UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In re: **U.S. DEPARTMENT OF ENERGY** **(High-Level Waste Repository)**	**Docket No. 63-001**

STATE OF CALIFORNIA'S PETITION FOR LEAVE TO INTERVENE IN THE HEARING

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INTRODUCTION

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II. Identification of Petitioner and Basis for Standing

The State of California hereby petitions for leave to intervene in the hearing on the Department of Energy's ("DOE") application for authorization to construct a geologic repository at Yucca Mountain, Nevada. (High Level Waste Repository, Docket Number 63-001.)

Regardless of whether a repository at Yucca Mountain is the right solution to our nation's nuclear waste disposal problem, it is beyond dispute that the repository must itself be safe and protective of the environment and waste must be shipped to the repository safely and without harming the environment. DOE's license application and environmental documents suffer from two major types of deficiencies. First, DOE has not adequately analyzed the impacts of transportation of radioactive waste through California that will occur if the Nuclear Regulatory Commission ("NRC") authorizes DOE to construct the Yucca Mountain repository. DOE proposes to send hundreds of trains and trucks full of radioactive waste from other states through populated areas of California without first analyzing the risks posed by various routes through California. Millions of Californians live near routes that will be used to transport waste to Yucca Mountain if, and only if, NRC approves the license. DOE has not committed itself to any future analysis of the environmental impacts on specific routes prior to starting shipments to the repository through California. DOE also fails to analyze how waste at California's reactors can be safely packaged for shipping and how the waste will be transported from reactors that are in geographically remote locations. It is unknown what analysis, if any, DOE will perform in the future to comply with the National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (hereinafter "NEPA"). The second major deficiency of DOE's license application and environmental documents is that they fail to properly analyze the risk to California's groundwater resources from the repository. Proceeding with the project in the manner described by DOE poses a threat to the people, natural resources, and environment of California. NRC may not approve DOE's license application unless DOE provides an adequate environmental analysis that analyzes threats to California and how to mitigate them.

A. Standing as a Matter of Right [10 C.F.R. § 2.309(d)]

1. The name, address and telephone number of the requestor or petitioner [10 C.F.R. § 2.309(d)(1)(i)]

The petitioner is the State of California[1] (hereinafter "California"). California is represented in this proceeding by the following individuals:

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2. The nature of the requestor's/petitioner's right under the Act to be made a party to the proceeding [10 C.F.R. § 2.309(d)(1)(ii)]

The Commission must grant a hearing upon the request of "any State . . . or any political entity within a State" whose interest may be affected by a proceeding for the granting of a

[1] Pursuant to 10 C.F.R. § 2.309(d)(2)(i), California designates itself, and not any other political entity within California state government, as the single representative of its interests for this hearing. To the extent that 10 C.F.R. § 2.309(d)(2)(i) requires the identification of an individual to represent California in the hearing, California designates Susan Durbin, Deputy Attorney General. Other individuals may assist or substitute for Ms. Durbin in the proceeding as needed.

license or construction permit and must admit any such entity as a party to the proceeding. 42 U.S.C. § 2239(a)(1)(A) [Atomic Energy Act § 189a(1)(A) (hereinafter "AEA"]; 42 U.S.C. § 2014(s) (definition of "person"). In its notice of hearing, NRC explained the scope of this proceeding as follows:

> The matters of fact and law to be considered are whether the application satisfies the applicable safety, security, and technical standards of the AEA and NWPA and the NRC's standards in 10 CFR Part 63 for a construction authorization for a high-level waste geologic repository, and also whether the applicable requirements of the National Environmental Policy Act (NEPA) and NRC's NEPA regulations, 10 CFR Part 51, have been met.

Notice of Hearing and Opportunity to Petition for Leave to Intervene, 73 Fed. Reg. 63,029 (Oct. 22, 2008).

NRC's standing requirements specifically contemplate that a state may intervene in the licensing proceeding to protect its interests, even if the facility in question is not within the state's boundaries. *See* 10 C.F.R. § 2.309(d)(2) ("A State . . . that desires to participate as a party in the proceeding shall submit a request for hearing/petition to intervene. The request/petition must meet the requirements of this section . . . except that a State . . . that wishes to be a party in a proceeding for a facility located within its boundaries need not address the standing requirements under this paragraph."). As described below, California's interests are affected by this proceeding and it must therefore be permitted to intervene.

California's interests are affected by DOE's failure to analyze the environmental impacts on California of NRC's possible decision to approve the license application. NRC must ensure that DOE has analyzed the environmental impacts that will be the direct result of its licensing decision. NEPA requires the analysis of all reasonably foreseeable impacts from the project; NEPA limits the degree to which an environmental impact statement can defer analysis of impacts until a later environmental impact statement. While an environmental impact statement necessarily involves some degree of forecasting, if discussion of environmental consequences can be deferred, based on a promise to perform a comparable analysis in connection with some later site-specific portion of a specific project, no environmental consequences would ever need to be addressed in an environmental impact statement. "NEPA is not designed to postpone analysis of an environmental consequence to the last possible moment. Rather, it is designed to require such analysis as soon as it can reasonably be done." *Kern v. U.S. Bureau of Land Mgmt.*, 284 F. 3d 1062, 1072 (9th Cir. 2002) (citing *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n. 9 (9th Cir. 1984)). Where impacts are reasonably foreseeable, it is not appropriate to defer analysis to a future date. *Neighbors of Cuddy Mountain v. U.S. Forest Service*, 137 F.3d. 1372, 1380 (9th Cir. 1998.) NEPA requires an environmental impact statement to contain a reasonably thorough discussion of the significant aspects of the probable consequences of an action. *Oregon Natural Resources Council v. Lowe*, 109 F.3d 521, 526 (9th Cir. 1997). Because DOE's environmental documents[2] do not comply with NEPA, NRC may not adopt them, and the license application cannot be approved until an environmental impact statement complying with NEPA has been submitted.

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[2] In this petition the following DOE environmental documents will be referred to by the shorthand name indicated:

> "Repository SEIS" refers to the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1), prepared by DOE in 2008.
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> "Yucca Mountain FEIS" refers to the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F), prepared by DOE in 2002.
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> "Nevada Rail Corridor SEIS" refers to the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S2).
>
> "Rail Alignment EIS" refers to the *Final Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369).

DOE failed to analyze many environmental impacts to California, particularly those impacts from the transportation of hundreds of casks of radioactive waste through California en route to Yucca Mountain. These future shipments are not speculative; they will be the direct result of NRC's approval of the license application. While DOE contends that, "At this time, many years before shipments could begin, it is impossible to know the highway routes or rail lines DOE would use" (Repository FEIS, Comment-Response Document, p. CR-404), it is beyond dispute that if this license is granted, radioactive waste *will* be transported to the repository through California. And yet DOE may take the position that it is not required to analyze those impacts in California either in this licensing proceeding or at any time in the future.

NEPA compliance is explicitly one of the factual and legal matters NRC must decide in this proceeding. The NEPA requirements and the non-NEPA requirements in NRC's 10 C.F.R. part 63 are intertwined, such that NRC's own NEPA obligations cannot be met at this time unless DOE has submitted an environmental impact statement that complies with NEPA. DOE is required to submit an environmental impact statement with its license application. 10 C.F.R. § 63.21(a); 10 C.F.R. § 51.67(a). NRC must also make an independent judgment on the environmental impacts of the repository before approving the license application. 10 C.F.R. § 63.31(c). NRC may fulfill its own obligations under NEPA by adopting DOE's environmental impact statement. 42 U.S.C. § 10134(f)(4) [Nuclear Waste Policy Act ("NWPA") § 114(f)(4)].[3]

NRC may not adopt DOE's environmental impact statement, as required by 10 C.F.R. § 51.109(c), however, if it is not "practicable" to do so. "[I]t would not be 'practicable' to adopt the FEIS unless it meets the standards for an 'adequate statement' under the NEPA and the

[3] NRC staff has recommended that NRC adopt DOE's 2002 EIS, 2008 Repository Supplemental EIS, and 2008 Rail Corridor SEIS, with further supplementation. 73 Fed. Reg. 53274 (Sept. 15, 2008).

Council for Environmental Quality's NEPA regulations." *Nuclear Energy Institute, Inc. v. Environmental Protection Agency*, 373 F.3d 1251, 1314 (D.C. Cir. 2004) (hereinafter "*NEI v. EPA*") (explaining that "any substantive defects in the FEIS clearly would be relevant to the 'practicability' of adopting the FEIS"). The requirement that the DOE environmental documents comply with NEPA is embodied in NRC's regulations governing adoption of those documents in 10 C.F.R. part 51.

NRC cannot "find that it is practicable to adopt any environmental impact statement prepared by the Secretary of Energy in connection with a geologic repository proposed to be constructed" if "significant and substantial new information or new considerations render such environmental impact statement inadequate." 10 C.F.R. § 51.109(c). Challenges to the sufficiency of DOE's environmental documents that contain significant and substantial information calling into question the adequacy of the documents are "new considerations" under 10 C.F.R. § 51.109(c) that will prevent NRC from adopting those documents (and consequently prevent NRC from issuing that license authorization). The Notice of Hearing and Opportunity to Petition for Leave to Intervene states that "[u]nder 10 C.F.R. § 51.109(c), the presiding officer should treat as a cognizable 'new consideration' an attack on the Yucca Mountain environmental impact statements based on significant and substantial information that, if true, would render the statements inadequate." 73 Fed. Reg. 63,029, 63,031 (Oct. 22, 2008). *See also* State of Nevada; Denial of Petition for Rulemaking, 73 Fed. Reg. 5762, 5765 (Jan. 31, 2008) ("NRC will treat Nevada's substantive claims against the FEIS as 'new considerations' within the framework of § 51.109(c)."); Letter from Bradley W. Jones, Assistant General Counsel for Rulemaking & Fuel Cycle, Nuclear Regulatory Commission, to Martin G. Malsch, Egan, Fitzpatrick & Malsch, PLLC (Mar. 20, 2008) (hereinafter "Jones to Malsch Letter") (referenced in the Notice of

Hearing as governing the interpretation of 10 C.F.R. § 51.109(c)). The information attacking the adequacy of the documents need not be literally "new" to be treated as a "new consideration" under 10 C.F.R. § 51.109(c). Jones to Malsch Letter ("[A] substantive NEPA claim is a new consideration meeting the criterion in 10 CFR 51.109(c)(2), whether it is based on new information or new considerations arising before or after DOE's site recommendation.")

NRC cannot issue the license to DOE unless NRC complies with its own regulations and makes findings on the adequacy of DOE's application. NRC's regulations in 10 C.F.R. § 63.31 provides that NRC cannot authorize construction unless it determines (among other things) that there are "reasonable assurances" that the repository can receive waste "without unreasonable risk to the health and safety of the public," and that DOE's proposal "will not be inimical to the common defense and security." 10 C.F.R. § 63.31(a) & (c). California's contentions allege that the license application fails to provide information that would allow NRC to make such findings.

DOE fails to properly analyze and mitigate risks to the resources, economy, and people of California resulting from the hundreds of radioactive waste shipments that will travel through the state if the license application is approved. DOE's application shows that it has not properly assessed the threats to California and safeguarded the people and resources of the state against the threats outlined in California's contentions. "Whether the application satisfies the applicable safety, security, and technical standards of the AEA and NWPA and the NRC's standards in 10 CFR Part 63" are matters to be addressed in this proceeding. Notice of Hearing and Opportunity to Petition for Leave to Intervene, 73 Fed. Reg. 63029 (Oct. 22, 2008). Because California's interests are affected by the issuance of a license to DOE, California must be allowed to participate in these proceedings. *See* 42 U.S.C. § 2239 [AEA § 189a(1)(A)]. California's contentions challenging the adequacy under NEPA of DOE's environmental documents constitute "significant and substantial information" that make it not practicable for NRC to adopt those documents, and California's NEPA contentions are therefore within the scope of the issues set out in the Notice of Hearing.

To the extent that the requirements of 10 C.F.R. § 2.326(a) are applicable to standing or the admissibility of NEPA contentions, California submits the following: First, California's petition to intervene is timely, as it is filed within the 60-day time provided by the October 22, 2008, Notice of Hearing. Second, California's contentions address significant safety or environmental issues, as described in detail in each of the contentions. Third, had DOE included in its environmental analysis the information that California's contentions state is lacking, a materially different result would be or would have been likely in that NRC would have had more complete information, and, more specifically, information that complies with NEPA, upon which to base its decision on the license application; in addition, California and the public at large would have had been assured that NRC was basing its licensing decision on adequate environmental review and would have had the opportunity to comment and contribute to the same.

California is in substantial and timely compliance with the requirements of 10 C.F.R. § 2.1003. *See Joint Stipulation of Department of Energy and State of California Regarding LSN Certification* (Aug. 8, 2008) (PAPO-00, ASLBP No. 04-829-01-PAPO).

3. The nature and extent of the requestor's/petitioner's property, financial or other interest in the proceeding [10 C.F.R. § 2.309(d)(1)(iii)]

California has an interest in protecting the people, economy, and natural resources of the state from hazards posed by radioactive waste. The health and safety of California's people and the vitality of its economic and natural resources are threatened by the issuance of a license for the repository without sufficient analysis of its impacts on California and possible mitigation steps. The threats to California that must be analyzed are discussed in greater detail in the contentions. In general, however, the threats to California's interests are of two types: those threats posed by transportation of radioactive waste through California from sites within and outside of California, and those threats posed by the migration of radioactive material from the repository into California's groundwater. In addition to these substantive threats to California's interests, California has a legal and procedural interest in being provided with a proper environmental impact analysis as required by NEPA and in having the licensing decision made by a fully informed NRC. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989).

If the license is granted, hundreds of shipments of radioactive waste will travel through densely populated communities and over economically crucial rail and highway routes, some of which contain natural and human-made hazards. DOE has not conducted sufficient analysis or provided sufficient evidence that such shipments will be conducted in the safest manner. If the license is granted, California's crucial groundwater resources will also be threatened. That the threatened injuries will occur in the future, not today, is no bar to standing in this proceeding. *In the Matter of Yankee Atomic Electric Company (Yankee Nuclear Power Station)*, 48 N.R.C. 185, 195 (1998) (explaining that for standing analysis, "The injury may be either actual or threatened.") (citing *Wilderness Society v. Griles*, 824 F.2d 4, 11 (D.C. Cir. 1987)).

a. California has the legal authority to assert its rights in this proceeding and has been granted the procedural right to do so.

