

GEOL3300: Earth Resources Citizenship Literacy Survey (Initial)

For multiple-choice questions, fill in your answer on the bubble sheet provided using a #2 pencil. Give only one answer for each question. Write the answers to other questions on the survey in the space provided.

Personal Background

1. What is your sex?
 - a. female
 - b. male
2. What is your age?
 - a. <18 years
 - b. 18-19 years
 - c. 20-21 years
 - d. 22-25 years
 - e. 26-30 years
 - f. over 30 years
3. How many years of science classes (chemistry, physics, biology, earth science, etc.) did you take in high school?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
 - f. more than 4 (by taking more than one at a time)
4. How many hours of college credit have you completed
 - a. < 29
 - b. 30-59
 - c. 60-89
 - d. 90
5. How many science classes (chemistry, physics, biology, earth science, etc.) have you taken in college?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. more than 3
6. How many math classes (excluding statistics) have you taken in college?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. more than 3
7. In what setting was your last Earth Science (or geology) class?
 - a. never taken one
 - b. in junior high school
 - c. in high school
 - d. in college
 - e. other, please explain _____

8. In which UW College are you enrolled?
 - a. Agriculture
 - b. Arts & Sciences
 - c. Business
 - d. Education
 - e. Engineering
 - f. Health Science
 - g. Law
 - h. undeclared
 - i. do not know
9. What is your major area of interest (pick only one)?
 - a. Fine Arts (art, dance, music, theatre)
 - b. Technology (engineering, computer science, architecture)
 - c. Business (accounting, finance, marketing, management, etc.)
 - d. Humanities (English, philosophy, language, liberal studies)
 - e. Social Science (anthropology, communications, history, psychology, sociology, etc.)
 - f. Biological Sciences (biology, zoology, botany, nursing, premed)
 - g. Physical Sciences (chemistry, geology, physics, astronomy)
 - h. Mathematics
 - i. Education
 - j. None of these
10. Which best describes your access to the Internet?
 - a. very convenient (e.g. access from "home")
 - b. somewhat convenient (e.g. easy access to computer lab)
 - c. somewhat inconvenient
 - d. very inconvenient

Attitude

11. How confident are you in your ability to understand science?
 - a. 1 (low)
 - b. 2
 - c. 3
 - d. 4
 - e. 5 (high)
12. How confident are you in your ability to understand math?
 - a. 1 (low)
 - b. 2
 - c. 3
 - d. 4
 - e. 5 (high)
13. Which best describes your reason for being in GEOL3300 this semester?
 - a. Science is required, so I'll get it over with early.
 - b. I put taking my science requirement off as long as I could before graduation.
 - c. It was the only University studies science class that was still open.
 - d. I am a geology major.
 - e. other, please explain _____

14. Which best describes your state of mind about taking this college science class?
- I can't sleep because I worry about it.
 - I'm a little nervous, but I'll probably pass.
 - I don't think about it.
 - I've been looking forward to taking it.
 - I can't sleep because I'm so excited about it.
15. How important do you think geology is to daily life?
- don't know
 - totally useless
 - mostly useless
 - somewhat important
 - very important

Social Context

Peruse the information on the country data sheet provided (p. 4) and answer the following questions. This is accurate information for an unidentified country.

Historical Background

16. What country would guess this is?
- Bangladesh
 - Mexico
 - Kenya
 - Brazil
 - Belgium
17. What continent is this country on?
- Asia
 - Africa
 - Europe
 - North America
 - South America

Population Demographics

18. The doubling time for the population of this country is: (see below)
- 87.7 years
 - 68.4 years
 - 61.4 years
 - 106.7 years

To calculate the number of years it will take for this country to double its population, use this formula:

$$\begin{aligned} \text{doubling time} &= \frac{70}{\text{birth rate} - \text{death rate}} \\ &= \frac{70}{\text{populatin growth rate}} \end{aligned}$$

Note that the birth rate minus the death rate is also the Population Growth Rate, shown as a percent of 100.

