Lander County and Battle Mountain Spent Fuel Shipments Fact Sheet 1

If the Yucca Mountain nuclear waste repository is opened, the Town of Battle Mountain and the County of Lander face the prospect of truck and/or railroad shipments of high-level nuclear waste moving through the community. If the shipments are by truck they may pass directly through the town on Interstate 80. If the shipments are by rail, some may traverse the town, but the majority would travel on the Union Pacific line north of Battle Mountain assuming the primary point of entry is eastern Nevada.

Lander County, with its small population of 5,794, could experience spent nuclear fuel shipments. There could be anywhere from 9,593 to 108,899 shipments traversing the Battle Mountain area on the way to Yucca Mountain depending upon the highway routes selected by the Department of Energy or the State of Nevada.

Lander County and Battle Mountain Spent Fuel Shipments Fact Sheet 2

What are the potential risks associated with High-Level Waste shipments?

The firm of Radioactive Waste Management Associates (RWMA) prepared a detailed, 34-page report, Battle Mountain Impact Report, addressing potential risks associated with this issue. The authors of the report are Dr. Marvin Resnikoff and Kevin Biglin, MA. Dr. Resnikoff is a nuclear physicist with over 30 years experience in risk assessment and nuclear waste management. He is Senior Associate of the internationally known, New York City-based firm, Radioactive Waste Management Associates.

This fact sheet is a summary of some of their findings from the Battle Mountain Corridor Risk Assessment. The complete report can be obtained by sending a note to kevin.biglin@rwma.com or by calling 212-620-0526.

Fact Sheet 2 Page 2

Status of the Yucca Mountain Waste Disposal Project

As of January 2006, the Department of Energy had not yet submitted the documentation required by the Nuclear Regulatory Commission for a construction and operating license application for the Yucca Mountain repository. After those documents are filed, opponents of the project will have six months in which to file their contentions. It is unlikely that the construction would start for at least another 4 years.

What would be shipped to Yucca Mountain?

The Yucca Mountain site would store 70,000 to 210,000 metric tons of irradiated, highly radioactive, spent fuel assemblies and other high-level waste inside deep tunnels at the site. The irradiated fuel assemblies would come from the nation's 103 operating, commercial nuclear reactors. Parts of decommissioned reactors would also be shipped to Yucca Mountain.

A high percentage of this spent fuel would come from reactors that are located in the eastern section of the United States. Of the 103 operating, commercial nuclear reactors, 80 are located east of the Mississippi River with only 23 located west of the Mississippi.

Spent fuel from the nation's nuclear weapons complexes and other types of high-level nuclear waste could also be sent to Yucca Mountain. This might include irradiated fuel from the US Navy's nuclear submarines, irradiated fuel from production of plutonium for nuclear bombs, solidified or "vitrified" high-level waste, and spent fuel from foreign research reactors.

US Department of Energy documents refer to this additional stream of high-level nuclear waste as Modules 1 and 2. The Modules' possible inclusion in planned shipments could increase impacts expected in Battle Mountain and Lander County. In risk assessment scenarios developed by RWMA for the Battle Mountain Corridor Risk Analysis, waste streams that both exclude and include Modules 1 and 2 were analyzed.

Lander County and Battle Mountain Spent Fuel Shipments Fact Sheet 3

Status of the Skull Valley Private Fuel Storage Project

How much nuclear waste could travel through Lander County is also impacted by the status of what's known as the Skull Valley project.

On September 9, 2005 the US Nuclear Regulatory Commission approved a construction and operating license for a temporary aboveground, spent fuel storage facility at Skull Valley in Utah. The facility at Skull Valley, sometimes called the Private Fuel Storage project, would be 45 miles west of Salt Lake City. The concept of this facility is to store 40,000 metric tons of spent fuel on an aboveground pad for 40 years. Subsequently, the high-level waste would be removed to a permanent repository.

Map of Skull Valley Utah

Approval of the Skull Valley facility would reduce the need for the Yucca Mountain project – but only temporarily. The spent nuclear fuel will still need to be moved to a permanent repository. Further, the Private Fuel Storage project is not designed to accommodate the nation's entire inventory of spent fuel.

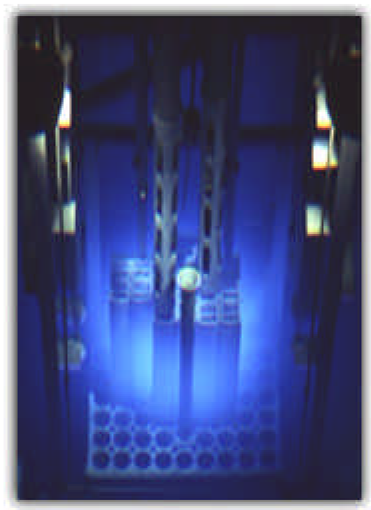
The Skull Valley project recently hit three major snags. In the fall of 2005 the Bureau of Land Management declined to approve a right-of-way for the 30-mile-long railroad that would haul the spent fuel across public lands to the storage site on the Skull Valley Indian Reservation. Then, in early December,

2005, several utilities that formerly supported the Skull Valley project stated they were withdrawing from the project. Finally, on January 6, 2006, President Bush signed a bill authorizing the Cedar Mountain Wilderness Area. The Wilderness Area will stop the construction of a railroad into the Skull Valley Project. Still, shipment by heavy-haul truck is possible.