California is a proper party to assert the interests of its citizens as well as to safeguard its own property and its ability to protect the health and welfare of its people and natural and economic resources. *Massachusetts v. Environmental Protection Agency*, 127 S.Ct. 1438, 1454, 549 U.S. 497 (2007) (stating that in its capacity of "quasi-sovereign" "the State has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air.") (quoting *Georgia v. Tennessee Copper Co.*, 206 U.S. 230, 237 (1907)); *Alfred L. Snapp & Son, Inc. v. Puerto Rico ex rel. Barez*, 458 U.S. 592, 602 & 607 (1982) ("[A] State has a quasi-sovereign interest in the health and economic well-being – both physical and economic – of its residents in general.") In addition, with respect to this licensing decision, Congress and NRC have granted states the procedural opportunity to protect their rights. 42 U.S.C. § 2239; 10 C.F.R. § 2.309(d)(2). The provision of this procedural right and California's stake in protecting its quasi-sovereign interests entitles California to "special solicitude" in standing analysis. *See Massachusetts v. EPA*, 127 S.Ct. at 1454-55.

The transportation threats to California arise from transportation from California facilities to the repository and transportation of waste from sites around the United States through California en route to the repository. The first type of transportation risk relates to DOE's failure to analyze or mitigate the risks posed by loading and transporting radioactive waste at California sites. California has two sets of operating nuclear plants, Diablo Canyon Units 1 and 2, and San Onofre Units 2 and 3. There are also three decommissioned nuclear plants in California that currently store nuclear waste, namely Humboldt, Rancho Seco, and San Onofre Unit 1.

The second type of transportation risk arises from the hundreds of radioactive waste casks that will enter California from other states and then travel hundreds of miles through California on their way to the repository. DOE's environmental documents discuss the localized impacts of the construction of the Mina or Caliente rail lines in Nevada. DOE understood that it needed to fully and specifically analyze environmental impacts from transportation in the state where the repository is located, yet it illogically did not do this analysis for the likely transportation routes in the rest of the country, and specifically not in California. By looking only at fatalities outside of Nevada from cancer, exposure to vehicle emissions, and traffic accidents, DOE concluded that variations in the routing of waste to Yucca Mountain will not have significant impacts. But DOE failed to analyze any other type of risk from transportation outside of Nevada, such as whether certain routes through California pose greater or lesser risk of accident or sabotage and how those risks can be mitigated through routing or emergency response. Thus, DOE's environmental documents do not sufficiently analyze the impacts on California of these shipments and are inadequate to serve as the basis for construction authorization.

In addition, DOE failed to analyze the repository's threat to California groundwater or propose how to mitigate it. California has an interest in ensuring the safety and availability of its natural resources, such as groundwater, and an interest in ensuring that possible threats to those resources are properly analyzed under NEPA. *See Sabine River Authority v. U.S. Dept. of Interior*, 951 F.2d 669, 675 (5th Cir. 1992).

b. Transportation of radioactive waste to the repository will have a direct impact on California.

If the Caliente line is constructed, radioactive waste traveling by rail will pass though southern California's Mojave Desert and enter southern Nevada near Las Vegas, passing through the city of San Bernardino (population 200,000), among others, and the Imperial Valley and Coachella Valley agricultural region. If the Mina line is constructed, however, DOE predicts that radioactive waste on rail will travel hundreds of miles through California's populous and agriculturally rich Central Valley before crossing the mountains near Lake Tahoe and entering Nevada near Reno. Using a computer model, DOE estimates over one hundred trains from out of state will pass through the cities of Bakersfield (population 323,000), Fresno (481,000), Modesto (209,000), Stockton (290,000), and Sacramento (467,000), the state capital. Also, from the north, DOE predicts that more than 1,000 casks of high-level radioactive waste from DOE's Hanford site in Washington will travel 200 miles through the agricultural lands of the Sacramento Valley and the city of Sacramento. Then, all of these trains will climb into the Sierra Nevada mountain range and pass through heavily traveled Donner Summit on a route that contains steep slopes, sharp curves, train tunnels and snow sheds, and that is occasionally made impassible due to heavy snowfall.

In fact, however, the impacts on California could easily be much greater than estimated by DOE because routes other than DOE's computer model's "representative routes" may take far more radioactive waste into California and through populated areas compared to what DOE projected. DOE's alternative computer simulation with "constraints in the rail network that illustrate another way the railroads might route shipments" show the potential for greater impacts in California than what DOE addressed. Repository SEIS, at pp. A-5 to A-7. To reach the Mina junction using the "constrained routes," it appears that radioactive waste from the entire southern United States would first travel hundreds of miles by rail through California (including the numerous populated and agricultural areas identified above) before crossing Donner Summit into Nevada. This would bring hundreds more radioactive waste trains through populated areas of California's Central Valley. The map also shows that scenarios are possible in which nearly all radioactive waste in the nation would travel this circuitous route through California to reach the Mina junction.

DOE's environmental documents do not discuss the relative risks between routes through California, nor do they discuss mitigation measures that should be taken to reduce transportation risks. These documents do not comply with NEPA and therefore cannot serve as the basis for the grant of the license. Furthermore, these unanswered questions about the safety of transportation through California prevent NRC from making the safety findings necessary to issue the license.

c. Under NEPA, California has the right to be informed of environmental impacts and to have decisions made on adequate information.

Finally, California and its citizens have a legal and procedural interest under NEPA to be informed of the environmental impacts of NRC's licensing decision and to have NRC make its decision after considering all relevant environmental, health, and safety information. NEPA requires all federal agencies to examine environmental impacts that could be caused by their discretionary actions. The Supreme Court has identified NEPA's twin aims as (1) obligating a federal agency to consider every significant aspect of the environmental impact of a proposed action and (2) ensuring that the federal agency will inform the public that it has indeed considered environmental concerns in its decision-making process. *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 97 (1983); *see also* 42 U.S.C. § 4332(2)(c) (identifying requirements of an environmental impact statement). Under NEPA, an environmental impact statement must "set forth sufficient information for the general public to make an informed evaluation . . . and for the decision maker to consider fully the environmental factors involved and to make a reasoned decision after balancing the risks of harm to the environment against the benefits to be derived from the proposed action." *Sierra Club v. U.S. Army Corps of Engineers*, 701 F.2d 1011, 1029 n.18 (2d Cir. 1983). An environmental impact statement must permit those who do not participate in its preparation to understand and consider meaningfully the reasoning, premises, and data relied upon, and to permit a reasoned choice among different courses of action. *See Friends of the River v. Fed. Energy Regulatory Comm'n*, 720 F.2d 93, 120 (D.C. Cir. 1983). NEPA requires that an environmental impact statement contain a reasonably thorough discussion of the significant aspects of the probable consequences of an action. *Oregon Natural Resources Council v. Lowe*, 109 F.3d 521, 526 (9th Cir. 1997).

California's contentions identify numerous inadequacies in DOE's environmental documents that make them inadequate as an informational document under NEPA and therefore not practicable for adoption by DOE.

4. The possible effect of any decision or order that may be issued in the proceeding on the requestor's/petitioner's interest. [10 C.F.R. § 2.309(d)(1)(iv)]

NRC's decision on DOE's license application will determine whether hundreds of shipments of radioactive waste will travel through California on the way to Yucca Mountain on routes of unknown danger. If NRC grants the license, radioactive waste destined for Yucca Mountain will travel through California; if NRC does not grant the license, those shipments will not occur.

These risks are currently unknown because DOE did not fulfill its obligation to analyze them and determine what are the safest routes and modes of transport through California, nor did it adequately discuss mitigation measures to protect California resources and people. Likewise, DOE failed to analyze the repository's threats to California groundwater and how to mitigate them. *See Foundation for N. American Wild Sheep v. U.S. Dept. of Agriculture*, 681 F.2d 1172, 1179 (9th Cir. 1982) ("[T]he very purpose of NEPA's requirement that an EIS be prepared for all actions that may significantly affect the environment is to obviate the need for . . . speculation by insuring that available data is gathered and analyzed prior to the implementation of the proposed action."); *Sierra Club v. U.S. Forest Service*, 843 F.2d 1190, 1195 (9th Cir. 1988). NRC cannot approve the license application because it is prohibited by 10 C.F.R. § 51.109(c) from adopting this flawed environmental analysis.

The threatened injuries to California can be redressed in this proceeding. If DOE were to be required to conduct an adequate environmental review before receiving the license, transportation of radioactive waste to Yucca Mountain through California would be conducted more safely. Routes and shipping conditions with greater risk could be identified and minimized; those with relatively less risk could be used instead, and proper mitigation measures could be imposed. Threats to groundwater could be analyzed and evaluated and mitigation measures could be devised. If NRC grants the license without proper NEPA review, however, these risks will remain unknown and unaddressed.

B. Discretionary Intervention. [10 C.F.R. § 2.309(e)]

In the event that California is determined to lack standing to intervene as a matter of right under subsection (d)(1) of 10 C.F.R. § 2.309, California alternatively seeks to intervene as a matter of discretion on the following grounds:

1. Factors weighing in favor of allowing intervention:

a. The extent to which the requestor's/petitioner's participation may reasonably be expected to assist in developing a sound record [10 C.F.R. § 2.309(e)(1)(i)]

California will be significantly impacted by shipments of radioactive waste traveling to the repository and how they are routed and safeguarded. Other states are not so affected by routing or by the choice between the Mina and Caliente lines in Nevada. While DOE will transport waste through other states as well, California is uniquely situated because decisions DOE makes about transportation in Nevada will determine the routes used in California, the areas of California at risk, and the degree of that risk. California also has unique expertise in its groundwater resources. California will provide expert testimony to NRC demonstrating that it is not practicable to adopt DOE's environmental documents due to their failure to analyze risks that are specific to California and demonstrating that the license application does not contain information showing that the health and welfare of Californians will be protected. California is not aware of other potential parties with the same incentive and ability to create a full record.

b. The nature and extent of the requestor's/petitioner's property, financial or other interests in the proceeding [10 C.F.R. § 2.309(e)(1)(ii)]

(Please refer to the discussion above in section II.A.3.)

c. The possible effect of any decision or order that may be issued in the proceeding on the requestor's/petitioner's interest [10 C.F.R. § 2.309(e)(1)(iii)]

(Please refer to the discussion above in section II.A.4.)

2. Factors weighing against allowing intervention [10 C.F.R. § 2.309(e)(2)]

a. The availability of other means whereby the requestor's/petitioner's interest will be protected [10 C.F.R. § 2.309(e)(2)(i)]

DOE will likely argue that its generic, computer generated analysis of transportation impacts is a sufficient basis for NRC to grant the license and set in motion the shipment of hundreds of radioactive waste trains and heavy-haul trucks through California. But DOE has not committed to conduct any further environmental review before these shipments in and through California begin. DOE has not committed to selecting the safest routes through California or even evaluating what they are. DOE has not committed to abandoning use of the Mina route, which would bring far more waste into California than the Caliente route. California believes that if it challenges DOE's NEPA compliance with respect to these shipments in the future in some other forum, DOE will contend that the challenge is moot because NRC would have already approved the license application or because routing decisions are not within its control. Similarly, DOE believes its groundwater analysis is complete, even though it fails to address impacts on California groundwater. Thus, this proceeding may be the only opportunity for California to raise substantive health, safety, and environmental concerns with the shipment of waste to the repository.

b. The extent to which the requestor's/petitioner's interest will be represented by existing parties [10 C.F.R. § 2.309(e)(2)(ii)]

No other likely party to this proceeding will represent California's interests, as no other state or party is subject to the same risks from the repository and radioactive waste transportation. For instance, Nevada does not have an interest in ensuring safe transportation of waste within California or the protection of groundwater resources in California. Only California has the legal right and obligation to protect its unique quasi-sovereign interests in its people and resources.

c. The extent to which the requestor's/petitioner's participation will inappropriately broaden the issues or delay the proceeding [10 C.F.R. § 2.309(e)(2)(iii)]

California's contentions are all related to legal deficiencies in DOE's environmental documents or to the absence of information in its license application, either of which would prevent NRC from issuing the license. DOE is required to submit an environmental impact statement with its license application. 10 C.F.R. § 63.21(a); 10 C.F.R. § 51.67(a). NRC may not adopt DOE's environmental impact statement, as required by 10 C.F.R. 51.109(c), if it is not adequate under NEPA. As will be argued more specifically in California's contentions, DOE has not provided adequate analysis on a number of subjects. NEPA requires that an environmental impact statement contain a reasonably thorough discussion of the significant aspects of the probable consequences of an action. *Oregon Natural Resources Council v. Lowe*, 109 F.3d 521, 526 (9th Cir. 1997). DOE both inadequately analyses environmental impacts outside of Nevada of transportation of radioactive waste and groundwater contamination, and illegally defers the analysis of non-Nevada impacts to another day. Without adequate analysis of all of the environmental impacts, such as likely transportation routes and the risks posed by such routes, DOE's NEPA documents do not fulfill DOE's nor NRC's statutory obligations.

Furthermore, NRC's regulations in 10 CFR § 63.31 provide that NRC cannot authorize construction unless it determines (among other things) that there are "reasonable assurances" that the repository can receive waste "without unreasonable risk to the health and safety of the public" and that DOE's proposal "will not be inimical to the common defense and security." 10 C.F.R. § 63.31(a) & (c).

NRC's Notice of Hearing established that:

> The matters of fact and law to be considered are whether the application satisfies the applicable safety, security, and technical standards of the AEA and NWPA and the NRC's standards in 10 CFR Part 63 for a construction authorization for a high-level waste geologic repository, and also whether the applicable requirements of the National Environmental Policy Act (NEPA) and NRC's NEPA regulations, 10 CFR Part 51, have been met.

Notice of Hearing and Opportunity to Petition for Leave to Intervene, 73 Fed. Reg. 63,029 (Oct. 22, 2008). California's challenges are squarely within the scope of the hearing as defined by NRC, as it is arguing that the applicable requirements of NEPA and NRC's regulations have not been met. California's intervention will, therefore, not inappropriately broaden the issues or delay the proceeding.