19. What is the population density?
- 54.6 persons per km²
 - 56.3 persons per km²
 - 5.66 persons per km²
 - The information needed to calculate density is not available here

Economic Context

20. What statistic would be most indicative that this country has not pursued a development strategy that would benefit everyone equally?
- Life expectancy for females is higher than it is for males.
 - Males are much more likely to be literate.
 - Income inequality between the poorest quintile and wealthiest quintile is about 1:10
 - Imports exceed exports by more than \$1.3 billion annually
21. Which of the following is a very serious problem facing this country?
- The high rate of HIV/AIDS infection and short life expectancy of the total population
 - The domination of Protestants over Catholics and others in the country
 - The large amount of development assistance the country receives
 - The deep poverty of more than three-quarters of the population

Cultural & Social Structure

22. How would you describe the success of this country since independence in 1961?
- It has succeeded in providing for the basic necessities for its people, improving health and education and protecting the population from natural disasters
 - It has faltered in its economic development and now is heavily in debt
 - It has followed a path of development that relies on the creation of industry, the modernization of agriculture, and the widespread extraction of significant earth resources
 - It has been wracked with political instability, overpopulation and invasions by its neighbors, all contributing to a failed economy and deeply divided nation along tribal lines

Critical Thinking

To answer questions 23-31, read the four discussions about various social issues raised by the extraction of Earth resources on pp. - - .

23. Which of the discussions do you think was written by an individual who most strongly supports earth resource development?
- Discussion 1
 - Discussion 2
 - Discussion 3
 - Discussion 4

24. Which of the discussions do you think was written by an individual who is most strongly a critic of earth resource development?
- Discussion 1
 - Discussion 2
 - Discussion 3
 - Discussion 4
25. Which of the discussions is written by an individual who is part of the organization that is directly involved in earth resource development?
- Discussion 1
 - Discussion 2
 - Discussion 3
 - Discussion 4
26. Though each discussion approaches a different subject, in which discussion do you have the most faith that the information is correct and does not leave out important facts on which to form a judgment about the subject addressed by the discussion?
- Discussion 1
 - Discussion 2
 - Discussion 3
 - Discussion 4

Here are the actual sources of the discussions. Now that you know this, please do not change your answers to questions 23-26. Answer the following questions:

- Discussion 1: Royal Dutch Shell - Nigeria Website.
http://www.shell.com/home/Framework?siteId=nigeria&FC2=/nigeria/html/iwgen/leftnavs/zzz_lhn1_0_0.html&FC3=/nigeria/html/iwgen/welcome.html.
 - Discussion 2: Powder River Basin Resource Council (environmental action group).
<http://www.powderriverbasin.org/cbm/index.htm>
 - Discussion 3: Michele L. W. Tuttle, Ronald R. Charpentier, and Michael E. Brownfield. "The Niger Delta Petroleum System: Niger Delta Province, Nigeria, Cameroon, and Equatorial Guinea, Africa." Technical Report AN2310. Washington, DC: U.S. Geological Survey. 1998.
 - Discussion 4: Jane Perlez. "Newmont's fight over pollution charges intensifies in Indonesia." The New York Times, December 23, 2004.
27. Now that you know the sources, how much faith do you have in the accuracy and honesty of the 1st discussion?
- Complete
 - A great deal, but not entirely
 - Some, but not a lot
 - Very little or none at all
28. Now that you know the sources, how much faith do you have in the accuracy and honesty of the 2nd discussion?
- Complete
 - A great deal, but not entirely
 - Some, but not a lot
 - Very little or none at all
29. Now that you know the sources, how much faith do you have in the accuracy and honesty of the 3rd discussion?
- Complete
 - A great deal, but not entirely
 - Some, but not a lot
 - Very little or none at all

30. Now that you know the sources, how much faith do you have in the accuracy and honesty of the 4th discussion?
 - a. Complete
 - b. A great deal, but not entirely
 - c. Some, but not a lot
 - d. Very little or none at all
31. Please explain why you answered questions 27-31 as you did

To answer questions, please read the hypothetical press release about the opening of a mine, beneficiation plant and smelter on pp. ---.

