SUPPLEMENT ANALYSIS OF FOREIGN RESEARCH REACTOR SPENT NUCLEAR FUEL TRANSPORTATION ALONG OTHER THAN REPRESENTATIVE ROUTE FROM CONCORD NAVAL WEAPONS STATION TO IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

Introduction

The Department of Energy is planning to transport foreign research reactor spent nuclear fuel by rail from the Concord Naval Weapons Station (CNWS), Concord, California, to the Idaho National Engineering and Environmental Laboratory (INEEL). The environmental analysis supporting the decision to transport, by rail or truck, foreign research reactor spent nuclear fuel from CNWS to the INEEL is contained in the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (EIS), DOE/EIS-0218F, issued in February, 1996 (DOE, 1996). The EIS considers the potential environmental impacts associated with shipment of foreign research reactor spent nuclear fuel on representative rail and highway transportation routes between CNWS and INEEL. The representative rail route starts at CNWS, proceeds to the cities of Sacramento and Roseville, California, through the Donner Pass in the Sierra Nevada mountains, through Reno and Sparks, Nevada, continues through Ogden and Pocatello, Utah, and Scoville, Idaho, until it reaches the INEEL. This Supplement Analysis examines the potential impacts of transporting spent nuclear fuel along a rail route that deviates somewhat from the representative route by bypassing Reno and Sparks to the north, and compares the impacts from this alternate route to those estimated in the EIS. In addition, this Supplement Analysis examines the recent rail incidents in the vicinity of the CNWS to determine if those incidents present any significant new information or circumstances relevant to environmental concerns.

Background

The EIS evaluated the transport by truck and rail of 38 casks of spent nuclear fuel from CNWS to INEEL. Because of the variety of truck and rail routes between CNWS and INEEL, the EIS uses representative routes for each transport mode for the calculations of the radiological risk. (Risk is defined in the EIS as the consequences of an action discounted by the probability of its occurrence.) Representative routes were selected consistent with current routing practices and all applicable routing regulations and guidelines. Specific highway routes were not identified at the time of preparation of the EIS because the selection of the actual route is responsive to environmental and other conditions in effect or reasonably expected at the time of shipment. Such conditions could include adverse weather conditions, road repairs, and bridge closures.

Department of Transportation routing regulations do not apply to rail transport of spent nuclear fuel. Although rail routes are generally fixed by the location of rail lines and urban areas can not be readily bypassed, the specific rail route for these shipments was not identified at the time of preparation of the EIS because the condition of the track, weather, equipment issues, and the precise carrier is not known until close to the actual shipment date. Unlike highway transport, the choice of rail carrier makes a difference in rail routing because the carriers own the track over which the rail cars travel. Even for the same origin/destination, substantially different rail routes might result because carriers will generally use their own tracks to the greatest extent possible. Consequently, a representative rail route must be selected for analysis. The INTERLINE computer code (Johnson et al., 1993) was used for this purpose.

The INTERLINE computer program is designed to simulate routing of the United States rail system. The INTERLINE database contains many rail subnetworks and contains routes from various competing companies in the United States. The database used by INTERLINE was originally based on Federal Railroad Administration data and reflected the United States railroad system in 1974. The database has been expanded and modified over the past two decades and the code is updated periodically to reflect current track conditions. The INTERLINE model uses a shortest-route algorithm that finds the minimum impedance path within an individual subnetwork. The routes selected as representative routes for analysis in the EIS use the standard assumptions in the INTERLINE model that simulate the selection process that railroads would use to direct shipments of spent nuclear fuel. For the CNWS-INEEL rail route, INTERLINE selected the representative route outlined above that traversed the Donner Pass using Southern Pacific railroad track all the way from CNWS to Ogden, Utah.

At the time of preparation of the EIS, Union Pacific, Southern Pacific, and Burlington Northern Railroads, among others, owned track in the area around the CNWS. Since the issuance of the EIS, Union Pacific has merged with Southern Pacific. The merger has resulted in changes to routes in areas where the two railroads previously provided service. One such change was the designation by Union Pacific of the old Southern Pacific line in California, which passes through Donner Pass, as the primary track for carrying intermodal cargo that is time-sensitive. The old Union Pacific line through the Feather River Canyon in California is now designated as primarily a heavy freight line. The new designation for the Feather River Canyon route means that it is a less traveled route that offers advantages in scheduling a restricted speed train, like the one that would be used for the spent fuel shipments, because it would have less impact on the overall rail network.