III. JOINT CONTENTIONS

California reserves the right to join the contentions of other parties within a reasonable after they are filed or after they are admitted.

CONTENTIONS

CAL-NEPA-1

DOE's NEPA Documents Impermissibly Segment the Project by Deferring Analysis of the Environmental Impacts of Transportation of Spent Nuclear Fuel and High-Level Waste Through California to Yucca Mountain

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that these NEPA documents segment the Yucca Mountain repository project by failing to analyze and disclose the possible and reasonably foreseeable significant route-specific environmental impacts on California – as DOE's NEPA documents purport to do for Nevada -- of transport of spent nuclear fuel and high-level radioactive waste through California, do not analyze or disclose the reasonably foreseeable non-radiological environmental impacts of such transport, and do not compare the alternative routes through California that would need to be used to connect to the Mina or Caliente rail routes in Nevada.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The NEPA documents prepared by DOE identify, predict, analyze, and disclose only what DOE characterizes as "representative routes" for transportation of spent nuclear fuel and high-level radioactive waste in and through California, but fail to identify, predict, analyze, and disclose actual and reasonably foreseeable specific routes in and through California, fail to identify different environmental impacts on California from different specific routes, fail to predict and disclose impacts beyond those from radiological releases, including reasonably foreseeable impacts on air (other than stating that the project will not cause national standards to be violated), water, water supply, land, housing, highways and freeways, railroad tracks, facilities and rights-of-way, or impacts on other environmental media and public facilities that may occur from transport in and through California of these radioactive materials, although the documents do at least some analysis of these factors for Nevada (e.g., Repository SEIS Chapter 6, sections 6.1.2 through 6.1.3), and fail to compare the impacts of routes in and through California that would be needed to connect with the Mina or the Caliente rail routes in Nevada.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a) (2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are legally inadequate and not practicable for adoption because they fail to fully identify, analyze, and disclose the potential significant route-specific, non-radiological, and route-comparative environmental impacts of transportation of radioactive materials through California to Yucca Mountain. The recent DOE "Project Decision Schedule (PDS)" (LSN CEC000000622) does not even list route selection –

other than through Nevada -- as a decision point in the process for the Yucca Mountain Project. The PDS states that selection of a "final suite of routes" and "detailed planning" for those routes is scheduled for an indeterminate time between three and five years prior to the commencement of shipments; DOE makes no mention of or commitment to performing any NEPA analysis for route selection. DOE's NEPA documents are not practicable for adoption by the NRC without such an analysis.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Yucca Mountain Repository project encompasses both the storage of radioactive materials in Yucca Mountain and the transportation of such materials to Yucca Mountain; without transportation of the materials, there would be nothing to store or dispose of at Yucca Mountain. NEPA, the CEQ regulations interpreting NEPA, and the NRC regulations to carry out NEPA require that the entire project be addressed in NRC's NEPA compliance. DOE's NEPA documents submitted to the NRC fail to comply with NEPA on several major counts. First, DOE has segmented and piecemealed its NEPA analysis by postponing any identification and environmental analysis of, and by deferring any comparison or selection of actual truck, rail, barge, or other transportation routes through California until years in the future, referring vaguely to a future Transportation Plan and Operations Plan whose contents and scope are currently unknown, despite the feasibility of analysis now of at least some California transport routes. Second, the NEPA documents substantially omit any analysis of the reasonably foreseeable route-specific environmental impacts of transport of nuclear waste in and through California, providing environmental analysis and disclosure only at a general, programmatic level and not at a route-specific level, despite the fact that DOE seeks approval for a license for the entire Yucca Mountain project, including transport, in this Proceeding. Third, DOE has not even purported to analyze any California-specific environmental impacts of transportation of spent nuclear fuel and high-level radioactive waste through California to Yucca Mountain other than radiological impacts, despite the reasonable foreseeability of, e.g., the deleterious effects of fifty years of overweight, oversize truck shipments on California state routes never designed or built to accommodate such vehicles, the air quality and economic impacts of any accident that blocks or makes useable any major Interstate Highway, commercial rail route, intermodal facility (such as a rail yard), or sea lane, the impacts on water quality or water supply of any accident that occurs in or near the California Aqueduct or other State Water Project facility, and many others. Fourth, the DOE NEPA documents fail to perform a comparison of the routes for transport of nuclear waste from other states through California that would connect to either the Mina or the Caliente rail corridor in Nevada, despite the fact that this choice has huge potential environmental consequences for California. Finally, the NEPA documents fail to analyze the choices of transport mode (e.g., truck or barge), as well as a transport route, from California reactor sites at Humboldt Bay and Diablo Canyon. Because the DOE NEPA documents describe the environmental impacts of transportation of these materials in and through California only at a generic, programmatic level, and not at a route-specific level that addresses all environmental impacts in detail and compares the alternative routes through California, they are inadequate under NEPA and are not practicable for adoption by the NRC.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

The DOE NEPA documents do not adequately address the potential significant environmental impacts of the entire Yucca Mountain project, because they do not analyze or disclose the route-specific, non-radiological, or route-comparative environmental impacts of transportation of nuclear waste within and through California to Yucca Mountain. Without a project-level, complete analysis of the reasonably foreseeable environmental impacts of transport in and through California, and all of such impacts, the DOE NEPA documents are not adequate and are not practicable for adoption by the NRC.

The specific portions of the License Application (hereinafter "LA") being challenged are the Yucca Mountain FEIS at Chapter 6 and Appendix J, the Repository SEIS and Nevada Rail Corridor SEIS at Chapter 6 and Appendices G and H, the Rail Alignment EIS, and the Response to Comments document, all of which fail to present the required analyses.

CAL-NEPA-2

DOE's NEPA Documents Impermissibly Segment the Project as to Route Selection and Route-Specific Impact Analysis

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that these NEPA documents segment and piecemeal the NEPA analysis of the Yucca Mountain project by postponing the identification and disclosure of reasonably foreseeable transportation routes within and through California until an unspecified time in the future, and do not analyze or disclose the possible and reasonably foreseeable significant route-specific impacts on the environment of California of the transportation of spent nuclear fuel or of high-level radioactive waste over these routes through California.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's NEPA documents identify, predict, analyze, and disclose only what DOE characterizes as "representative routes" for transportation of spent nuclear fuel and high-level radioactive waste, segmenting and piecemealing the NEPA analysis by deferring the identification and analysis of actual routes and the route-specific environmental impacts until a time years in the future when DOE will purportedly prepare a Transportation Plan and Operational Plan of unspecified content, specificity, and scope, documents that bear directly on the safety and environmental impacts of the Yucca Mountain project, but that may not even exist to be presented to the Atomic Safety and Licensing Board or the NRC until this Proceeding is over, preventing the public from reviewing and commenting on them and the NRC from considering them.

3. <u>Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]</u>

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a) (2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they segment and piecemeal the project by postponing the identification and full analysis of the significant environmental impacts of transportation in and through California of radioactive materials to Yucca Mountain until a time that DOE predicts will be several years after the Licensing Proceeding begins, and probably after it concludes. It is not practicable for the NRC to adopt a NEPA analysis of a DOE transportation and operations analysis that does not now exist, and may not exist during the pendency of the Licensing Proceeding.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Yucca Mountain Repository project encompasses both the storage of radioactive materials in Yucca Mountain and the transportation of such materials to Yucca Mountain;

without transportation of the materials, there would be nothing to store or dispose of at Yucca Mountain. NEPA requires that the entire project be addressed in NRC's NEPA compliance. However, the NEPA documents state explicitly that no actual transportation routes will be identified, let alone analyzed and their environmental impacts disclosed or compared, until approximately four years before transportation of material to the Yucca Mountain repository begins. (Yucca Mountain FEIS App. J, section J.1.2.2, Repository SEIS App. H, section H.4.2, H.10.4.2, Response to Comments at CR-185.) Yucca Mountain is currently estimated by DOE to be opened to receive waste in about 2020, so that the transportation and operations plan DOE contemplates preparing would not be done until about 2016, or approximately four years after the Licensing Proceeding is scheduled to end. The recent DOE "Project Decision Schedule (PDS)" (LSN CEC000000622) does not even list route selection – other than through Nevada -- as a decision point in the process for the Yucca Mountain Project. The PDS states that selection of a "final suite of routes" and "detailed planning" for those routes is scheduled for an indeterminate time between three and five years prior to the commencement of shipments; DOE makes no mention of or commitment to performing any NEPA analysis for route selection. This decision by DOE to deliberately segment off and postpone the analysis of actual transportation and operational plans for routes in and through California until a future time that DOE concedes will be some years after the Licensing Proceeding commences, and that will almost certainly occur after it is completed, deprives the public of the opportunity guaranteed it by NEPA to review and comment on the whole Yucca Mountain repository project before it is approved. It also deprives the NRC of the ability to carry out its duty to evaluate the environmental harm the whole project may do, weigh that harm against the overall benefits of the whole project , and attach conditions needed to protect the environment, all as required by NRC regulations at 10

C.F.R. § 63.31(c). Accordingly, the DOE NEPA documents do not comport with NEPA or NRC regulations, and are impracticable for adoption by the NRC.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

DOE contends that its NEPA documents are adequate under NEPA and the NRC's regulations, despite their deliberate segmentation and postponement of analysis and disclosure of the potential significant environmental impacts of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain on actual routes in and through California. It is impracticable for the NRC to adopt and rely upon a NEPA analysis that does not exist and is not expected to exist during the pendency of this Proceeding, and whose contents therefore cannot be known by the public or considered by the NRC. DOE contends that this segmentation and piecemealing of the Yucca Mountain repository is lawful, and California contends that it violates NEPA and NRC regulations.

The specific portions of the LA that are being challenged are the Yucca Mountain FEIS at Chapter 6 and Appendix J, the Repository SEIS at Chapter 6 and Appendices G, H, and M, and the Response to Comments at CR-223, CR-230, CR-234, CR-236, CR-238, CR-258-59, CR-426, all of which fail to include the required analysis.

CAL-NEPA-3

DOE's NEPA Documents Impermissibly Fail to Analyze and Disclose Different Environmental Impacts from the Mina and Caliente Routes

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the NEPA documents do not analyze or disclose the possible and reasonably foreseeable significant impacts on the environment of California of the choice between rail transportation in Nevada of spent nuclear fuel and high-level radioactive waste using the Mina route, as opposed to the Caliente rail route.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The NEPA documents prepared by DOE identify, predict, analyze, and disclose only the potential route-specific environmental impacts on Nevada of rail transportation of spent nuclear fuel and high-level radioactive waste via the rail routes identified by DOE as the Mina route or the Caliente route, but fail to identify, predict, analyze, and disclose the difference in the potential environmental impacts on California from these different routes and the dramatically different amounts of radioactive material that will be transported through California from other states, depending upon whether the Mina route, or the Caliente route, within Nevada is chosen.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R.

§ 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to fully identify, analyze, and disclose the potential significant environmental impacts on California of the choice of rail routes for transportation of nuclear waste within Nevada.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The choice between the two proposed rail corridors, Mina or Caliente, will have a profound effect on the California environment, since the maps of so-called "representative routes" presented in DOE's NEPA documents show that the number of shipments made through California, the length of the trips those shipments will make through California, and the number of persons potentially exposed to radiation in California differ dramatically depending on whether DOE chooses and uses the Mina route or the Caliente route for rail shipments within Nevada. The DOE NEPA documents do not attempt to address the difference in potential significant environmental impacts, including the difference in the potential for sabotage, of the choice of rail routes through Nevada as that choice affects the transportation of radioactive materials through California.

The DOE NEPA documents state that at least 755 rail casks (on 252 trains), mostly from other states, will travel through California en route to Yucca Mountain if the Caliente route is chosen. (Repository SEIS Chap. 6, at 6-18-19, App. G at G-16-18,) If the Mina route is chosen, 1,963 rail casks (on 654 trains), mostly from other states, will be carried on California rail lines. To reach the Mina junction using the "constrained routes," it appears that radioactive waste from the entire southern United States would first travel hundreds of miles by rail through California. Using DOE's TRAGIS computer program, which "uses rules that are designed to simulate routing practices that have been historically used by railroad companies in moving regular freight and dedicated trains in the United States" (Repository SEIS App. G, Section G-2 , at G-5), the Repository SEIS indicates that scenarios are possible in which nearly all radioactive waste in the nation would travel through California on that route. (Repository SEIS App. G, Figure G-2, at G-8). If the Caliente line is constructed, radioactive waste traveling by rail will pass though Southern California's Mojave Desert and enter Nevada near Las Vegas, after passing through the city of San Bernardino (population 200,000), among others, and the Imperial Valley and Coachella Valley agricultural region. If the Mina line is constructed, however, radioactive waste on rail will travel hundreds of miles through California's populous and agriculturally rich Central Valley before crossing the mountains near Lake Tahoe and entering Nevada near Reno.

DOE estimates over one hundred trains carrying radioactive materials originating outside California will pass through the California cities of Bakersfield (population 323,000), Fresno (481,000), Modesto (209,000), Stockton (290,000), and Sacramento, the state capital, (467,000) if the Mina route is used. Also, more than 1,000 casks of high-level radioactive waste from DOE's Hanford site in Washington may enter California from the north and travel 200 miles through the agricultural lands of California's Sacramento Valley and through the City of

Sacramento to be able to connect to the Mina route. All of the trains bound for connection with the Mina route will then climb into the Sierra Nevada mountain range and pass through heavily traveled Donner Summit on a route that contains train tunnels and snow sheds and that is occasionally made impassible due to heavy snowfall. DOE has never acknowledged, let alone analyzed, the difficulty of retrieving a dropped cask in the Sierra Nevadas, or the impacts on traffic or other environmental factors that such an accident could have, nor has it acknowledged or analyzed the potential environmental impacts of trains laden with TAD casks traveling many of the other areas of steep slopes and sharp curves that trains taking the California routes to connect with the Mina route at Hazen, Nevada would have to traverse.