If you lived in or near Sleepyville or Riverdale, your reaction to the announcement of a new operation in the area could be one of many. Here are just six possible reactions. Rank them in terms of whether you agree or disagree with the response.

32. Excited, especially about the potential economic benefits – including new jobs.
 - a. strongly agree
 - b. agree
 - c. neutral
 - d. disagree
 - e. strongly disagree
33. Fascinated to see the operation of a complex integrated mining, smelting and refining operation in action.
 - a. strongly agree
 - b. agree
 - c. neutral
 - d. disagree
 - e. strongly disagree
34. Guardedly optimistic, knowing companies sometimes announce plans and then pull out or do not do all the things they say they will do.
 - a. strongly agree
 - b. agree
 - c. neutral
 - d. disagree
 - e. strongly disagree
35. Skeptical and wondering if the operations will disrupt the lifestyle and quality of life of these rural small towns, bringing newcomers and all the problems of growth.
 - a. strongly agree
 - b. agree
 - c. neutral
 - d. disagree
 - e. strongly disagree

36. Opposed, largely because these kinds of operations despoil the environment (rip up the mountains, pollute the air with mine dust and toxic waste from smelting and refining) while brining few long-term benefits to the area.
- strongly agree
 - agree
 - neutral
 - disagree
 - strongly disagree
37. Concerned about what the announcement is not saying: who will build the roads, housing, schools, water treatment plant and other public infrastructure to handle both the 'boom' population during construction and the permanent workforce and its families and who will pay for these.
- strongly agree
 - agree
 - neutral
 - disagree
 - strongly disagree
38. Would your feelings be different if you live in Utah, but far away from the site of the mine and smelting operation?
- Yes
 - No

If you were to organize or attend a community meeting to discuss the press release from Triple M Mining and Brewing, what would you want to discuss or hear discussed? To all that apply, indicate on the bubble sheet **how much** you would like to have a discussion about the following issues. Mark **1** for most important, **2** for important, **3** for less important and **4** for not important.

- Financial costs to the community.
- Whether or not the workforce would be members of labor unions.
- The values and expectations of the new families and individuals that'd move in
- Other communities' experiences with similar development projects
- New businesses that could benefit from the activity
- Ways to settle issues that might come up with Triple M Mining and Brewing Co.
- How much of the company's receipts and revenues will be kept in local banks, making loan money available to local citizens
- What the company plans to do about reclamation and other damage caused by it's operation
- The impact of this plan on the local ski resort
- The water that will be required to run the operation and support the larger population associated with the development
- The kind of amenities the company expects the communities to provide for the workforce, including its professionals – e.g. a recreation center, a shopping mall, golf course, increased police protection, etc.
- Air pollution, especially the threat of toxic waste discharge
- State support for the interests for the company over those of the communities and local area
- Potential pollution to the river near Rivervale and the threat this poses to those using the river for fishing, drinking water, agricultural irrigation, and boating
- The aesthetic damage to the mountains of the mining operation
- Changes in the political climate the newcomers will bring - with new ideas, expectations, values and opinions, as well as the power the new voters will have

55. The amount of tax revenue the operations can be expected to generate and ways to get up-front money based on these revenue projections, in order to build the public infrastructure needed to handle the impacts
56. How to plan for the cycles of the buildup, peak labor force, operational labor force and then bust periods when the mine is exhausted
57. What happens if the company starts operations then goes bankrupt
58. How to deal with the inevitable opposition of groups – some of them outside the community and the state – who'll try to prevent the operation from being built
59. Whether or not the communities have any say so about whether or not this operation can be build and operated, even without the support of the communities
60. Consequences if the company or the operation is sold to someone else who won't honor the agreements worked out with Triple M Mining and Brewing Co.
61. The amount of the tax revenues levied by the state that will be returned to the community
62. If the jobs created by the operations can keep local young people in the area after finishing their education
63. The impact the operations will have on wildlife, including hunting and fishing that is practiced by almost every family in the area
64. Current ownership Triple M Mining and Brewing Co. - Americans or foreigners?