Subsequent to the issuance of the EIS, DOE began to work actively with state and local officials and the railroad carrier to plan for the first West Coast spent fuel shipment. The merger between Union Pacific and Southern Pacific in September 1996 changed the likely route for the spent fuel from CNWS to INEEL. Based on discussions with Union Pacific, the Department learned that the rail carrier preferred a route for the restricted speed dedicated spent fuel train that varied from the representative route analyzed in the EIS.

The alternate Feather River Canyon route offers a number of advantages over the representative route in the EIS, such as: less traffic, bypass of Reno and Sparks, and seamless rail in the Sierra Nevada pass. The alternate route deviates from the representative starting at Sacramento until the routes meet at Ogden (See Figure 1).

Representative and Alternate Rail Routes

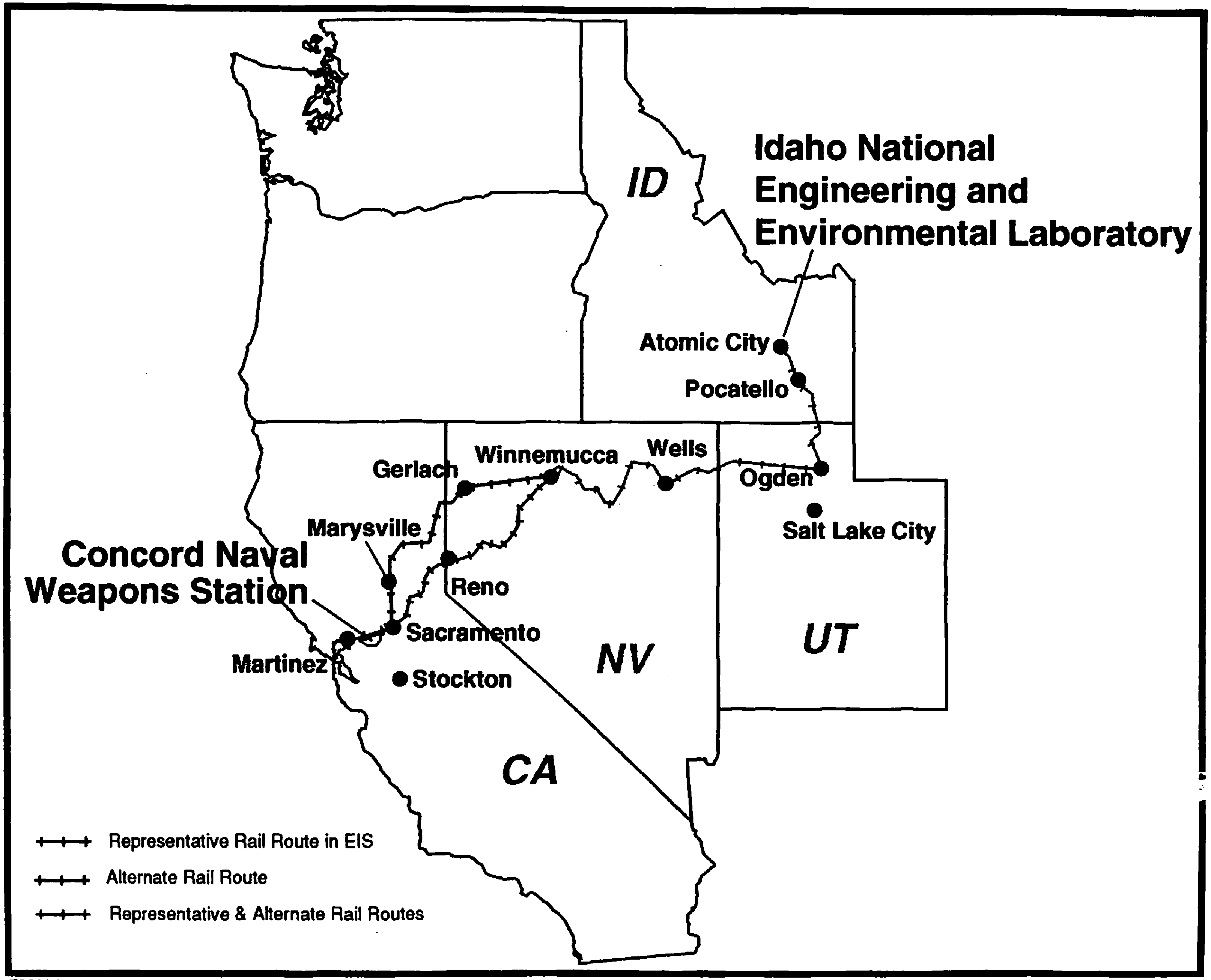

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FIGURE 1

Since the issuance of the EIS, a number of rail incidents have taken place around the CNWS. Officials in California have expressed the concern that these incidents may be the result of conditions or present circumstances not considered by DOE in preparation of the EIS and in the selection of CNWS as a preferred port of entry.

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA), 40 CFR 1502.9(c), direct federal agencies to prepare a supplement to an environmental impact statement when an agency "makes substantial changes in the proposed action that are relevant to environmental concerns, or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or impacts." When it is unclear whether a supplemental EIS is required, DOE regulations for compliance with NEPA (10 CFR 1021.314) direct the preparation of a supplement analysis to assist in making that determination. This supplement analysis evaluates the transport of foreign research reactor spent nuclear fuel along a route that partially deviates from the representative route analyzed in the EIS, compares the potential environmental impacts from the alternate transportation route to those evaluated in the EIS, and evaluates recent rail incidents around the CNWS.

Analysis

Incident-Free Assessment

Radiation doses during normal, incident-free transportation of spent nuclear fuel result from exposures to external radiation fields emanating from the spent fuel within the transportation casks. The total population dose depends on the number of people exposed, their proximity to the containers, the duration of their exposure, and the intensity of the radiation field. The EIS conservatively assumed for purposes of analysis that the intensity of the radiation fields around the