DOE has not compared the potential impacts from using the California routes that would connect with the Mina rail route with the impacts that could result from choosing the routes through California that would connect with the Caliente rail route. Further, the recent DOE "Project Decision Schedule (PDS)" (DOE OCRWM draft December 1, 2008) does not even list specific route selection – other than routes within Nevada -- as a decision point in the project decision process for the Yucca Mountain Project. The PDS states that selection of a "final suite of routes" and "detailed planning" for those routes is scheduled for an indeterminate time between three and five years prior to the commencement of shipments; DOE makes no mention of or commitment to performing any NEPA analysis for such route selection. Without such an analysis, the NEPA documents are incomplete and inadequate, and are therefore impracticable for adoption by the NRC.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

NEPA, the CEQ regulations interpreting NEPA, and the NRC regulations to carry out NEPA require that all reasonably foreseeable environmental impacts of the entire project be addressed in NRC's NEPA compliance. California contends that the NEPA documents prepared by DOE are inadequate for failure to make a comparison of the environmental impacts of the choice of rail routes to be used within Nevada as that choice affects the amount of waste that would be transported through California, the location, length, and population numbers along the routes through California that would connect to the Mina or Caliente rail corridors, the comparative hazards and potential for accidents and sabotage of those California routes, and the respective environmental impacts of the choice of routes. Without such an analysis, the DOE NEPA documents are not adequate and are not practicable for adoption by the NRC.

Specific sections of the LA that are being challenged are Repository SEIS App. G sections G-2 and G.9.5, App. H, sections H.4.2 through H.4.6, and H.10.3.2, the Response to Comments at CR-185, CR-212, CR-222, CR-223, CR-226-27, CR-416-17, which do not contain the Mina versus Caliente analysis.

CAL-NEPA-4

DOE'S NEPA Documents Fail to Adequately Discuss or Analyze Mitigation in California Adequately

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the NEPA documents' discussion of mitigation is internally inconsistent and inadequate: they analyzes, discusses, and provides mechanisms for mitigating the hazards of spent nuclear fuel shipments and high-level radioactive waste shipments through Nevada, but fail to do so for the same types of hazards from shipments in and through California.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The NEPA documents analyze and discuss mitigation for the environmental impacts of Yucca Mountain within Nevada, including discussion of mitigation boards to ensure appropriate mitigation, but do not analyze, discuss, or commit to mitigation measures for the environmental impacts of the transportation portion of the project in California.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may legally issue a license to DOE for the Yucca Mountain repository, the NRC must find that all requirements of 10 C.F.R. part 51 have been satisfied, including the NRC

NEPA regulations found at 10 C.F.R. §51.10 et seq. Any party may, pursuant to 10 C.F.R. §51.109(a) (2) contend that the DOE environmental impact statement is not practicable for the NRC to adopt. The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, in that DOE has failed to analyze or discuss mitigation, as required by NEPA, the CEQ regulations, and NRC's NEPA regulations, for the environmental impacts of transport of nuclear materials within and through California on their way to the Yucca Mountain repository, while they do analyze, discuss, and establish mechanism for providing such mitigation for such environmental impacts in Nevada .

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Repository SEIS, Chapter 9, contains information about the mitigation measures necessary to reduce or avoid impacts in the vicinity of the Yucca Mountain site. The Repository SEIS also indicates that the DOE might form a mitigation advisory board to assist with mitigation activity. However, there is no comparable commitment or projected mechanism for mitigating impacts that will occur outside the State of Nevada, principally from transportation. Specifically, the Repository SEIS does not assess the need for mitigation within California, despite the huge volumes of waste that will traverse California. The NEPA documents state that at least 755 rail casks (on 252 trains), mostly from other states, will travel through California en route to Yucca Mountain if the Caliente rail route is chosen. (Repository SEIS App. G, Figure G-1 at G-7.) If the Mina rail route is chosen, 1,963 rail casks (on 654 trains), mostly from other states, will be carried on California rail lines. (Repository SEIS App. G Figure G-2 at G-8.) More casks will be carried by truck through California, and the total volume of shipments through California by rail and truck may exceed these totals, particularly if Congress accepts

DOE's recommendation in DOE/RW-0595 to remove the existing capacity cap on Yucca Mountain. California will experience more volume of waste transport through its lands and among its people than almost any other state except Nevada, and the degree to which it is impacted by this program is also the degree to which NEPA mandates that the NEPA documents present and discuss mitigation for these impacts. While the Congress established a requirement for funding training for first responders (section 180(c) of the Nuclear Waste Policy Act Amendments), this does not obviate the DOE's responsibility for mitigating the hazards and potential environmental impacts of transporting these materials.

Because of the high volume of material that will be transported through California, there will be a plethora of areas where larger-than-average incident-free radiation doses will occur, and for which mitigation should be analyzed and discussed in the NEPA documents. For example, there will be substantial intermodal handling required near San Luis Obispo- at least 122 Casks, causing worker and possibly public exposure (Repository SEIS App. G, Table G-10, at G-16). Similarly, at least 1332 shipments will go through the Barstow, California rail handling yard, also causing worker and possibly public exposures (Repository SEIS App. G, Figure G-1, at G-7, and Table G-10, at G-16). The Repository SEIS fails to describe how DOE will establish a plan or create a mechanism for mitigating these impacts. Neither does the Repository SEIS acknowledge that there may be a need for special handling facilities, such as a dedicated spur in the Barstow classification yard, special facilities to protect inspectors, or other methods to mitigate the readily foreseeable impacts of these shipments. The Repository SEIS overlooks and fails to consider significant location-specific impacts that will occur from transport within and through California, depriving the public of information that NEPA mandates be provided to it, and also making it impossible for the NRC to perform the balancing between environmental damage and overall benefit, or to require conditions to protect the environment, that NRC regulations require. The NEPA documents are not practicable for adoption by the NRC.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a significant dispute between California and the DOE about the sufficiency of DOE's analysis of its planning for the transportation of these materials in and through California. The DOE has failed to provide a framework for mitigating the routine and non-routine impacts of this program in California, and has failed specific actions needed to mitigate the impacts of the program in California. The NEPA documents do not describe how the DOE will comply with NRC requirements for protection of the public. As a result of these deficiencies the NEPA documents are not practicable for adoption by the NRC.

The specific portions of the License Application being challenged are Chapter 9 and Appendices G and H of the Repository SEIS, and Sections 3 and 4 of the Nevada Rail Corridor SEIS and Rail Alignment EIS, which should have contained the same kind of detailed analysis of mitigation (e.g., best management practices, avoidance of sensitive areas) for California areas affected by the transportation of spent nuclear fuel and high-level radioactive waste as DOE performed for Nevada areas so affected.

CAL-NEPA-5

DOE's NEPA Documents Are Based on an Incomplete and Inaccurate Project Description, Since a Doubling or Tripling of Yucca Mountain's Capacity Is Reasonably Foreseeable Due to DOE's Request to Congress to Authorize Such a Capacity Increase

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that they present an incomplete and inaccurate project description that describes Yucca Mountain as having only a capacity of 70,000 metric tons heavy metal being stored and/or disposed of at Yucca Mountain (e.g., Repository SEIS at S-7), with only that amount being transported (including transportation through California), while it is now reasonably foreseeable that Congress, at DOE's request and upon DOE's recommendation (DOE/RW-0595, LSN CEC000000613), may authorize the storage and/or disposal of up to four times that total, or even more; in the alternative, the NEPA documents impermissibly segment the project if DOE plans to issue a supplement to the NEPA documents addressing this reasonably foreseeable capacity increase, either during or after the completion of the Licensing Proceeding.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

In December 2008, DOE submitted to Congress "The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository" (DOE/RW-0595, LSN CEC000000613), in which DOE recommended that Congress remove the existing limit on the legal capacity of Yucca Mountain to receive and emplace nuclear waste, and describing Yucca Mountain as capable of storing and/or disposing of three times its current limit (*Id.* at 1, 8), or even four to nine times its current limit (*Id.*, at 8), amounts of waste that the NEPA documents do not do more than acknowledge in passing (Repository SEIS Chap. 8), and for whose transportation, including the portion that would be transported through California, the NEPA documents do not analyze or disclose the reasonably foreseeable environmental impacts.

3. <u>Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]</u>

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they are based on a project description that limits waste received and emplaced at Yucca Mountain to the current legal limit of 70,000 MTHM, contained in an estimated 9,495 rail casks and 2,650 truck casks of spent nuclear fuel (Repository SEIS, App. G at G-15) and an estimated 9,675 casks of high-level radioactive waste (Repository SEIS, App. G at G-34), a large portion of which will be transported through California. However, DOE has now requested and recommended to Congress that the legal capacity limit at Yucca Mountain be removed, without recommending a new capacity limit, and without performing any NEPA analysis of an expanded capacity at Yucca Mountain, particularly as to the possible inclusion of spent nuclear fuel from plants currently not built but in the application or planning process, in violation of NEPA. Either the project description is inaccurate for substantially understating the scope of the project, or DOE has segmented the NEPA analysis by presenting an analysis for a capacity of 70,000 MTHM while reasonably foreseeing that Congress may remove that limit and authorize a far larger capacity.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The DOE report asks Congress to remove the capacity limit on Yucca Mountain, and does not recommend any capacity limit to replace it; the Finding and Recommendation merely states that Yucca Mountain "can be expanded to accommodate three times, or more, the current statutory limit of 70,000 MTHM." (DOE/RW-0595, LSN CEC000000613 at 1.) The report appears to cite favorably studies that estimate that Yucca Mountain's capacity, with further site characterization, could be expanded to hold four to nine times the current legal limit. (*Id.*, at 8.) The NEPA documents do not address a project of that size, and do not estimate, analyze, or disclose the impacts on California's environment and resources of increasing the number of casks transported through the state by such multiples, despite the clear implication by the timing of the report that DOE has known during the pendency of this Proceeding that it could make the recommendation to Congress that it has now made. The Repository SEIS in its cumulative impacts analysis in Chapter 8 presents a cursory acknowledgement that Yucca Mountain might someday accept 130,000 MTHM, but it lacks any detail whatsoever, and if Yucca Mountain's capacity were expanded to include waste produced by nuclear plants that are now planned but not built (DOE/RW-0595, LSN CEC000000613, at 2), or to the four-to-nine times the current cap to which the report refers, even the 130,000 MTHM possible inventory would be exceeded. That Congress will accede to DOE's request and recommendation to remove the limit on Yucca

Mountain's capacity is at least reasonably foreseeable, and a removal of the current legal limit of 70,000 MTHM is now within the scope of the project DOE desires and plans to construct if it gains authorization. That being the case, NEPA requires that DOE describe the project it proposes to build accurately and completely, including the possibility of these much larger amounts of nuclear waste being transported to Yucca Mountain, and also requires that the NEPA documents analyze and disclose the environmental impacts of transporting such increased volumes of nuclear waste. At present, the State of California and its residents cannot know whether the cask shipments that will be made through California will double, triple, or quadruple in volume or frequency or both, and cannot know how long the shipments will or may continue through California. Such a project expansion affects every aspect of the transportation portion of the project, including the choice of routes, the impacts of use of heavy-haul trucks, the training of emergency responders, and more. NEPA requires that projects be accurately and completely described, and that the full project be analyzed at once, where its scope is reasonably foreseeable, as it is here. An incomplete and inaccurate project description, or alternatively a segmentation of the environmental analysis of the project when its full parameters are reasonably foreseeable, deprives the public of the opportunity to comment on the actual, whole project, and deprives the NRC of the ability to carry out its duty to evaluate the environmental harm the entire project may do, weigh that harm against the overall benefits of the entire project , and attach conditions needed to protect the environment, all as required by NRC regulations at 10 C.F.R. § 63.32(c). Accordingly, the DOE NEPA documents do not comport with NEPA or NRC regulations, and are impracticable for adoption by the NRC.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

The NEPA documents do not provide specific information that describes or analyzes the environmental or public safety impacts of a tripling, quadrupling, or even greater increase in the amount of spent nuclear fuel or high-level radioactive waste being transported through California to Yucca Mountain. DOE proposes to have its license approved, even though neither DOE, nor the NRC, nor the public, knows the actual size and scope of the project, either as to additional amounts of nuclear waste to be transported or additional years that transport will require. If DOE plans to perform a NEPA analysis on the expansion of Yucca Mountain's capacity at a future time, it is impermissibly segmenting the project. If DOE plans not to perform a NEPA analysis on the expansion of Yucca Mountain's capacity at all, it has impermissibly presented an incomplete and inaccurate project description. Either possibility makes the license application impracticable for adoption by the NRC.

The specific portions of the LA that are being challenged are Repository SEIS Summary sections S.2.1, S.4.3, S.6, Chapter 2 sections 2.1 and 2.1.7.2, Chapter 6 sections 6.1.7., 6.1.10, and 6.3, Chapter 8 sections 8.1.2.1 and 8.4, and Appendix G, G.3, G-4, where the appropriate project description and analysis do not appear.

CAL-NEPA-7

DOE'S NEPA Documents Fail to Adequately Describe Transportation Impacts on Emergency Services in San Bernardino County

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the Repository SEIS, in Chapter 6 and in Appendices A and G, fails to analyze impacts associated with repository transportation on emergency management agencies, fire services, police departments, emergency medical services, hospitals, emergency communications centers, public health and public works in San Bernardino County, California.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

In the Repository SEIS (Figure G-6), DOE identifies rail and highway routes through San Bernardino County, California, that could be used for 857 truck shipments and 755 rail cask shipments (Repository SEIS app. G, Table G-10) or more, over a period of 50 years, but DOE fails to assess the impacts of these shipments, and any accidents that could occur, on San Bernardino County agencies and emergency services.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The Repository SEIS is not practicable for adoption because it fails to assess the environmental impacts of transport in and through San Bernardino County, California on the agencies and emergency response capabilities of San Bernardino County.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

San Bernardino County has unique status as the county of transit for all rail and Highway shipments to Yucca Mountain from California reactors if the Caliente rail route in Nevada is chosen, and for a high percentage of the shipments from other states that will pass through California, whether the Mina or the Caliente rail route is chosen. According to the representative routes identified in the Repository SEIS (at Chap. 6, at. 6-18 and 6-19 and App. G at Figure G-6), and the shipment estimates provided in the Repository SEIS (App. G at Table G-10), San Bernardino County would be traversed by about one-third of the total truck shipments to Yucca Mountain. On average, San Bernardino County could expect one to two truck shipments per month, every week for 50 years, and about 5 trainloads per year. The number of shipments could increase significantly if there were to be no second repository, or if DOE rail carriers chose to use cross-country routes through Arizona and California to a greater extent than is reflected in the NEPA documents. A study prepared for the State of Nevada (The Transportation of Spent

Nuclear Fuel and High-Level Waste: A Systematic Basis for Planning and Management at National, Regional, and Community Levels, LSN NEV000000642) indicated that under certain circumstances, almost 80 percent of the rail casks, and more than 90 percent of the truck casks, shipped to Yucca Mountain could traverse San Bernardino County.

