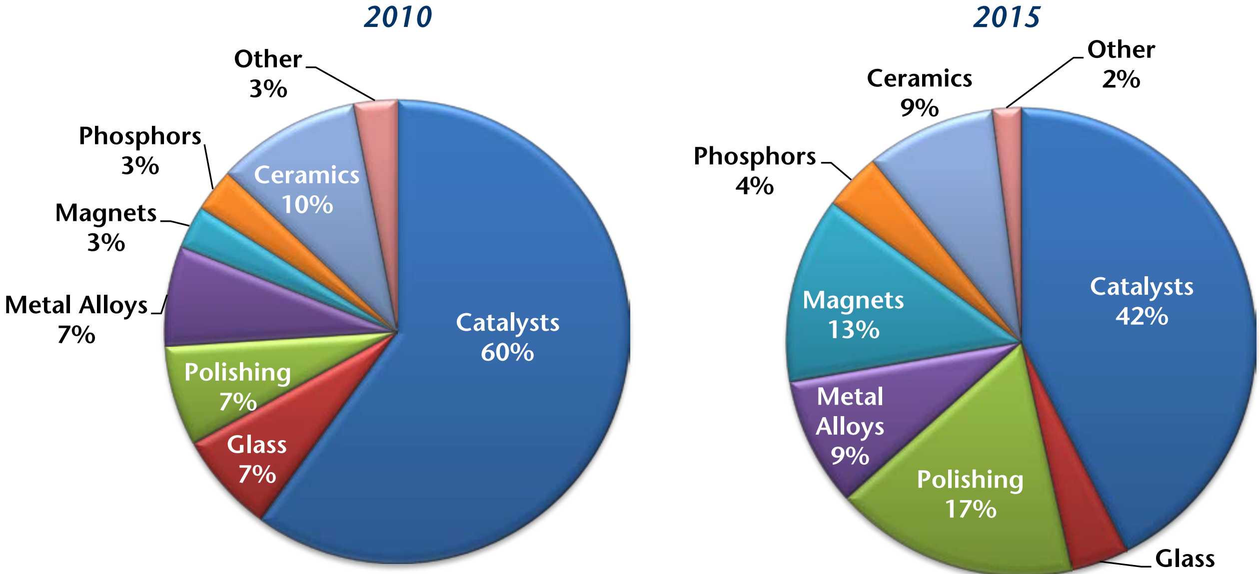
Defense Uses of REEs

REE	Use
Lanthanum	Night vision goggles
Neodymium	Laser range-finders, guidance systems, communications
Samarium	Permanent magnets that are stable in high temperatures, precision-guided weapons, "white noise" production in stealth technology
Europium	Fluorescents and phosphors in lamps and monitors
Erbium	Amplifiers in fiber-optic data transmission

Source: http://geology.com/articles/rare-earth-elements/

Expanding new technologies have resulted in significantly increased demand for REEs. In 2010, it was estimated that world demand totaled 136,100 tons, while global production totaled 133,600 tons annually. By 2015, it is estimated that global demand will reach anywhere from 185,000 tons to 210,000 tons per year. U.S. demand for REEs is expected to rise along with global demand. Demand for permanent magnets is predicted to grow by 10 to 16 percent over the next several years and demand for REEs needed in auto catalysts and petroleum refining should increase by 6 percent and 8 percent, respectively, during this time.[21]