Predicting Consequences

65. What are some likely impacts on the environment near the mine?

66. What are the likely impacts of this development project on the transportation system of the region?

67. Is there something the company is not telling the public about the operations of the beneficiation plant?

68. Will all of the economic impacts on the communities adjacent to these operations be beneficial?

Recognizing Impacts

69. How will public services in the region be impacted by this project?

70. Would you be concerned about the impact of mining on water supplies?

71. What is likely to be the impact of the project on property values in Sleepyville?

72. How do you predict populations will change in the towns affected?

Identifying Hidden and Shared Costs

73. What additional costs will the adjacent towns be faced with?

74. What increased costs will the state of Utah confront?

75. Should the population of the region be concerned with any safety issues from the project that directly affect their well-being?

76. How is the state of Utah benefiting economically from this mine?

77. Critics of the 1872 Mining Act could use this project to justify their claims that the citizens of the United States are being cheated by the Triple M Mining and Brewing Company. Why?

Alternative Strategies

78. How might ore transportation be made more safe?

Social Context

Country Data Sheet

Area: *total:* 582,650 sq km
land: 569,250 sq km
water: 13,400 sq km

Area - comparative: slightly more than twice the size of Nevada

Climate: varies from tropical along coast to arid in interior

Terrain: low plains rise to central highlands bisected by major valley; fertile plateau in west

Elevation extremes: *lowest point:* Coast 0 m
highest point: Mount K. 5,199 m

Natural resources: gold, limestone, soda ash, salt, rubies, fluor spar, garnets, wildlife, hydropower

Land use: *arable land:* 8.08%
permanent crops: 0.98%
other: 90.94% (2001)

Natural hazards: recurring drought; flooding during rainy seasons

Environment current issues: water pollution from urban and industrial wastes; degradation of water quality from increased use of pesticides and fertilizers; water hyacinth infestation in Lake V; deforestation; soil erosion; desertification; poaching

Environment international agreements: *party to:* Biodiversity, Climate Change, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Dumping, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Wetlands, Whaling

Geography note: the Highlands comprise one of the most successful agricultural production regions on the continent; glaciers are found on Mount K; unique physiography supports abundant and varied wildlife of scientific and economic value

Population: 32,021,856
note: estimates for this country explicitly take into account the effects of excess mortality due to AIDS.

Age structure: *0-14 years:* 40.6% (male 6,575,409; female 6,430,218)
15-64 years: 56.5% (male 9,126,847; female 8,962,905)
65 years and over: 2.9% (male 399,050; female 527,427) (2004 est.)

Median age: *total:* 18.6 years
male: 18.5 years
female: 18.7 years (2004 est.)

Population growth rate: 1.14% (2004 est.)

Birth rate: 27.82 births/1,000 population (2004 est.)