Within San Bernardino County, the potential highway routes identified by DOE cover relatively long distances, and represent a substantial portion of the total affected highway and rail routes within the State of California. According to the supporting data provided by DOE (BCO-006, 10-04-2007), potential DOE highway routes within San Bernardino County total about 266 miles, compared to a total of about 434 highway route miles within California. For rail shipments via the Caliente route, DOE would potentially use about 329 miles of the existing mainline railroads in San Bernardino County, compared to a total of about 1395 rail route miles within California. Emergency planning and response in San Bernardino County will be heavily strained by the confluence of rail and highway routes in the City of Barstow, and by the concentration of population and business activities near the potential DOE highway and rail routes to Yucca Mountain through San Bernardino County. The State of California estimates at least 93,000 residents of San Bernardino County live within one-half mile of the rail routes for shipments to Yucca Mountain via Caliente, and at least 46,000 residents of San Bernardino County live within one-half mile of a highway route for truck shipments to Yucca Mountain. California estimates that 95 percent of San Bernardino County's 1.7 million residents live within the 50-mile radiological region of influence for transportation accidents and sabotage. Any accident or terrorist incident occurring within San Bernardino County could have enormous environmental consequences that could overwhelm the County's emergency agencies and first-responders, but that DOE has not analyzed or described in any way in the Repository SEIS.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between California and DOE regarding impacts associated with repository transportation on emergency management agencies, fire services, police departments, emergency medical services, hospitals, emergency communications centers, and public health and public works in San Bernardino County. Because DOE has failed to analyze these impacts in the Repository SEIS, the Repository SEIS fails to meet the requirements of NEPA, and is not practicable for adoption by the NRC.

The specific portions of the LA being challenged are Repository SEIS Chapter 6 and Appendices A and G, where the required analysis is not performed.

CAL-NEPA-8

DOE'S NEPA Documents Fails to Describe the Maximum Reasonably Foreseeable Accident

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the NEPA documents do not contain project-specific estimates of the costs of cleanup of the release of radioactive materials resulting from the maximum reasonably foreseeable accident during transport of spent nuclear fuel or high-level radioactive waste in and through California on its way to Yucca Mountain (calculations DOE's computerized models are capable of producing), but instead present cost estimates based on reports on and analyses of hypothetical releases, not directly related to or calculated for Yucca Mountain or the maximum reasonably foreseeable accident, making the NEPA documents' analysis inadequate and not practicable for adoption by NRC.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

Repository SEIS Section G.9.7 acknowledges the possibility of damage to truck and rail shipping casks due to various accident scenarios, calculates the possible amounts of radioactive materials that could be released from what DOE considers to be the maximum reasonably foreseeable accident, and estimates the potential public health impacts that the release of radioactive materials in urban and rural areas from such an accident would cause, but provides no estimate of the cost of cleanup after the maximum reasonably foreseeable accident, and no estimate of other economic impacts from such accident, despite the fact that DOE computer models are fully capable of calculating and producing such estimates.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with the NRC requirements applicable to Yucca Mountain, and falls within the scope of the hearing as specified in section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may legally issue a license to DOE for the Yucca Mountain repository, the NRC must find that all requirements of 10 C.F.R. part 51 have been satisfied, including the NRC NEPA regulations found at 10 C.F.R. § 51.10 et seq. Any party may, pursuant to 10 C.F.R. § 51.109(a)(2), contend that the DOE environmental impact statement is not practicable for the NRC to adopt. The NEPA documents are inadequate and not practicable for adoption because they fail to analyze or provide an adequate appraisal of the cost of cleaning up the releases of radioactive material in California that DOE concedes may occur following the maximum reasonably foreseeable accident, despite DOE's technical ability to present such cleanup cost estimates.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

DOE's NEPA documents discuss and use computer modeling results to estimate the release of radioactive materials that could result from what DOE considers to be the maximum reasonably foreseeable accident that could occur from transport of spent nuclear fuel and high-level radioactive material to Yucca Mountain, and estimates the public health impacts that could occur from such a release, including the impacts in California. However, while the Repository SEIS discusses various studies and estimates of the costs of cleanup of a release of radioactive materials in hypothetical situations, the Repository SEIS contains no estimate for the cost to cleanup or recover from the possible transportation accidents occurring during the life of the Yucca Mountain Project that were evaluated by DOE. The DOE assumes that such recovery and cleanup would occur. The costs to recover from an accident involving a release of radiation would be very substantial. The software used to evaluate the risk of transporting radioactive material (RADTRAN) has an economic model that produces an estimate of the cleanup consequences of an accident over a wide range of alternative accidents. (Sandia National Laboratories, *RADTRAN 5 User Guide*, LSN DN2001393102 - ALD.20050315.7530.) In order to produce the calculations of potential public health impacts, the software also calculated the cleanup costs -- yet this cost estimate is not included in the Repository SEIS for any specific locations within California or for any bounding scenario.

In addition, the DOE software has been calibrated against other historical experience and reported in *Survey of Costs Arising From Potential Radionuclide Scattering Events*. (LSN CEC000000611.) That report found that cleanup costs will be expensive. Additionally, the DOE sponsored a report on some historical plutonium contamination events that the Repository SEIS fails to consider (*Site Restoration: Estimation of Attributable Costs from Plutonium Dispersal Accidents*, LSN CEC000000618). This report found cleanup costs for such contamination to range from $100 million to $500 million per square kilometer. Neither report's conclusions are reflected in the Repository SEIS. The Repository SEIS also failed to consider the consequences of the Chernobyl accident, which provide information about cleanup costs, extent of contamination and the mechanics of cleanup itself.

Further, the Repository SEIS fails to consider the entire range of costs, including indirect costs, that will result from the contamination occurring as the result of transporting these materials through California. Because of the routes on which these shipments will travel, it is possible that, should the maximum reasonably foreseeable accident occur in California or anywhere else, it will cause: 1) contamination of critical transportation system components (e.g. rail yards, highway interchanges, and ports); 2) contamination of urban or suburban areas that cannot be effectively decontaminated except by razing and interdiction; 3) contamination of natural resources (e.g., rivers, lakes); or 4) rendering of public lands unavailable for use (e.g., parks, scenic areas, wildlife preserves). Despite the great harm that could result from such an accident, the Repository SEIS does not assess these impacts with a bounding analysis.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between California and DOE regarding the cost of cleanup following the maximum reasonably foreseeable accident evaluated in the Repository SEIS, Subsections 6.3.3.2, and 6.2.4. DOE has failed to provide cleanup cost estimates in the Repository SEIS, despite its technical ability to do so. This is a significant deficiency because, without an assessment of transportation accident cleanup costs, the Repository SEIS fails to assess the project adequately under NEPA. The lack of cleanup cost figures also impairs NRC's consideration of reasonable alternatives to the design of the transportation portion of the project, since with the addition of cleanup costs, the economic impacts could be materially different. Further, the omission of this information has deprived the public of the opportunity to review this information, and also makes it impossible for NRC to perform the balancing between environmental damage and overall benefit, or to require conditions to protect the environment, that NRC regulations require at 10 C.F.R. § 63.31(c). The NEPA documents are not practicable for adoption by NRC. The specific portions of the LA being challenged are Repository SEIS sections 6.3.3.2, 6.2.4, G.8, and G.9.7.

CAL-NEPA-9

DOE Failed to Comply with NEPA's Procedural Requirements for Full Public Review and Opportunity for Comments in California

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE refused to hold public hearings in California on the Repository SEIS in areas of maximum population and potential environmental impacts, despite explicit and specific requests from California that it hold such public hearings.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

Shipments of spent nuclear fuel and high-level radioactive material to Yucca Mountain will be transported through California through heavily populated Southern California, the North Coast area, the Central Valley, and the Sacramento Valley, all areas of significant population concentrations and potential resource damage, yet DOE violated NEPA's procedural requirements by refusing to hold public hearings on the Repository SEIS in any of these locations, despite specific requests from California that it do so, and by holding its only California public hearing on the Repository SEIS in the sparsely populated, remote town of Lone Pine, California.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c), and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may legally issue a license to DOE for the Yucca Mountain repository, the NRC must find, supported by substantial evidence in the administrative record, that it is practicable for the NRC to adopt DOE's NEPA documents. The Repository SEIS is not practicable for adoption because DOE failed to provide a full and adequate opportunity for public comment through public hearings that were reasonably accessible and available to the affected public, including those members of the affected public for whom it is a great hardship to travel hundreds of miles to a remote location on the other side of the Sierra Nevada Mountains from where transportation impacts will be felt. By holding its sole California hearing on the Repository SEIS in Lone Pine, DOE deprived the affected California public of the full opportunity that NEPA requires to publicly comment on the Repository SEIS.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

Although the shipment of tens of thousands of tons of spent nuclear fuel and high level radioactive waste may travel by heavy-haul trucks and by rail through Barstow, San Bernardino, large portions of the Central Valley of California and the metropolitan area of Sacramento, and through the redwood forests along the North Coast of California, the only public meeting on the Draft Supplement to the Yucca Mountain FEIS, the draft Rail Alignment EIS and the draft Nevada Rail Corridor SEIS occurred in Lone Pine, California, a remote location hundreds of miles from the California cities where the majority of the rail routes will be located, and hundreds of miles from the Donner Summit, where truck and rail shipments destined to connect with the Mina rail route would pass through the Sierra Nevada Mountains. DOE made no effort to ensure that heavily populated areas of California received notice and were made aware of

DOE's proposed action, even though DOE will transport thousands of tons of high level nuclear waste near or through their communities. DOE refused to hold additional California public meetings, even though the California Energy Commission, as well as others, repeatedly asked for at least one public meeting in Sacramento, as well as other cities.

According to the representative routes identified in the Repository SEIS (at G-7 and G-8), and the shipment estimates provided in the Repository SEIS (at G-16-18), California would be traversed by about one-third of the total truck shipments to Yucca Mountain. In particular, on average, San Bernardino County in the southern part of the State could expect one to two truck shipments per month, every week for 50 years, and about 5 trainloads per year. The number of shipments could increase significantly if there were to be no second repository, or if DOE rail carriers chose to use cross-country routes through Arizona and California to a greater extent than is reflected in the NEPA documents. A study prepared for the State of Nevada (PIC, 1996) estimated that under certain circumstances, almost 80 percent of the rail casks, and more than 90 percent of the truck casks, shipped to Yucca Mountain could traverse California. Yet, the only public meeting DOE held on the draft Repository SEIS was in Lone Pine, a town of about 2,000 people with no commercial airport and which is a four hour drive from Los Angeles and six hours from Sacramento. NEPA requires that the public be given an adequate opportunity to comment on environmental documents such as the Repository SEIS; because DOE did not provide such an opportunity in California, the Repository SEIS is inadequate under NEPA and is not practicable for adoption by the NRC

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between DOE and California in that California believes that DOE did not allow for sufficient public participation in California on the Repository SEIS, while

DOE believes that it did.

The specific portion of the LA being challenged is Repository SEIS section 1.5.2.

CAL-NEPA-10

Failure to Analyze Impacts of Intermodal Transfers

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the public health and safety and other environmental impacts from the handling of intermodal transportation containers.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

T he NEPA documents fail to provide a specific description or analysis of how DOE will fulfill its obligations to safely handle and ship spent nuclear fuel from California reactor sites to Yucca Mountain using intermodal transportation.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) A challenge to DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the public health and safety and other environmental impacts from the handling of intermodal transportation containers. For example, DOE's proposed representative routes for intermodal handling of shipments from Diablo Canyon and Humboldt Bay nuclear power plants may bring substantial numbers of shipments into the downtown area of two California cities, but the NEPA documents do not assess the public health and safety and environmental consequences of the large number of intermodal handling operations in the California cities of San Luis Obispo and Redding that might be necessary to transport spent nuclear fuel to the Yucca Mountain Repository.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

Chapter 6 and Appendix G of the Repository SEIS contain information about DOE's proposed transportation program, but lacks sufficient detail or adequate analysis of intermodal handling. The Comment Response document, CR-229, Sec. 1.6.2 (1822) states: "The transportation of rail casks from generator sites not serviced by railroads could be achieved by transporting rail casks to a rail head by either heavy-haul truck or barge. Both methods were evaluated in the Yucca Mountain FEIS. The Draft Repository SEIS evaluated only heavy-haul truck since the relative environmental impacts of heavy-haul trucks and barge would be similar. As the schedule for these shipments grows closer, the logistics associated with the selection of heavy-haul truck or barge shipment will be further evaluated." This postponement of the evaluation of a key component of the project, namely, the specific problems of intermodal handling at proposed transfer sites in California, constitutes an inappropriate segmenting of the project.