Spokesmen for the Skull Valley Private Fuel Storage facility claim that the project is still alive. Yet it is likely that these recent developments will increase the pressure to move forward with the Yucca Mountain repository.

Lander County and Battle Mountain Spent Fuel Shipments
Fact Sheet 4

What is Spent Fuel?



Fuel power reactor core

The phrase "spent" fuel can be misleading. It implies a substance that is harmless or used-up. According to nuclear utilities the phrase makes sense; spent fuel is fuel that no longer fissions efficiently inside the reactor core. Thus, it can be described as used up. From the viewpoint of legislators, emergency preparedness teams, and the public, the term is less appropriate. Because it's highly radioactive, spent fuel is not used-up or harmless. Quite the contrary, it's extremely hazardous to humans and the biosphere.

Spent fuel is considerably more radioactive than the slightly enriched uranium that is initially loaded into nuclear reactors. The spent fuel is so radioactive that when it is first removed from a reactor it must be shielded by lead or water. Why is this material so radioactive? During the fissioning process inside the reactor, a number of by-products have built up inside the fuel. These by-products include intensely radioactive materials such as cesium-137, cobalt-60, strontium-90 and plutonium.

During storage in spent fuel pools at nuclear reactor sites, spent fuel becomes considerably less radioactive than it was at the time of removal from the core. However, even after a ten-year cool down period, spent nuclear fuel emits dangerous levels of gamma, beta and neutron radiation. After ten years of storage in a spent fuel pool, about one-half of the fission activity is generated by cesium-137. (See below under Volatile Cesium why this fact is of particular concern to Lander County residents)

In order to assess the risk of nuclear waste shipments traveling through Battle Mountain and Lander County it is necessary to examine the strength and integrity of the barriers between the toxic spent fuel and the environment. *Continued on Page 2*

Fact Sheet 4 Page 2

Three Barriers: Fuel Pellets, Rods and Casks

For a release of radioactive materials from a shipping cask to take place, three barriers must be breached. These barriers are the fuel pellets themselves, the metal cladding that surrounds the fuel pellets, and the cask itself.

Sometimes the fuel pellets are called the fuel matrix. This is enriched uranium that has been made into small ceramic pellets about 1 inch long by ½ inch in diameter. Thus each pellet is a little larger than the size of pencil eraser. These pellets have a very high melting point – 5,080 degrees Fahrenheit. The pellets need a high melting point to withstand the extremely high temperatures during reactor operation.

The pellets are stacked into long, thin rods, called fuel rods. The fuel rods are grouped into what are called fuel assemblies. Depending upon the type and size of the reactor, each assembly can include 100's of rods. The thin cladding on the fuel rods is made out of an alloy of zirconium called zircaloy. The extremely heavy, 25 to 125-ton, uranium and lead casks are the third barrier.

Weaknesses in the Barriers

Each of these barriers has significant weak points. When the ceramic pellets of enriched uranium are fissioned or split inside a nuclear reactor two very important things happen.

1) The fissioning process creates highly toxic radioactive elements inside the fuel pellets as well as on the outside surface of assemblies, as in the case of cobalt-60.

2) During reactor operation, a percentage of the volatile radionuclides, such as cesium and iodine, will migrate outside of the fuel pellets. These elements then reside in the space or gap between the fuel pellet and the surrounding metal tube or rod.

Thus, one barrier has already been partially breached before the spent fuel rods have left each nuclear reactor site and started on the rail or truck journey through such communities as Battle Mountain on the way to Yucca Mountain. If there is a breach in the cladding, cobalt-60 and other radionuclides would be released.

Continued on Page 3

Fact Sheet 4 Page 3

Volatile Cesium

A study by the US Department of Energy's Pacific Northwest Laboratory measured 9.9% of the cesium created during reactor operation as present in the gap. In the event of an accident in which the fuel cladding and cask body or cask seal is breached, this volatile and mobile cesium will be available to be dispersed to the surrounding environment. The cesium would travel in whichever direction the wind is blowing to contaminate areas surrounding the accident site. Cesium is a strong gamma emitter. Because of its long half-life it will be hazardous for several hundred years.

The amount of cesium in any one shipment will differ due to the type, age and amounts of fuel. Given this radionuclide's longevity, volatility and mobility it's presence in the fuel and in the fuel rod gap poses a concern.