| | |
|--|--|
| Death rate: | 16.31 deaths/1,000 population (2004 est.) |
| Net migration rate: | -0.1 migrant(s)/1,000 population. <i>note:</i> 220,000 refugees from neighboring countries at end of 2001 (UNHCR) |
| Sex ratio: | <i>under 15 years:</i> 1.02 male(s)/female <i>15-64 years:</i> 1.02 male(s)/female <i>65 years and over:</i> 0.76 male(s)/female <i>total population:</i> 1.01 male(s)/female (2004 est.) |
| Infant mortality rate: | <i>total:</i> 62.62 deaths/1,000 live births <i>male:</i> 65.55 deaths/1,000 live births <i>female:</i> 59.6 deaths/1,000 live births (2004 est.) |
| Life expectancy at birth: | <i>total population:</i> 44.94 years <i>male:</i> 44.79 years <i>female:</i> 45.1 years (2004 est.) |
| Total fertility rate: | 3.31 children born/woman (2004 est.) |
| HIV/AIDS - adult prevalence rate: | 6.7% (2003 est.) |
| Ethnic groups: | K. 22%, L. 14%, L. 13%, K. 12%, K. 11%, K. 6%, M. 6%, other 16%, including 1% European |
| Religions: | Protestant 45%, Roman Catholic 33%, indigenous beliefs 10%, Islam 10%, other 2% |
| Languages: | English (official), K. (official), & numerous indigenous languages |
| Literacy definition: age 15+ can read and write | <i>total population:</i> 85.1% <i>male:</i> 90.6% <i>female:</i> 79.7% (2003 est.) |
| GDP (in millions) | \$ 13,842 |
| Labor force - by occupation: | agriculture 75% (2003 est.) |
| Agriculture - products: | tea, coffee, corn, wheat, sugarcane, fruit, vegetables; dairy products, beef, pork, poultry, eggs |
| Industries: | small-scale consumer goods (plastic, furniture, batteries, textiles, soap, cigarettes, flour), agricultural products processing; oil refining, cement; tourism |
| Population living at \$2 a day or less | 24.1% |
| Percentage Share of Income | <i>Highest 20% - 51.2% of national income (highest 10% - 37.2%)</i> <i>Lowest 20% - 5.6% of national income (lowest 10% - 2%)</i> |
| Development Assistance | \$13 per capita (2002 est.) |
| External Debt, as | 40% (\$6 billion, 2002 est.). <i>Public debt: 62% of GDP (2004 est.)</i> |

percent of GNI

Merchandise Exports: \$2,395
Trade, in millions Imports: \$3,735

Sources: CIA World Fact Book (<http://www.cia.gov/cia/publications/factbook/>) and *World Development Report 2005*, World Bank, Washington, DC.

Critical Thinking

Discussion #1

...community unrest remains high – and sometimes leads to disruption of operations. In turn, on occasions, this provides cover for criminal activities such as sabotage, crude oil theft, piracy, armed robbery, kidnapping and hostage taking...However, we are pleased to note an encouraging reduction in the number of violent incidents against staff (including hostage taking) over the last two years.

As in any other part of the world, the government has a duty and an obligation to uphold the rule of law – whilst at the same time respecting the human rights of its people. In areas where armed crime and lawlessness are widespread, appropriate policing is required. But *[name of organization]* will not use force, nor seek armed intervention, to suppress demonstrations by peacefully protesting communities – even if oil production is disrupted. Dialogue to resolve the underlying problems – and not force – is the answer in such situations.

But let's be clear about the root cause of community unrest in the Delta. There are two fundamental reasons; first, the people of the Niger Delta want a greater say in the political process, something they have been pushing for some time. Second and more importantly, they want a larger share of government oil revenues returned to the Delta for the development of the area.

We have every sympathy with the communities' sense of grievance that a fair share of the revenues from oil has not been applied in the development of their areas... [T]he government has set up a special commission, the Niger Delta Development Commission, to effect development in the area, and is working to support the NDDC to develop the area.

In addition to contributing to the funding of the Niger Delta Development Commission ... also has a major community development program. This program provides a wide range of infrastructure projects (such as hospitals, health center, schools, water schemes, electricity schemes and roads) and social programs (including youth training schemes, micro-credit schemes and agricultural and fishery programs). Increasingly, such projects and programs are being implemented through local participation and in partnership with NGOs and developmental agencies. But...cannot be expected to take over the role of government. It has neither the means nor the mandate.

The rise (from 3% to 13%) in the amount of government revenues from oil allocated to the oil producing communities will, if properly managed with the involvement of the communities, bring significant improvements to the area.

Discussion #2

Coalbed methane development ...is transforming a mixed prairie landscape ranging from rolling hills with red scoria outcrops to deep-cut draws and craggy breaks into an energy development industrial zone. Roads, power lines, and pipeline corridors indelibly scar what were untouched expanses of sagebrush and native grass—home to large herds of pronghorn antelope, mule deer, and the elusive sage grouse, which is suffering serious population declines.