The NEPA documents do not contain any information about how the large numbers of complex intermodal handling operations that may be necessary in San Luis Obispo and Redding will be done safely, nor does it contain such information about intermodal transfers at any other point. Intermodal handling operations, which involve transferring spent nuclear fuel from one mode of transportation to another (e.g., from heavy haul truck to rail), may be required for shipments from Diablo Canyon, and Humboldt Bay. In addition, shipment of the spent nuclear fuel from Humboldt Bay may be done by barge, which would require heavy duty cranes to lift the casks unto the barges. The Repository SEIS provides some information about the numbers of shipments and the general destinations of the shipments, but does not provide any detail about how shipments will be handled at points of transfer. For example the maps in the NEPA documents depict an overweight truck route moving waste from Diablo Canyon into San Luis Obispo, California. However, the NEPA documents do not address specific handling issues that will arise in San Luis Obispo, such as how a shipper would unload heavy haul trucks or load rail cars in the middle of San Luis Obispo where no intermodal handling facility now exists. Because there is no intermodal handling facility at the point of transfer in San Luis Obispo, DOE would have to construct, staff, and operate one, which has not been considered in the NEPA documents. Additionally, DOE will need to consider how to prevent or mitigate the radiation that will be emitted in the middle of San Luis Obispo as a result of this transfer. The same problem exists in Redding California, where intermodal transfer may be necessary for shipments from Humboldt Bay. There is no intermodal handling facility in that city for easy handling of these casks.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between the State of California and DOE over the fact that the

Repository SEIS does not provide specific information that describes or analyzes the environmental or public safety impacts of the handling and transfer of intermodal containers of spent nuclear fuel that will be an essential part of DOE's proposed action. The Repository SEIS does provide general information about DOE's intermodal handling preferences, however, nowhere in the NEPA documents or their supporting documentation does DOE describe and analyze : 1) the specific actions necessary to load and transfer spent nuclear fuel that is necessary to implement the proposed action; 2) the intensity of the environmental impacts of the handling, loading and transferring of spent nuclear fuel onto trucks, trains and/or barges that are a necessary part of the proposed action; 3) an assessment of the public safety impacts of the handling, loading and transferring of containers of spent nuclear fuel involved in the proposed action. The Repository SEIS does not provide an adequate description of the proposed action and it postpones to later transportation planning the responsibility of describing how the spent nuclear fuel containers will be transferred at the intermodal sites. Instead, in Chapter six, subchapters 6.2.2 through 6.2.5, DOE provides only a brief, generic analysis of possible risks while loading at a generator site, but there is no discussion of the impacts from the unloading, transfer and loading at intermodal points in California. DOE proposes to have its license approved, even though it will not analyze the clear impact from the transfer of spent nuclear fuel until a subsequent transportation plan is created in a future process. NEPA requires an analysis of all reasonably foreseeable impacts, and DOE's failure to perform the analysis of impacts at intermodal and other transfer points makes the NEPA documents impracticable to adopt.

The specific portion of the Repository SEIS that is being challenged is Chapter 6 and Appendix G of the Repository SEIS to the extent that discussion of these impacts have been totally omitted, as well as more specifically, Repository SEIS Chapter six, subchapters 6.2.2 through 6.2.5 and Appendix G, G.1.2. and G.1.1.3, and CR-224.

CAL-NEPA-11

Failure to Evaluate Impacts Within All Radiologic Regions of Influence

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that they fail to evaluate the environmental impacts within all radiological regions of influence (ROI) for transportation in California and nationally.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS, Sec. 3.2.1, define the regions of influence for radiological impacts of incident-free transportation (0.8 kilometers or 0.5 mile on either side of the transportation route centerline) and for the radiological impacts of transportation accidents and sabotage (80 kilometers or 50 miles on either side of the transportation route centerline); but the Repository SEIS fails to assess the environmental impacts of the ROI anywhere outside the State of Nevada.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been

satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).). The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, namely they have not considered the ROI for transportation impacts of the proposed action for areas outside of Nevada.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Repository SEIS describes the ROI for public health and safety along existing transportation routes is 800 meters (0.5 mile) from the centerline of the transportation rights-of-way and from the boundary of rail yards for *incident-free* (nonaccident) conditions. The ROI extends to 80 kilometers (50 miles) to address potential human health and safety impacts from accident scenarios. The Rail Alignment EIS, Sec. 3.2.10.1.2, and 3.3.10.1.2, provides information that describes exposed populations and health and safety impacts within the radiological regions of influence only along the Caliente and Mina alignments. Neither the Repository SEIS nor the Rail Alignment EIS provide comparable dose and population information for the ROI along existing routes in California and nationally, even though these areas will be traversed by the same shipments assessed in the Rail Alignment EIS. Based on the 2000 decennial census prepared by the Bureau of the Census estimates, about 1,890,000 people in California live within the area defined by the ROI for incident free transportation. There are also a significant number of public facilities within these areas. Federal Emergency Management Agency (FEMA) Multi-Hazard databases (2006 version) show that there are: 47 Medical centers, 1 emergency center, 64 Fire stations, 102 police stations, and 631 schools within the radiological region of influence for incident free transportation. Accordingly, there is a substantially greater number of these facilities within the ROI that could be subject to accidents or sabotage. The Repository SEIS does not evaluate the effect of its proposed action on these facilities. The potential impacts on the exposed populations and on these facilities have not been assessed, nor has an analysis which establishes bounds around possible impacts been provided in the Repository SEIS.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

There is a genuine dispute between California and DOE as to the analysis of exposed populations and the evaluation of health and safety impacts within the various ROIs along rail and truck routes within California and nationally. DOE has provided information only for the ROIs along the Caliente and Mina alignments within Nevada. The NEPA documents are deficient in a significant way because they fail to analyze California's exposed populations and health and safety impacts within the transportation ROI. There is an inadequate disclosure of the environmental impact of the routes. California believes that the NEPA documents are impracticable to adopt because they fail to provide a full analysis of risks and environmental

The Specific portion of the TSPA-LA that is being challenged is the Repository SEIS subsections 3.2.2 and 6.4.1. and Rail Alignment EIS, subsections. 3.2.10.1.2, and 3.3.10.1.2,

CAL-NEPA-12

Failure to Discuss and Analyze Collocation Risks

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the Repository SEIS's analysis of accident risks and consequences does not discuss or analyze the collocation of essential facilities on the possible routes to the repository.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS analyzes accident risks in a generic fashion that applies statewide accident values without considering the unique local conditions, including the collocation of essential facilities, that may make an accident more likely or the consequences of an accident more severe.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess all of the environmental impacts of the proposed Yucca Mountain repository, namely, it does not describe or analyze public health and safety and other environmental impacts of the collocation of routes with essential facilities.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

Chapter 6 of the Repository SEIS contains information about the risks of transporting spent nuclear fuel and high-level radioactive waste to the Yucca Mountain repository. To estimate these risks, the DOE used generic accident consequences and state accident rates to analyze the impacts of the proposed action. The Repository SEIS overlooks significant evidence related to location-specific risks and the consequences of severe accidents due to the collocation of other facilities. This problem is particularly severe in California due to the density of facilities collocated in certain areas.

For example, on May 12th 1989, a train derailed in the El Cajon Pass in San Bernardino County in California. On May 25th 1989, as part of the cleanup, a bulldozer pierced the CALNEV pipeline and caused a fire which destroyed eleven homes and caused fourteen million dollars in damage. (National Transportation Safety Board, 1990, *Derailment of Southern Pacific Railroad Transportation Company Freight Train on May 12th 1989, Washington, D.C.,* at Vi.) A subsequent Federal Emergency Management Agency (LSN # CEC000000619, Federal Emergency Management Agency, *Collocation Impacts on the Vulnerability of Lifelines During Earthquakes with Applications to the Cajon Pass, California*, Washington, D.C. at 49.) study found 250 different transmission facilities collocated within the El Cajon Pass. Another derailment and fire occurred in the same area in 1994 and again in 1996. (LSN # CEC000000620, National Transportation Safety Board, 1996, *Derailment of Freight Train H-Balti*-31, Washington, D.C., at V.) According to the Repository SEIS, 233 rail shipments, (approximately 14 percent of the total) and 2650 truck shipments (approximately 31 percent of the total) will travel through the Cajon Pass, yet the Repository SEIS makes no effort to consider whether or not the use of this area for other public infrastructure facilities such as natural gas pipelines changes the probability or severity of environmental harm from accidents or terrorism incidents incumbent in the use of these areas as transportation routes to the Yucca Mountain repository. The impacts of an accident during shipment of spent nuclear fuel or high-level radioactive waste in an area such as the Cajon Pass where so many facilities are congregated has not been discussed or analyzed.

Additionally, other trends in the location and frequency of severe accidents as a category have been ignored by the Repository SEIS. The National Academy of Sciences Study, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, examined a report that described 12 severe accidents involving that occurred throughout the United States. Of the 12 severe accidents discussed, four occurred in California. Despite the fact that California may have unique risks, the Repository SEIS treats accidents and their consequences in a generic manner that ignores local conditions that may contribute to an accident or amplify the environmental consequences of an accident.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

There is a significant dispute between California and DOE about the sufficiency of DOE's analysis of the risks of transporting spent nuclear fuel or high level radioactive waste where the routes are collocated with pipelines or other facilities that could increase the probability or severity of an impact. DOE has failed to provide a set of routes for its proposed action; it has also failed to assess the implications of its proposed action in a context of accident rates for specific areas. The Repository SEIS does not describe how DOE will comply with NRC requirements for protection of the public or fully analyze and disclose the environmental impacts that may result from accidents on routes with collocated infrastructure facilities. As a result of these deficiencies, the Repository SEIS is not practicable for adoption by NRC. The specific portions of the Repository SEIS that are being challenged are Chapter Six and Appendix G to the extent discussion of these impacts have been omitted entirely, and more specifically, Repository SEIS subsections 6.3.1, 6.3.3.1, and 6.3.3.2.

CAL-NEPA-13

Failure to Discuss and Analyze Barge Risks

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that Repository SEIS Chapter six and Appendix G provide the estimated numbers of shipments and the distances and modes that shipments of spent nuclear fuel must travel from California reactors to intermodal sites and suggests multiple alternative modes of transportation for several California sites, including the use of barges, without assessing the environmental or public health impacts of the barge shipments in California.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS fails to describe or analyze how DOE will fulfill its obligations to safely ship spent nuclear fuel from Humboldt Bay and Diablo Canyon, California generator sites to the Yucca Mountain repository, including how it will safely use barges as an alternative means of transporting spent nuclear fuel to railheads with the ultimate destination of the Yucca Mountain repository.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, namely the proposed representative routes obscure DOE plans for shipping waste from California reactors at Humboldt Bay and Diablo Canyon by barge, and do not assess the site specific public health and safety and environmental consequences of a large number of intermodal handling operations required for casks sent by barge from Humboldt Bay and Diablo Canyon.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Comment Response Document, page CR-254, Sec. 1.6.2.5 (383) states: "Appendix G, Section G.9.10 has been updated to include Humboldt Bay as a site that could potentially ship spent nuclear fuel by barges, eliminating the need to use heavy-haul trucks to ship spent nuclear fuel to a nearby rail head." Appendix J Section 2.2. of the Yucca Mountain FEIS includes and evaluation of the "large-scale barge scenario" and indicated that the DOE could also ship spent nuclear fuel from Diablo Canyon by barge, but does not assess the implications of this program. Nor does the Repository SEIS explain what the basis will be for choosing alternative shipping modes. The NEPA documents do not contain any information about how large numbers of intermodal handling operations will be performed at Diablo Canyon, Port Hueneme, or

Humboldt Bay and the Port of Oakland due to the use of barges. The Repository SEIS states that the radiological impacts of shipping from these sites via heavy haul and barge are similar, but concludes that the impacts are similar because the exposed populations are similar. At Diablo Canyon, DOE has suggested that it will transfer spent nuclear fuel into TAD canisters, transfer the TADs to a barge, ship the barge to Port Hueneme, transfer the TADs onto rail cars, and then ship the TADs to Yucca Mountain. There is no ability to compare modes at specific generating sites based on radiological exposures. The NEPA documents do not describe any of the health and safety implications at the specific locations where spent fuel handling will occur, and how it will be done at transfer locations that do not currently have the capacity to transfer the heavy TAD canisters.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

The NEPA documents do not describe or analyze DOE's proposed action relative to the two California sites that require intermodal handling in order to use barges to transport spent nuclear fuel to other locations for shipment to the Yucca Mountain repository. The NEPA documents do not adequately analyze the public health and safety impacts of the proposed shipping by barge. NEPA requires an analysis of all reasonably foreseeable impacts, and DOE's failure to perform an adequate analysis of impacts at intermodal sites for barging, or the other environmental impacts of the use of barges makes the license application impracticable to adopt.

The specific portion of the Repository SEIS being challenged are Chapter 6 generally, the Comment Response Document at subsections 1.6.2 and 1.6.2.5, and Appendix G, subsection G.9.10, and CR 254.

CAL-NEPA-14

Failure to Describe and Analyze Waste Acceptance Criteria

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the Repository SEIS fails to describe and analyze under what conditions the nuclear waste will be accepted for shipping from generator sites, or upon delivery at Yucca Mountain and has impermissibly deferred such analysis to a later date.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS does not consider the problems of accepting different kinds of waste at California generator sites even though spent nuclear fuel handled, packaged and shipped from California and through California will be in a variety of conditions and may have been damaged or so brittle that it will require special handling and may cause higher exposure to workers.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

This contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain repository, namely they do not adequately describe how DOE will verify the condition of the spent nuclear fuel that will be accepted for shipments from California generator sites or for nuclear waste that will traverse California on its way to the Yucca Mountain repository.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The Repository SEIS fails to describe the criteria for accepting the wide variety of waste types that may be stored at the generator site for eventual shipment to the Yucca Mountain repository. This is a significant failing because the condition of the waste, for example, whether it is damaged, may delay its shipment and increase the radiation exposures to the workers handling the waste at the shipping sites, as well as the public along the shipment routes. In section 2.1.7.1, the Repository SEIS indicates that: "This Repository SEIS assumes that at the time of shipment, the spent nuclear fuel and high-level radioactive waste would be in a form that met approved acceptance and disposal criteria for the repository."

Yet the NEPA documents do not explain, nor do they cite any references, that describe how DOE will confirm that the waste is suitable and safe for shipping at the originating site, whether in California, or elsewhere. Instead, DOE appears to have decided to address that issue at a later time; in doing so, DOE has unacceptably segmented and piecemealed its NEPA

analysis by postponing any identification and environmental analysis, and by deferring any discussion of the environmental impacts arising from its waste acceptance decisions.
The Repository SEIS does not define any standards the waste must meet in order to be determined safe for shipping, nor does the Repository SEIS describe how DOE will manage and ship waste that has been damaged. The Repository SEIS does not describe how damaged fuel assemblies will be managed. The absence of this information in the NEPA documents means that DOE has not performed a sufficient analysis of the impacts on the environment or public health and safety posed by shipping waste that is not in acceptable condition.