Fuel Cladding Breach

Many studies have estimated what types of impacts will shatter the fuel rods. Both end and side impacts can cause 3% to 100% shattering of the rods.

When they leave the reactor sites some of the fuel rods may already be degraded. This could be the result of several factors. The environment inside an operating reactor is a demanding one with extremely hot water or steam (depending upon the type of reactor) and all metal components are under very high pressure.

Sometimes in reactor water there are metal chips or debris, for example from a rusted pipe. These can cause damage to the fuel cladding. Cladding can corrode and become embrittled. It can crack, pit and thin. Ironically, these problems may mean less volatile cesium available to be released during transit (because it's already been released either in the reactor or the spent fuel pool.)

However, if the fuel cladding has been weakened before encountering the possible shocks and vibrations expected during transit on the nation's highways and railroads, the potential for further fuel rod degradation is real. *Continued on page 4*

Fact Sheet 4 Page 4

Breach of the Cask or the Cask Seal

None of the current generation of shipping casks for either truck or rail shipments have been actually physically tested. All tests have been by computer simulation.

The truck casks weigh approximately 25 tons (Figure 1), the railroad casks 100 – 125 tons. Although the casks themselves are notably heavy and large, there is a potential problem with the cask seal. In the event of a fire, the cask seals will degrade or fail at lower temperatures than the cask itself.

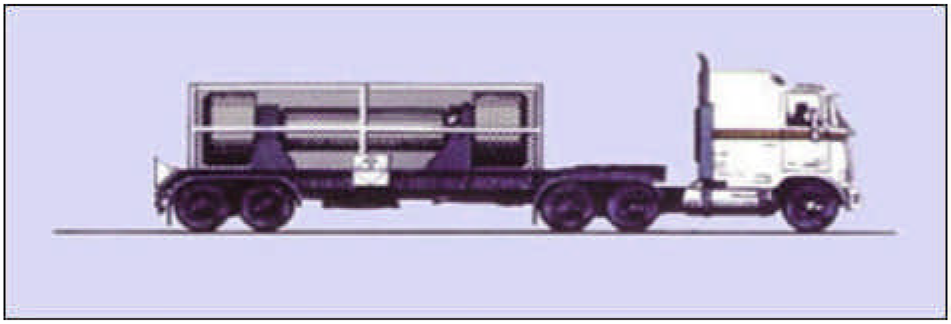


Figure 1. Spent fuel casks are made of steel and lead or uranium

The casks are designed to withstand a fire of 1475° Fahrenheit (F). The cask seals, however, have what the industry calls “service temperatures” that are in some cases ½ that of the cask body. Depending upon the cask type, the seals may degrade or fail at 536° F to 800° F.

Studies have shown that the temperatures in a fire vary tremendously. The hottest spot in the fire is usually at the boundary where the most oxygen is present, if the more vulnerable cask seal is at this boundary, than the seal may be breached which would release the volatile radionuclides inside the cask to the environment.

Lander County and Battle Mountain Spent Fuel Shipments Fact Sheet 5

Shipping Nuclear Waste

The Transportation Record Of Used Nuclear Fuel

Small amount of waste carefully managed. The high-Level waste currently produced by all US nuclear power plants as used fuel rods totals about 2000 tons per year. The United States produces a total of about 41 million tons of hazardous waste each year, 8 million tons of which is routinely transported around the country annually. All used nuclear fuel has been managed so that no adverse impacts to human health or the environment has occurred.