The technology being used to produce coalbed methane requires pumping large volumes of water to the surface, where it is stored in huge wastewater impoundments that now dominate the visual landscape. This practice, which is designed to evaporate and infiltrate the waste water into the shallow aquifer, not only removes hundreds of acres of rangeland from production, but is a blatant waste of valuable underground water reserves.

Other methods of water disposal have included "atomizing" the water into the air for evaporation, but freezing conditions have transformed the mist into giant ice mounds, rendering the technology ineffective, and damaging the soils underneath.

Huge compressor stations are required to move the gas through the pipelines, and are being built on open rangelands... The once quiet prairie now roars like the engine of a 747 revving up for takeoff. People living near compressor stations can no longer sit peacefully outdoors or leave their windows open at night without the constant reminder that their quiet lifestyle has been destroyed for the foreseeable future.

Over three quarters of the development of 40,000 new coalbed methane wells projected to take place over the next decade will be on privately owned surface overlying minerals owned and controlled by the Bureau of Land Management (BLM). This mixed ownership of surface and minerals is known as the "split estate", and under current law the rights of the mineral lessee are dominant over the surface owner. This situation places a significant burden on landowners trying to maintain a ranching operation or simply protect their property from the impacts of development.

Under current ...law, coalbed methane companies holding valid mineral leases may enter private property without the landowner's permission, and without including the landowner in planning how the development will proceed on their land. Roads, wells, power lines, pipelines, wastewater discharge pits, and even compressor stations may be built on private property with landowners having little or no say as to how, when, or where!

Discussion #3

The Niger Delta is situated in the Gulf of Guinea and extends throughout the Niger Delta Province as defined by Klett and others (1997). From the Eocene to the present, the delta has prograded southwestward, forming depobelts that represent the most active portion of the delta at each stage of its development (Doust and Omatsola, 1990). These depobelts form one of the largest regressive deltas in the world with an area of some 300,000 km² (Kulke, 1995), a sediment volume of 500,000 km³ (Hospers, 1965), and a sediment thickness of over 10 km in the basin depocenter (Kaplan and others, 1994).

The Niger Delta Province contains only one identified petroleum system (Kulke, 1995). This system is referred to here as the Tertiary Niger Delta (Akata –Agbada) Petroleum System.¹ The maximum extent of the petroleum system coincides with the boundaries of the province. The minimum extent of the system ... contains known resources (cumulative production plus proved reserves) of 34.5 billion barrels of oil (BBO) and 93.8 trillion cubic feet of gas² (Petroconsultants, 1996a). Currently, most of this petroleum is in fields that are onshore or on the continental shelf in waters less than 200 meters deep, and occurs primarily in large, relatively simple structures. A few giant fields do occur in the delta, the largest contains just over 1.0 BBO (Petroconsultants, Inc., 1996a). Among the provinces ranked in the U.S. Geological Survey's World Energy Assessment (Klett and others, 1997), the Niger Delta province is the twelfth richest in petroleum resources, with 2.2% of the world's discovered oil and 1.4% of the world's discovered gas (Petroconsultants, Inc. 1996a).

In 1908, the German Nigerian Bitumen Corporation drilled the first wells in the vicinity of the tar seep deposits in the northern portion of the delta (Frost, 1997). However, significant oil shows were not found in Tertiary rocks until the early 1950's. Shell-British Petroleum brought the first well on stream in 1958 at 5,100 barrels per day. From 1958 until the Biafran War in 1967, exploration and production increased in Nigeria. The war curtailed both activities until its end in 1970, when world oil prices were rising and Nigeria again could benefit economically from its petroleum resources in the Niger Delta. In 1971, Nigeria joined the Organization of the Petroleum Exporting Countries (OPEC) with a total production of 703 million barrels of oil (MMBO) per annum.