By comparison, the Waste Acceptance Criteria for Waste Isolation Pilot Plant (WIPP) document (LSN # CEC000000608) in New Mexico went through six revisions and is 104 pages long (Waste Acceptance Criteria for the Waste Isolation Pilot, revised, 6.2, 5/30/2008). The Waste Acceptance Criteria provides a detailed and comprehensive plan for the management and transfer of waste at the origination and receiving sites. By contrast, the Repository SEIS for the Yucca Mountain repository contains no details about the much greater challenges associated with this proposed action. This is particularly true in California, where two sites in California, Humboldt Bay and Rancho Seco, have extremely old fuel in non-standard containers. The San Onofre site is an operating reactor that will require a mix of both TAD canisters and the shipment of the current NUHOMS canister system. The Repository SEIS indicates that the Diablo Canyon site will ship all of its waste in TAD canisters, but fails to describe how the waste that is currently in dry storage on site will be transferred from interim storage containers to the TAD system. The Repository SEIS provides no detail on the problem of managing this difficult and complex undertaking. Nor does the Repository SEIS assess the environmental impact of managing this part of the proposed action. Instead, the Repository SEIS assesses these impacts by applying generic exposure rates for all of the affected sites.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between California and DOE regarding the NEPA documents' failure to provide waste acceptance criteria and to discuss the impacts of shipping waste that may be in a degraded or damaged condition. This failure to describe such an essential part of the shipping program and analyze its impacts makes the NEPA documents and the license application impracticable for adoption to adopt by NRC.

The specific portion of the Repository SEIS being challenged is Chapter 6 and Appendix G generally to the extent this discussion is omitted entirely, and more specifically, Chapter 6 at section 6.2, Appendix G at section G.1 and Appendix H.2.

CAL-NEPA-15

By Using Representative Routes, DOE Has Failed to Analyze Environmental Impacts of Probable Routes Railroads Would Use

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), in that the Repository SEIS proposes to let the railroads, rather than DOE or other governmental entity, choose the routes over which spent nuclear fuel and high level radioactive waste will be shipped to the Yucca Mountain repository, including routes through California, yet in its analysis of environmental impacts it ignores routes that the railroads have suggested they will actually use and instead bases its environmental analysis on historic rail industry practices (See Section A3, Page A-5), thereby failing to analyze the true potential environmental impacts of the proposed action.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The "representative rail routes" described in the Repository SEIS were estimated using a very generic model that does not reflect specific recommendations made by the rail industry; the Repository SEIS fails to demonstrate that the routes it analyzes are the actual routes railroads will use, as opposed to an artificial construct that does not reflect the real routes over which the waste will travel through California or nationwide to the Yucca Mountain repository.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain repository, namely they have used a generic rail routing model that does not reflect specific route recommendations made by the rail industry; thereby failing to adequately analyze the environmental impacts along the actual routes that will be utilized in shipping nuclear waste to the Yucca Mountain repository, including routes through California.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The Repository SEIS described the way in which it identified potential rail routes to the Yucca Mountain repository:

> *For this Repository SEIS, DOE used the TRAGIS computer program (DIRS 181276-Johnson and Michelhaugh 2003, all) to derive representative highway and rail routes for transportation of spent nuclear fuel and high-level radioactive waste for use in the analysis of health and safety impacts. TRAGIS based the estimated population densities along routes on the 2000 Census. TRAGIS identified highway routes from commercial and DOE generator sites to the proposed repository that would meet U.S. Department of Transportation regulations; no corresponding federal regulations constrain the routing of rail shipments.* (Section 3.2.1)

While this model may be adequate for rough planning calculations, DOE is required under NEPA to provide specific information about its proposed action. Since DOE has made the choice to let the railroads choose the routes they will use for shipments to the Yucca Mountain repository, the NEPA documents should reflect routes that the railroads have indicated they are likely to choose. In 2003, a representative of the Union Pacific Railroad provided a specific map of the rail routes desired by the Union Pacific Railroad; the Repository SEIS ignores those routes in favor of routes generated by the "historic" DOE model.

It was and is feasible for DOE's NEPA documents to identify realistic and reasonably foreseeable transport routes, DOE has been put on notice repeatedly that it should do so, and has in the past indicated that it would do so. A March 22, 2002 letter from NRC Chairman Richard A. Meserve to United States Senator Richard J. Durbin pointed out that the 2002 Yucca Mountain FEIS did not have sufficient NEPA analysis of transportation and that it was expected that more precise estimates of impacts would result in revisions to DOE's NEPA analysis and that this additional review would be completed in support of the license application. (LSN #DN2001959227) In 2006, the National Academy of Sciences (NAS) published *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, a report that urged DOE to precisely define the routes used to ship spent nuclear fuel and high level radioactive waste. The NAS study indicated that there may be individual routes that could have risks that are significantly higher or lower than estimated in DOE's 2002 Yucca Mountain FEIS for the Yucca Mountain repository. In 2006, the DOE issued its draft transportation plan, which implied that early selection of rail and truck routes was a goal of the DOE. In 2007, the California Energy Commission published a report that also called for the early designation of routes. (LSN # CEC 0000000022.) Despite these requests for early action on route selection and identification, the NEPA documents fail to analyze routes whose use is reasonably foreseeable, which are the routes that have been suggested by the railroads themselves.

Specific routes present different risks than have been evaluated in the NEPA documents. For instance, the combined Ports of Los Angeles and Long Beach handle $148 billion dollars in trade annually. Any disruption of the transportation system in this area, e.g., by an accident or terrorist incident involving shipments to Yucca Mountain, would cause worldwide economic harm. It is this kind of specific risk that has not been analyzed. Instead, DOE's NEPA documents rely on a computer model that does not realistically reflect the rail industry's current and intended practices as to these shipments. Because of this, potential environmental impacts of the project along the routes proposed by the railroad companies have not been analyzed and cannot be known by the public or considered by NRC in making its findings.

As another example of the type of problem that has not been addressed because only representational routes were considered, the NEPA documents do not discuss or demonstrate the adequacy of the rail line connecting Rancho Seco to the main Union Pacific rail line at Ione. The last shipment on this rail line occurred in 2004, approximately sixteen years before a shipment could be made over it. The Repository SEIS does not provide any details about how or if the DOE will refurbish the rail line or how the dry storage casks at the Rancho Seco facility will be loaded onto a rail car at a location that no longer has large capacity cranes or fuel handling facilities.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute between California and DOE regarding the shipment routes used to move high-level radioactive waste and spent nuclear fuel to Yucca Mountain. The Repository SEIS lacks important information about what actual routes will be used from the generator sites to the Yucca Mountain repository. As a result, the Repository SEIS does not identify the affected environment for the proposed action. In fact, railroad industry representatives have proposed sets of routes for use in shipping to the Yucca Mountain repository, but these proposals have been ignored in the Repository SEIS. The Repository SEIS admits that it is an incomplete document as regards route selection and states that additional plans will be needed, thereby effectively conceding that it has impermissibly segmented the project. Accordingly, the NEPA documents are not practicable for adoption by NRC.

The specific portions of the Repository SEIS that are being challenged are subchapter 3.2, especially subpart 3.2.1.1, and more generally, to the extent the discussion of likely rail routes is not included at all, Chapter 6 and Appendix G.

CAL-NEPA-16

DOE Has Ignored the NAS Recommendation of Independent Examination of the Security of Shipments

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51 in that the NEPA documents fail to include essential security and environmental information required by the NRC regulations, to wit, there is no independent review of security arrangements by an organization independent of the government, as recommended by the National Academy of Scientists (NAS).

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

Because DOE has not followed the recommendation of the NAS that there be an independent examination of spent fuel and high level radioactive waste transportation security by a technically knowledgeable group independent of the government, there has not been a full and adequate analysis of security and environmental impacts arising from the project, namely, the potential risks of acts of sabotage or terrorism, including such acts while nuclear materials are being transported within or through California.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing

4. <u>Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]</u>

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63031 (Oct. 22, 2008).) The Repository SEIS is not practicable for adoption in that it does not contain analysis required by the NRC regulations, to wit, the NRC may only authorize construction if, pursuant to 10 C.F.R. § 63.31(b), it determines that the proposed activities will not be inimical to the common defense and security, and if, pursuant to 10 C.F.R. section 63.31(c), it weighs environmental benefits against environmental costs, and after considering conditions to protect environmental values. The NRC has not complied with these requirements in that it has not adopted the recommendation of the NAS that an independent examination of the security of spent fuel and high-level waste transportation should be carried out prior to the commencement of large-quantity shipments to the Yucca Mountain repository. DOE has not adequately analyzed the risks from terrorism in that it did not include an independent analysis of the security risks in transportation of spent fuel and high level radioactive waste to the Yucca Mountain Repository, as NAS recommended, and the Repository SEIS is not practicable for adoption.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The National Academy of Sciences report, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States,* identified malevolent acts against spent nuclear fuel and high level radioactive waste shipments as a major technical and societal concern that NAS was unable to evaluate. The NAS Committee concluded that such concerns are likely to grow, especially once shipments begin. NAS, in its Findings and Recommendations cited to in the Repository SEIS at Appendix H, section H-10, recommended that

> "An independent examination of the security of spent fuel and high-level waste transportation should be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage. This examination should provide an integrated evaluation of the threat environment, the response of packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high level waste while in transport. This examination should be carried out by a technically knowledgeable group that is independent of the government and free from institutional and financial conflicts of interest."

DOE has ignored this recommendation, and instead merely promises to work with other federal agencies and stakeholders on the issue. (Appendix H at p. H-25). The missing analysis recommended by NAS is vital in order to comply with the mandate of 10 C.F.R. § 63.31(b) and 10 C.F.R. § 63.31(c). Without this independent review, the Repository SEIS cannot assure the public that necessary protective measures in the event of an emergency have been adequately analyzed, or that appropriate security measures have been anticipated and security risks have been adequately evaluated. The failure to include this independent analysis of environmental impacts does not meet the NRC regulatory requirements; therefore the Repository SEIS is not practicable for adoption.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

There is a significant dispute between California and the DOE about the sufficiency of DOE's analysis of security risks and environmental values because the advice of NAS to have an independent entity review the security of the shipments of high level radioactive waste to the Yucca Mountain repository was not followed, and California feels that it must be. The specific portion of the Repository SEIS being challenged is Chapter 6, to the extent it does not contain the independent review recommended by NAS, as discussed in Appendix H, section H.10.1 and Chapter 6.

CAL-NEPA-17

Environmental Impacts from the Use of Heavy Haul Trucks at Local Sites

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the Repository SEIS' analysis fails to adequately describe how DOE will mitigate the impacts from large numbers of heavy haul truck shipments from Diablo Canyon to San Luis Obispo; therefore DOE has failed to assess the environmental impacts of the proposed action.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS (section 6 and G-15, G-18) describes the numbers of shipments that will originate from the Diablo Canyon reactor; however, the Repository SEIS does not assess the consequences of using roads and highways in the area around the reactor for large numbers of heavy-haul shipments of spent nuclear fuel over an extended time period.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been

satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain repository, namely they do not analyze the impacts of heavy haul trucks connecting Diablo Canyon to an intermodal transfer site in or near San Luis Obispo.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

The Repository SEIS, Chapter 6 and Appendix G contain information about the numbers of shipments transported from individual shipping sites. The map in Appendix G of the Repository SEIS suggests that DOE intends to use Avila Beach Drive and San Luis Bay Drive as the overweight truck route from Diablo Canyon to an intermodal handling facility. However, these roads are minor arterials that are not designed to handle regular shipments of heavy haul cargo on extremely large vehicles as depicted in Chapter 6, Figure 6-0c. This route will require crossing San Luis Obispo Creek and may require substantial improvements or increased amount of maintenance due to these shipments. The DOE plan suggests that 17 percent of all heavy haul truck shipments will take place on this road, with perhaps five shipments per year. DOE has not evaluated the implications of this proposal on the local area around the Diablo Canyon facility.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

There is a significant dispute between California and DOE about the sufficiency of DOE's assessment of the transportation impacts on the environment near the reactor sites in California from the proposed action. DOE has failed to assess and define how heavy haul shipments will affect local roadways en route to an intermodal transfer point. The Repository

SEIS does not describe how the DOE will comply with NRC requirements for protection of the public near these roadways. As a result of these deficiencies the Repository SEIS is not practicable for adoption by the NRC.

The portion of the Repository SEIS being challenged is Chapter 6 and Appendix G, as they omit discussion of these environmental impacts.

CAL-NEPA-18

Failure to Analyze Impacts from the Use of California State Route 299

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the environmental impacts, including those to the Trinity National Wild and Scenic River and other unique natural resources, from use of California State Route 299 as a transportation route for heavy haul trucks to a railhead in Redding for ultimate rail shipment to the Yucca Mountain repository.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS indicates that DOE plans to use California State Highway 299 as a heavy haul route from Humboldt Bay to Redding California; yet the NEPA documents provide no analysis of the potential environmental hazards of using this route for heavy haul trucks despite the fact that the route crosses difficult terrain, parallels a national scenic river for much of the distance, and has already been the site of a nuclear waste cask accident.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*. 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the impacts on public health and safety and the unique natural resources from the use of heavy haul trucks on California State Route 299 for transportation of spent nuclear fuel bound for rail shipment to the Yucca Mountain repository.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The Repository SEIS, at Appendix G, page G-68, and Figure G-6, depicts DOE's representative routes from the California reactor sites to Yucca Mountain. The route identified for shipments from Humboldt Bay is California State Highway 299. This highway was constructed to standards set by the American Association of State Highway and Transportation Officials (AASHTO). These standards, found in *A Policy on Geometric Design of Highways and Streets, 5th Edition*, define lane width, curvature, roadbed and other design factors that contribute to safety. The highway is suitable for use by vehicles with standard weight and size restrictions. However, DOE intends to use heavy haul trucks to carry shipments from the Humboldt Bay reactor to a railhead in Redding, California along this route. The Repository SEIS does not consider the difficulty of making heavy haul shipments on this particular highway, where there are difficult curves and significant elevation changes. The operating characteristics of heavy haul trucks are such that they will cause significant disruption of traffic and pose significant problems. For instance, on August 30 2008, a semi-truck traveling on a similar roadway (State Route 36) west of Dinsmore, California, veered off the highway and completely blocked the road. (LSN # CEC000000614, *Semi Truck Blocks Roadway on State Route 36*, Eureka Times-Standard, 8/30/2008.) The vehicle was carrying a new dry storage cask for waste stored at Humboldt Bay. Because of the cask, the vehicle exceeded the design standards of the roadway, which contributed to the accident.