REE Demand in the US, by Application, 2010 and 2015



Source: http://www.fas.org/sgp/crs/natsec/R41347.pdf

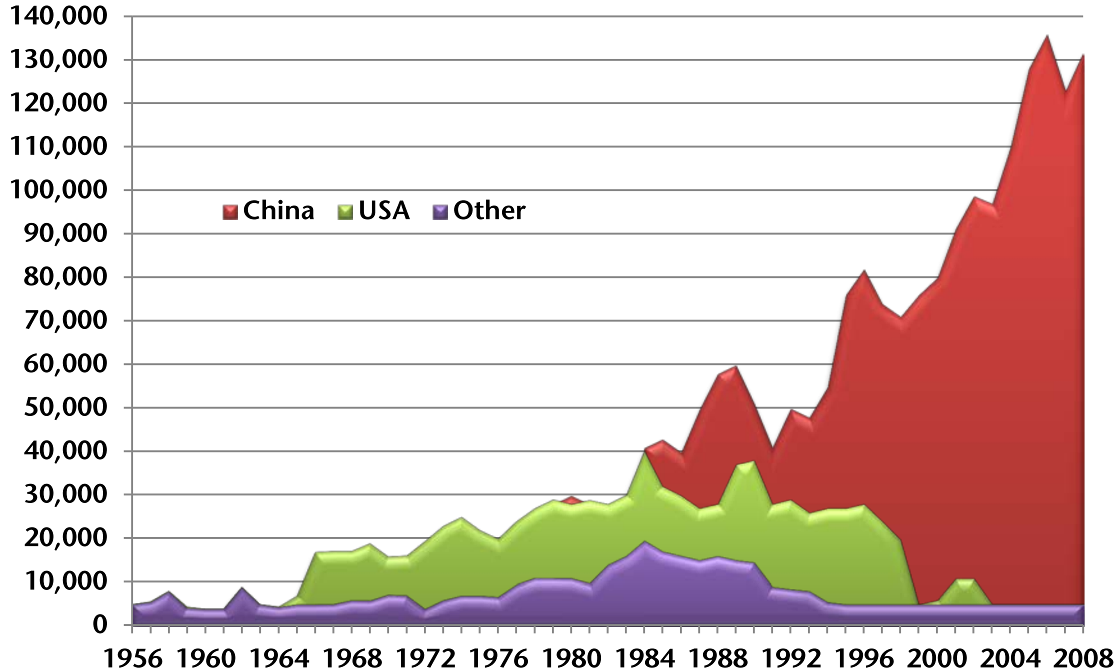
Historical and Current Production

For a 35-year period from about 1965 to 2000, California's Mountain Pass REE mine was the world's dominant producer of REEs. Mountain Pass, along with mines in South Africa, India, and Brazil met most of the world's needs until about 1985 when China entered the REE mining industry in a substantial way. Chinese REE production grew rapidly, and for the past 15 years China has been the world's dominant producer of REEs. When Mountain Pass closed in 2002 due to declining REE prices and new environmental

[21] http://www.fas.org/sgp/crs/natsec/R41347.pdf

restrictions, China's dominance in REE production was secured, the result of low labor costs and unrestricted environmental impacts.

REE World Mine Production, 1956-2008



In 2011, China's mine production accounted for 97 percent of total global REE production. Other producers include India, Brazil, and Malaysia. Although a number of promising prospects have been discovered in the U.S., production has not yet begun.[22]

REE World Mine Production and Reserves, 2011

	Production (tons)	Reserves (tons)
China	130,000	55,000,000
India	3,000	3,100,000
Brazil	550	48,000
Malaysia	30	30,000
Common Wealth of Independent States	NA	19,000,000
United States	-	13,000,000
Australia	-	1,600,000
Other countries	-	22,000,000
Total	**133,580**	**113,778,000**

Source: http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/mcs-2012-raree.pdf

[22] http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/mcs-2012-raree.pdf

In 2011, 100 percent of REEs consumed by the U.S. were imported. China is the largest source of imports, accounting for 79 percent of total REE imports in 2010. Remaining sources include France (6 percent), Estonia (4 percent), Japan (3 percent), and small percentages from other countries (8 percent).

North American Production Potential

Although the U.S. and Canada have not been producing REEs, there is significant production potential and a number of projects are in the works. U.S.-based Molycorp currently has some rare earth mine production at Mountain Pass, California, though it is not an active mine. The company sells rare earth concentrates and refined products from previously mined above-ground stocks. However, Molycorp has an exploratory program underway and plans for full mine production in late 2012. Mountain Pass once produced 20,000 tons of REEs per year. Another U.S.-based company, US Rare Earths, is in the pre-feasibility stage of projects in Idaho, Colorado, and Montana.

Great Western Minerals Group (GWMG) of Canada and Avalon Rare Metals are currently working toward production of heavy rare earth elements (HREEs). Avalon is developing an area at Thor Lake in the Northwest Territories of Canada that is thought to contain one of the largest REE deposits in the world with HREE production potential. GWMG plans to have a refinery near the mine production site in South Africa in order to allow greater integration and control over the supply chain.

Ucore's plans for operations at Bokan Mountain are, so far, the first U.S.-based project specifically targeted at the production of HREEs.