In 1997, production rose to 810 MMBO. Thirty-one percent of this production was exported to the United States, making Nigeria the fifth largest supplier of U.S. oil. Despite the political uncertainty in Nigeria today, the country's sustainable production capacity is expected to increase over current production... Petroleum exploration is also expanding,

especially in deeper water offshore, with the Nigerian government currently planning to offer six additional lease blocks in water up to 3000 m deep...

Discussion #4

An internal company report warned top executives at Newmont Mining, the world's largest gold producer, in 2001 that the company was putting tons of toxic mercury vapors into the air in Indonesia. The document, shown to ... by a person close to Newmont, sheds new light on operations at one of the most troubled mines of a company that has drawn the rising ire of environmental groups and local communities over the impact of its operations, which started at the Indonesia site in 1996...

Villagers at Buyat Bay near the Newmont mine on Sulawesi, a northern Indonesian island, sued the company for \$543 million in August after complaining about dizziness, difficulty breathing, tumors and skin diseases, which they say began soon after Newmont started mining. The report... says that some 33 tons of mercury that Indonesian officials say should have been collected and sent to a legal dump for toxic waste were put into the environment over four years. About 17 tons were sent into the air and 16 more tons released into the bay, the audit says.

Experts consulted on the emissions said they probably posed greater risk to the mine's workers than to the villagers but agreed that airborne mercury was one of the mining byproduct's most toxic forms. Glenn Miller, a professor of environmental science at the University of Nevada and a specialist in mining and mercury, described it as "an outrageous amount of mercury to put into the atmosphere."

In the interview, the Newmont executives defended the company's operations but did not dispute the mercury totals and acknowledged that they were aware of the emissions even before the findings of what they called a draft report. "Today I don't think it is under dispute, that 16 and 17," David Francisco, executive vice president for operations, said of the totals. "Is there an impact, is it harmful, is it within the accepted limits we have as an industry, that governments have established? Yeah, I think there was an impact. On the other hand, no, it didn't negatively impact on the bay and the people."

...The Newmont audit classifies the finding on mercury as "significant," meaning that it could pose an "imminent risk" to human health and the environment or result in a violation that could cause a plant closure or loss of permits. The Newmont executives said those warnings were about "potential issues." But the emissions were enough of a real concern that the company went to the trouble of installing a scrubber, a bulky pollution-control device costing nearly \$10 million. As Newmont sought to "optimize gold recovery," the audit said, the scrubber did not work much of the time it was supposed to.

...In defending the Indonesian operations, David Baker, vice president for environmental affairs... said Newmont applied the same standards on mercury emissions here that it would in Nevada. "Those emissions were within the limits that were identified in the Indonesian permitting process and were well within any standard or requirement," he said. Nevada, the center of U.S. gold mining, has more mercury emissions than any other state and also the most relaxed standards for mercury in the United States, said Miller, the mercury specialist. In a lawsuit against the company, two former employees who were dismissed by Newmont leveled similar accusations of disregard for environmental rules at operations in Nevada in 2001. Neither the state nor the U.S. Environmental Protection Agency regulates mercury emissions at Nevada mines, except as water pollutants, Miller said.

Newmont's Indonesia mine averaged more than four tons of mercury in the air annually, about equal to the largest similar emission at a U.S. mine in Nevada in the late 1990s, he said. But one former Newmont employee familiar with the Indonesian mine's operations said that in 1998, when the mine was at the height of production and the scrubber was often not working, the emissions into the air could have been as much as eight tons or more.

An American toxicologist, Joe Rodricks, whom Newmont recommended as a mercury specialist, said he had been told by the company that when the scrubber was in operation, emissions at the Indonesian mine met the standards for airborne mercury in Nevada. "My understanding is that the times when they didn't meet the standards was when the scrubber was not working," he said. But he said he did not think the airborne mercury would have harmed local people.