transportation casks was the regulatory maximum of 10 millirem (mrem) per hour at 2 meters from the transporting vehicle or rail car. This same cask dose rate and a train speed of 35 miles per hour were used in a routing analysis performed for DOE as part of the transportation planning process for the first West Coast shipment (Johnson, 1997). Using this same speed and regulatory limit cask dose rates, the incident-free radiation dose to the population located within 0.5 miles of either side of the rail route was calculated. Table 1 contains a comparison of the incident-free parameters of the representative and alternate routes based upon a train speed of 35 miles per hour and the regulatory limit for cask dose rates.

Table 1
COMPARISON OF REPRESENTATIVE AND ALTERNATE ROUTE FOR INCIDENT-FREE TRANSPORT

Representative Route (miles)	Alternate Route (miles)	Representative Route Affected Population	Alternate Route Affected Population	Representative Route Population Dose (person-rem)	Alternate Route Population Dose (person-rem)
919	990	204,000	133,350	0.07[1]	0.07[1]

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[1] 0.07 person-rem is predicted to result in approximately $3.5x10^{-5}$ latent cancer fatalies.

As shown in Table 1, although the alternate rail route is slightly longer than the representative route, the avoidance of population centers such as Reno and Sparks results in a decrease in the overall affected population. However, the total population dose for either route is extremely low and no latent cancer fatalities (LCFs) are expected in either case.

There is no convincing evidence from the scientific literature that chronic radiation doses below 1.0 rad per day will harm animal or plant populations. It is highly probable that limitation of the exposure of the most exposed humans (the critical human group, living on and receiving full sustenance from the local area) to 100 mrem per year will lead to dose rates to plants and animals in the same area of less than 1.0 rad per day. DOE orders and NRC regulations limit annual human exposures to values far lower than those that have caused observable damage in plant and animal populations. Therefore, specific radiation protection standards for nonhuman biota are not needed. (See the EIS at Section 4.1.6, page 4-7.) Thus, the Department would not expect any observable damage in plant and animal populations as a result of incident-free transport along the alternate route.

The incident-free analysis only considers scenarios under which there are no incidents or accidents. Consequently, the occurrence of rail incidents such as those recently experienced in the vicinity of the CNWS would have no effect on the calculation of incident-free impacts.