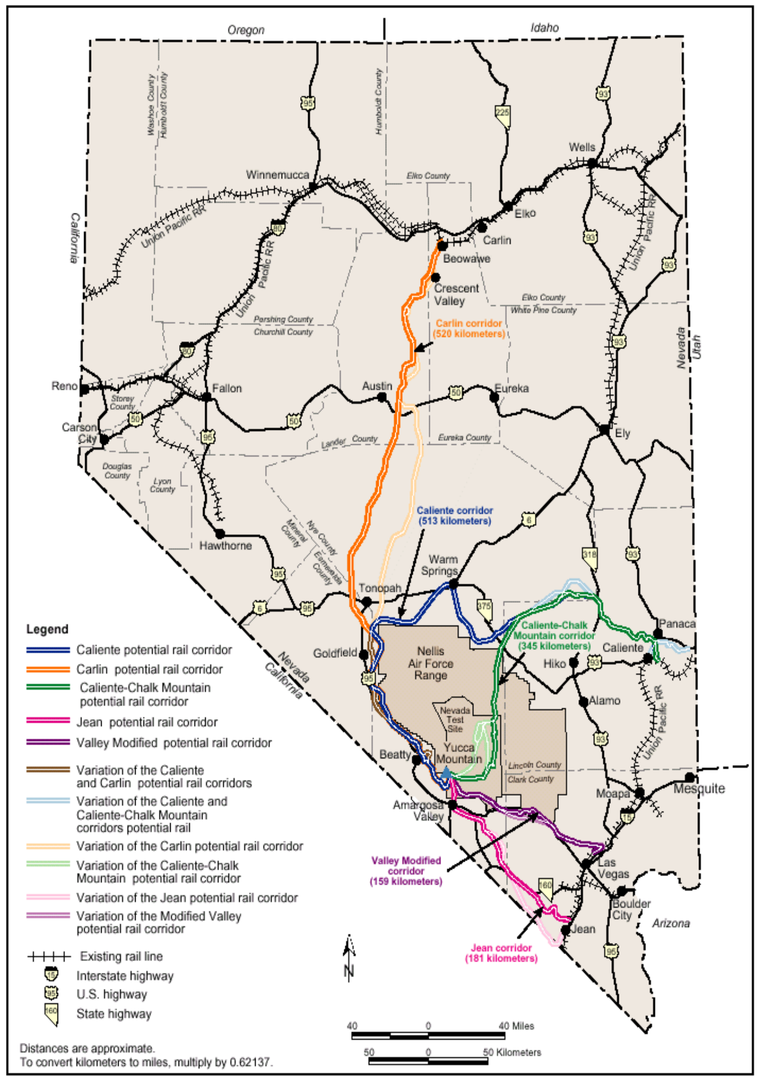


Figure S-13. Potential Nevada rail routes to Yucca Mountain.

Record of safety

The nuclear energy industry has carried out more than 3000 shipments of used nuclear fuel over 1.7 million miles of US highways and railroads since 1964. No nuclear fuel container has ever leaked or cracked in any way. In total, fuel containers were involved in just eight accidents, only four with fuel loaded in the container. The most serious was an overturned truck in 1971. No radiation was released in any of the accidents. *Continued on page 2*

Fact Sheet 5 Page 2

What are the Likely Routes for High-Level Nuclear Waste through Lander County and Battle Mountain?

The Department of Energy currently favors transporting spent fuel and other high-level waste to Yucca Mountain via railroad. There is, however, no access to Yucca Mountain by railroad either from the East or West. Initially all shipments to the facility will have to be by highway. Furthermore, many nuclear reactors are not accessible by railroad so truck shipments will be used to ship waste from these locations.

Truck shipments may pass directly through the Town of Battle Mountain on Interstate 80. Depending upon whether the shipments are from the East or West, rail shipments would travel on two different branch lines of Union Pacific. Shipments from the East will pass directly through the Town of Battle Mountain and shipments from the West will pass on the rail line to the north of the Town of Battle Mountain. Because the U.S. Department of Energy does not have any rail routes under consideration west of Battle Mountain, likely rail shipments may occur north of Battle Mountain along the east bound Union Pacific railroad.

Fact Sheet 5 Page 3

The number of shipments would vary depending upon various factors. Among these factors are what alternative routes are selected by the Department of Energy, whether shipments are by rail or highway, how many US reactors obtain license renewals, and whether the US Congress raises the current (and arbitrary) 70,000 metric ton limit on waste that Yucca Mountain can store. If Yucca Mountain is opened to high-level nuclear waste from the nation's nuclear weapons factories, the number of shipments will be even larger.

The Battle Mountain Impact Report, using Department of Energy and other estimates, calculates that Battle Mountain over a period of 24 to 39 years could be traversed by 9,593 to 17,899 shipments in the event of a mostly-by-rail scenario and by 53,086 to 108,899 shipments in the event of a mostly truck scenario.

Each of these scenarios presumes a mix of type of shipments. For example, the mostly-by-rail scenario includes a range of 8,514 to 14,777 rail shipments plus 1,079 to 3,122 truck shipments. Likewise the by-rail scenario includes some truck shipments. To give an idea of the over-all magnitude of these shipments we have added them together in this Fact Sheet, though for purposes of dose calculations they are separated in the Battle Mountain Impact Report. The wide range in numbers of shipments is accounted for by the large increase in shipments that occur when re-licensed commercial nuclear power plants and Models 1 and 2 wastes are also included in the totals.

Severe Accidents

The Battle Mountain Impact Report states that a severe accident involving a major release of radiation is credible. However, an accident leading to a major release has an extremely low probability of occurrence. Such a release could occur in the event of a high-impact truck or a rail collision or a long-duration fire.

In the case of a truck accident, it would require a fairly high-speed collision with the concrete beams supporting a highway overpass, such as the one at Exit 231. It could also involve a long duration, high temperature fire if the spent fuel shipment collided with a gasoline tanker or other shipment involving hazardous chemicals. Such a collision may be highly unlikely given the divided nature of Interstate 80 through Battle Mountain.