...Francisco, the executive vice president for operations, described the decision to install a mercury scrubber as "an example of Newmont trying to do the right thing." The audit said, however, that in 1997 the company processed ore with high mercury content by "roasting" it at high temperatures on 84 days before the scrubber arrived. After it arrived, the audit said, the scrubber did not function on 213 of 310 days in 1998. A major reason for the breakdown, according to the audit, was that the mine operators had increased the heat during the roasting to maximize the recovery of gold. "The mercury scrubber facility does not have the physical ability to handle the entire volume of gases now emitted from the roaster," the Newmont document said. Pictures with the audit showed filters from the device torn out of the machine and strewn on the ground. Baker, vice president for environmental affairs at the company, said the scrubber had been operated at the intended temperature but had been clogged with dust. The company responded to the audit, he said, by fixing the scrubber in mid-2001...

Two former employees said the decision was made at Denver headquarters to cut costs and maximize gold retrieval at a time when Newmont was saddled with debt and gold prices had fallen. "Decisions come downward," said one former executive who was intimately familiar with operations at the site. "It's always about cost." Ellen Silbergeld, a professor at Johns Hopkins Bloomberg School of Public Health, who is directing a mercury study in Latin America, said airborne mercury was particularly dangerous in tropical climates, like that in Indonesia, because it changes more quickly into a form that can enter the food chain. "All forms of mercury are toxic, and mercury vapors are extremely toxic," she said.

Critical Thinking

Triple M Mining and Brewing Company Laramie, Wyoming

The Lucky Strike Mine and Processing Facilities

For immediate press release

The Triple M Mining and Brewing Company announces the development of the Lucky Strike Mine and Processing Facilities, a disseminated copper and gold mine in the Uinta Mountains of Utah. The deposit is located 20 miles northwest of the town of Sleepyville (population: 1,000), a small ski resort. The deposit occurs at an elevation of 11,000 feet with the highest grade ore underlying an estimated 5 square miles. The copper grade averages 4 % whereas gold has a grade of 0.0003 %. With an estimated ore tonnage of 1,765,234,123 tons, the deposit contains 33,539,448 tons of copper and 177 tons of gold. At current world prices (copper: \$1.46/lb; gold: \$418/oz), the value of the copper is estimated at \$97,935,189,144 and the gold is valued at \$2,361,177,163. This discovery represents a major geologic discovery and places this copper-gold deposit with the Grasberg mine of Irian Jaya in Indonesia.

To recover the metal, Triple M Mining and Brewing will develop an open-pit mine that will employ a truck and shovel mining cycle. At current metal prices, the mine is projected to have a lifetime of 25 years and at peak production employ 220 people. To recover most of the ore, the pit will reach a depth of 2,000 ft with a surface diameter of 6,000 feet. At maximum capacity, it will produce 120,000 tons of ore/day. Development of the mine will start immediately and full production is anticipated to be achieved in 2 years.

To process the raw ore into shipping grade concentrate (30 % copper and 15 % gold), a beneficiation plant will be constructed in adjacent Sleepyville. The plant will crush and mill 115,000 tons of ore each day. Sulfide flotation cells will produce 10,000 tons of concentrate each day for shipment. The raw ore will be transported from the mine via haul trucks each with a capacity of 250 tons. Construction of the plant will require a workforce of 300 and take approximately 3 years to construct. Once fully operational, the plant will employ 150 workers at peak capacity.

Triple M Mining and Brewing will also construct a smelting and refining complex to process the shipping ore and produce refined metal. This complex will be constructed in Riverville, Utah, a small farming community (population: 2500) on the Green River approximately 120 miles northwest of Sunnyville. The complex will contain a smelter to separate the copper from its host sulfide ore minerals and a refiner to produce doree gold bars (97 % pure) that will be shipped to Europe for further processing. The combined plants will require 5 years to construct by a work force of 345. When fully operational, the plants will employ a permanent workforce of 196. The smelter will use state-of-the-art scrubbers to prevent air pollution. The total cost of these facilities will be \$750 million.

Combined these projects will bring 466 jobs to the state with an annual payroll estimated at more than \$17 million. In addition, 645 construction jobs will be created for a three to five year period providing a large economic boom to the region. Taxes from mine wages and property is expected to contribute \$4 million annually to state and local coffers for the 30 years of the project.