Accident Assessment

Under accident conditions, impacts to human health and the environment may result from the release and dispersal of radioactive material. The methodology used in the EIS to estimate radiological impacts from severe accidents involving spent fuel examines the impacts on a population located as far as 50 miles from the accident site. Because the accident analysis considers such a large area around a potential accident location, deviations from the route are usually bounded by the accident analysis for the representative route. In other words, when short deviations from the representative route are required, the deviation is typically within the area already considered. However, the alternate route in this case would deviate from the representative route by a distance greater than 50 miles in some areas. Consequently, the radiological risks associated with potential accidents along the alternate route were calculated.

Using the same input parameters used in the EIS for accident analyses and the data reported in Johnson, 1997, the accident risks associated with the alternate route were calculated. Table 2 contains a comparison of the accident risks associated with the two routes.

Table 2
Comparison of Accident Risks for Representative and Alternate Rail Routes

Representative Route Potentially Affected Population	Alternate Route Potentially Affected Population	Representative Route Total Population Risk (person-rem)	Alternate Route Total Population Risk (person-rem)
15,108,920	14,312,460	0.0033	0.0018

A comparison of the accident risks associated with the representative and alternate routes shows that the radiation risks for the representative route are approximately twice those associated with the alternate route, although both values are extremely small. Nevertheless, based on the extremely low risks associated with rail transport along either route, the Department would not expect any fatalities even from the most reasonably foreseeable severe accident. Further, for the reasons discussed under incident-free impacts, no impacts on plant and animal populations are expected.

Consideration of the recent rail incidents in the area around the CNWS does not alter this conclusion in any way. DOE obtained from the Federal Railroad Administration a copy of the "Rail-Equipment Accident/Incident Report" for each of the incidents in the vicinity of CNWS since 1993. The event reports were reviewed for cause of incident, nature of incident, speed of train, railroad responsible for track maintenance, and consequence of incident (Massey, 1997). There were several low speed derailments, but the majority of the more severe incidents involved medium- high speed trains (greater than 40 miles per hour) in collisions with vehicles either crossing or stalled on the tracks. In most of the collisions, the highway vehicle, not the train or cargo, sustained the damage.

Analysis, testing, and actual accident data have shown that the spent fuel casks will survive a low speed derailment without any breach of containment. In fact, the Nuclear Regulatory Commission's requirements for cask design mandate that a cask be capable of surviving forces equivalent to a 30 miles per hour crash into a non-yielding surface. This regulatory test is more severe than a 60 mile per hour head-on collision between two trucks -- a condition more representative of actual accident conditions (Massey, 1997). Additional testing has demonstrated that spent fuel casks can withstand forces more rigorous than regulatory requirements. For example, a cask survived without breach a test in which a truck bearing the cask was deliberately placed in the path of and struck by a 120-ton locomotive traveling about 80 miles per hour (NRC, 1996). In practice, the dedicated train that will transport the spent fuel will not be traveling at high speeds.

In all of the incidents reviewed, no scenarios were present that would have exposed a spent fuel cask to conditions more severe than those for which it is designed (Massey, 1997). No fire was involved in any of the incidents over the last four years, nor was any other source of fuel present that would have posed a hazard to a cargo of spent fuel. Thus, the recent derailments present no circumstances that would reasonably lead to cask failure and subsequent release of radioactive substances into the environment. Even if such an accident were to occur, however, no fatalities would be expected on the basis of the EIS analysis. As a practical matter, however, the Department is engaged in an extensive planning process with state, local, federal, and railroad officials to prepare for the shipments and to minimize the potential for collisions or derailments.

Conclusions

This Supplement Analysis considers the potential environmental impacts from the transportation of foreign research reactor spent nuclear fuel along a route that differs somewhat from the representative route analyzed in the EIS and considers the recent rail incidents around the CNWS. There is no change in the estimated number or type of planned shipments from CNWS to INEEL.

The results of the Supplement Analysis indicate that the potential environmental impacts for both incident-free and accident conditions from the transportation of the foreign research reactor spent nuclear fuel along the alternate rail route are within those associated with the representative route analyzed in the EIS. Further, the new information associated with the recent rail incidents does not depart significantly from the information relied upon in the EIS. This new information does not present a materially different picture of environmental consequences than those projected in the EIS. Accordingly, DOE has determined that the transportation of foreign research reactor spent nuclear fuel along the alternate route and the recent rail incidents in the CNWS area do not constitute significant new circumstances or information relevant to environmental concerns, and therefore no supplement to the EIS need be prepared.

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Date: January 14, 1998

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