In addition to traffic and public safety impacts, any accident along State Route 299 would endanger the Trinity Scenic Byway (140 miles of Route 299 is part of the byway), the Trinity National Wild and Scenic River, Whiskeytown Lake, and the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area. The Repository SEIS fails to consider any of the potential environmental impacts to these invaluable natural resources from additional heavy haul traffic, or from accidents during shipments.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

Repository SEIS does not provide detailed information or an adequate assessment of the environmental impacts of heavy haul shipments from Humboldt Bay to Redding, California. Although there will be a relatively small number of shipments, the failure of the Repository SEIS to consider the difficulty of these shipments raises questions about the quality and depth of the DOE's planning. There is a genuine dispute between California and DOE with regard to the failure of DOE to analyze public health and safety impacts and environmental impacts associated with the use of California State Route 299 for high level radioactive waste shipments, accordingly, the NEPA documents are impracticable to adopt.

The specific portion of the Repository SEIS that is being challenged is Chapter 6, Appendix G, and Comment Response 1.6.2 at CR-228.

CAL-NEPA-19

Failure to Analyze Use of TAD Canisters

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that the Repository SEIS fails to assess the environmental impacts of, and the costs and ability to use, Transportation, Aging and Disposal (TAD) canisters at California generator sites.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

The Repository SEIS fails to provide an adequate assessment of whether or not the TAD canister system can be used at California reactor sites, as well as the burden that it will impose on the generators, and does not assess the health and safety implications of the additional spent fuel handling required for the TAD canister system.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may legally issue a license to DOE for the Yucca Mountain repository, the NRC must find that all requirements of 10 C.F.R. part 51 have been satisfied, including the NRC NEPA regulations found at 10 C.F.R. § 51.10 et seq. Any party may, pursuant to 10 C.F.R.

§ 51.109(a)(2) contend that the DOE environmental impact statement is not practicable for the NRC to adopt. The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts from DOE's proposed use of the TAD system in California. Use of TAD canisters may not be possible at the San Onofre and Diablo Canyon reactor sites. Before the repository project is approved, including the use of the TAD system, there must be an analysis of whether the generator sites will be able to utilize the TAD canisters at their sites. Even if these generators can physically accommodate the loading of TAD canisters, the Repository SEIS does not assess the costs of such a system, or space limitations, at generator sites. There also needs to be an assessment of how spent nuclear fuel, which is not currently stored in TAD canisters at the sites, will be loaded into TAD canisters at the California generator sites. For instance, at Rancho Seco, there no longer is a facility that could be used for unloading the current containers and reloading the spent nuclear fuel into TAD canisters. The failure to provide this analysis, including what risks to health and safety or the environment may be entailed, makes the Repository SEIS impracticable to adopt.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The Repository SEIS, Chapter 2, section 2.1.7.1, provides a very general description of DOE's plans to load waste at the reactor sites. However, the Repository SEIS ignores concerns raised by the nuclear industry about the feasibility of the TAD system. DOE has proposed designing and developing a TAD canister system for spent fuel shipments from reactors to the proposed repository. Using TADs, spent fuel could be moved directly from a spent fuel storage pool into a TAD canister and then remain in the same canister (with different overpacks) for above-ground dry storage at the reactor followed by transport to the Yucca Mountain repository for disposal. The National Academy of Sciences (NAS) 2007 spent fuel transport study *Going* *the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, noted that spent fuel stored at reactor sites in other canisters that are not TAD compatible may need to be repackaged prior to shipment. The California Energy Commission testified in November 2007 at a DOE hearing on the Repository SEIS and expressed concerns about the compatibility of the proposed TAD system with interim storage systems already in place in California.[4] The state testified that, due to the potential need for repackaging at a reactor site, the use of the TAD canister system will significantly increase workers' radiological exposure and the risks associated with handling bare spent fuel assemblies, and loading and welding canisters at reactor sites. The State of California recommended that DOE examine how the TAD system will interface with the dry cask storage system at each reactor site in California and requested clarification on the financial responsibility for developing a repackaging system at reactor sites.

The Nuclear Energy Institute (NEI) anticipates that spent fuel in dry cask storage will not be repackaged into TAD canisters for shipment to Yucca Mountain.[5] NEI explained that by the time Yucca Mountain is in operation, the amount of spent fuel at utility sites will exceed the current legal capacity of Yucca Mountain. Utilities will have the choice of which spent fuel to ship, and they will choose to ship spent fuel from spent fuel pools, since they have never been packaged into canisters, instead of spent fuel from dry cask storage which would need to be

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[4] California Energy Commission. “Barbara Byron Comments on Draft Supplemental Yucca Mountain Repository EIS and Supplemental Rail Corridor and Rail Alignment Environmental Impact Statements.” November 19, 2007, page 6. <http://www.ocrwm.doe.gov/ym_repository/seis/comments/RRR000108.pdf (LSN # CEC000000022)

[5] McCullum, Rod, Nuclear Energy Institute. “Transportation, Aging, and Disposal (TAD) Canisters**:** A Tool for Integrating the Used Fuel Management System.” Presentation to WIEB HLW Committee. April 23, 2008, slide 11. <http://www.westgov.org/wieb/meetings/hlwsprg2008/briefing/present/r_mccullum.pdf>.(LSN # BEN000000687)

repackaged.[6] NEI anticipates that utilities would only adopt the TAD system for on-site interim storage if DOE offered compensation to cover the increased cost and reduced capacity of the TAD canisters.[7]

In the absence of final cask specifications for TAD canisters, the utilities have adopted their own canister systems. The Pacific Gas & Electric Company has said the spent fuel canister system at Diablo Canyon is not compatible with DOE's proposed TAD system.[8] Southern California Edison stated that it is unclear whether San Onofre's storage system will comply with DOE's final TAD requirements.[9] At a panel discussion in May of 2007, Jorge Morales, Projects Manager from Southern California Edison, described several concerns about the TAD canister. (LSN # CEC000000612, Slide Presentation.) There is very limited space to expand storage pads to accommodate the existing NUHOMS dry cask storage system. The TAD system is limited to 21 Pressurized Water Reactor fuel assemblies. A utility will have to provide storage space for both the TAD system proposed by the DOE and its existing NUHOMS system. Because of the space limitations at some reactor sites, this may not be desirable. Another issue is cost, if the utility must pay for both storage systems at the generating site, there is a question as to who will pay to provide that space. DOE does not consider this and does not describe a program that will offset additional costs to utilities. The same space constraints exist at Diablo Canyon and should have been considered.

Finally, there may be state regulatory requirements that will need to be considered. The

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[6] McCullum, Rod. "Transportation, Aging, and Disposal (TAD) Canisters. April 2008: 11.(LSN # NEN000000687)

[7] McCullum, Rod. "Transportation, Aging, and Disposal (TAD) Canisters. April 2008: 9. .(LSN # NEN000000687)

[8] "AB 1632 Assessment of California's Operating Nuclear Plants," Final Report. Prepared by California Energy Commission, October 2008, CEC100-2008-005 (LSN # CEC000000621)

[9] *Id.*

California Public Utilities Commission determines the revenue requirements for plant operations and major capital projects and has the responsibility to determine how the costs should be allocated among ratepayers and shareholders, and would have to approve ratepayer cost recovery for these kinds of alterations to the site layout. DOE has not considered this problem. The Repository SEIS does not examine these constraints nor does it fully assess the health and safety implications of the additional spent fuel handling required for the TAD canister system. Accordingly, the Repository SEIS is impracticable for adoption.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

There is a genuine dispute with DOE because its Repository SEIS does not describe its proposed action related to California generating sites that will use TAD canisters at their sites. The Repository SEIS does not consider the space constraints, costs or regulatory and physical hurdles at any of the California sites. DOE has improperly segmented its analysis by failing to assess the full range of the implications of its proposed action. As a result of these deficiencies, the Repository SEIS is impracticable for adoption.

The specific portion of the Repository SEIS being challenged is Repository SEIS, Chapter 2, section 2.1.7.1, and Chapter 6 and Appendix G, which each fails to address this as a transportation issue.

CAL-NEPA-20

Failure to Adequately Analyze Impacts on Local Emergency Management Responsibilities

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS, the Repository SEIS, or the Nevada Rail Corridor SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51 in that the NEPA documents fail to adequately describe how DOE intends to fund and train local, state and tribal public safety officials to respond to emergencies during transportation of spent nuclear fuel and high level radioactive waste through their jurisdictions, as required by section 180(c) of the NWPA, nor does it even attempt to analyze what would be an adequate level of funding for this purpose, or what kind of training would be needed.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

Although DOE's Repository SEIS recognizes that environmental impacts could result from transportation-related incidents, it fails to analyze or disclose how it will ensure adequate funding and training of state and local government to assist in responding to any accidents or sabotage to shipments of high level radioactive waste to Yucca Mountain; instead, it merely states that "States and tribes along shipping routes have the primary responsibility for the protection of the public and environment in their jurisdictions" (Section H-6, page H-16).

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

Because this contention raises an issue whether DOE has complied with NEPA and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, it is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section III.B, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to analyze or discuss how DOE will protect public health and safety pursuant to Nuclear Waste Policy Act, comply with the Comprehensive Environmental Release Cleanup and Liability Act (42 U.S.C. § 9601*, et seq*. [CERCLA]), and meet its responsibilities under the National Contingency Plan established pursuant to Executive Order 12580, or the NRC rules relating to the security of shipments and the responsibilities of the owners in 10 C.F.R. § 73.37 and 67 FR 63,167 (Oct. 10, 2002). Should DOE fail to provide for effective emergency response to an accident or terrorist incident during transport of spent nuclear fuel or high-level radioactive waste to Yucca Mountain, public health and the environment will be endangered. Despite the above-describe statutory and regulatory mandate, the NEPA documents are inadequate because they fail to provide adequate description and analysis as to how it intends to carry out its responsibilities under NWPA section 180(c), of ensuring that proper funding and training for emergency response is available along all transportation routes through California, how it will ensure that California, tribes, and local governments continue to receive adequate funding and training in emergency response for the duration of the five decades of shipments to the Yucca Mountain repository, or what the environmental impacts will be if California, tribes, and local governments fail to receive adequate funding and training. Since DOE's NEPA documents do none of these things, they are inadequate and not practicable for adoption by NRC.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

Neither the Yucca Mountain FEIS nor the Repository SEIS provides any analysis of how emergency response management will be accomplished, either by DOE or by States and localities, to avoid environmental impacts from any accident or terrorist incident that occurs during transport. Instead, the Yucca Mountain FEIS and Repository SEIS essentially parrot language in the Nuclear Waste Policy Act Amendments that requires DOE to provide funds to affected States, Tribes, and localities for training of emergency personnel, and then assumes without analysis or evidence that such funding will prevent any environmental impacts from accidents or terrorist incidents. The Repository SEIS does not acknowledge DOE's responsibilities under CERCLA or under Executive Order 12580 (establishing the National Contingency Plan), which makes DOE "responsible for responding to hazardous substance or radioactive material releases on or from DOE facilities or vessels under the jurisdiction, custody, or control of DOE, including transportation-related incidents." These responsibilities are reiterated under Nuclear/Radiological Incident Annex of the Federal Emergency Management Agency's (FEMA) National Incident Management System. The Yucca Mountain FEIS and Repository SEIS do not analyze or disclose whether and how DOE will adequately respond to any accident or terrorist incident during transport such that environmental impacts will be prevented, or, alternatively, whether and how funding provided by DOE for emergency management and response training will enable California, and Tribes and localities within California to prevent such impacts in this state.

DOE's current funding proposal for emergency response preparation would be inadequate for California, as at least twenty counties (and significantly more if mutual aid is included) and several major metropolitan areas will be impacted by repository shipments in the State, as well as the additional factors of multiple shipment modes, long shipping corridors, and the large estimated number of spent fuel shipments from in-state and out-of-state generator sites being transported through California.

Neither the Yucca Mountain FEIS nor the Repository SEIS addresses DOE's role as coordinating agency for radiological incidents found in the January 2008, National Response Framework, also known as the National Contingency Plan. (LSN # DEN001593502.). DOE's NEPA documents also fail to address how DOE will fulfill its CERCLA responsibilities related to transportation incidents, as set out in 40 C.F.R. § 300.120(c) and 40 C.F.R. § 300.175(b)(5). Yucca Mountain FEIS Section H, Page H-16T asserts that DOE will follow or exceed standards in transporting high level radioactive waste or spent nuclear fuel, but it fails to describe how it will do so or provide evidence to support the document's assertion. The Nuclear/Radiological Incident Annex (NRIA) to the National Response Framework (LSN # CEC000000607 at NUC-1) "describes the policies, situations, concepts of operations, and responsibilities of the Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving release of radioactive materials to address the consequences of the event," DOE is responsible for:

- Mitigating the consequences of an incident;
- Providing notification and appropriate protective action recommendations to State, tribal, and/or local government officials; and
- Minimizing the radiological hazard to the public.
  (p. NUC-11)

However, the Repository SEIS does not describe how an incident involving high level radioactive waste or spent nuclear fuel will be managed and how various responsibilities for managing these incidents will be handled. It is crucial to have such responsibilities well described and assigned in advance, as the key determinant of the effectiveness of decontamination is the time between the release and the decontamination. The shorter the time, the more effective the decontamination will be.

Past episodes of radiological contamination have required extremely expensive and complex responses, as a few examples show. The Palomares accident in Spain in 1966 required the removal of 830 cubic meters of soil and has been estimated to have cost $100 million dollars; even so, the response was incomplete. (LSN # CEC000000618, Chanin & Murfin, 1996, at A-1.) The cleanup of the Eniwetok Atoll, which began in 1972, required over 1000 people working for three years to move 84,000 cubic meters of material, at a total cost of approximately $100 million. (Id, at A-3.) The cleanup of Johnston Island, which began in 1984, cost approximately $244 million per square kilometer. (*Id.*, at A-4.) The estimated cost to clean up a radium factory in East Orange New Jersey fell between 400-500 million per square kilometer; costs were greater because East Orange is an urban area. (*Id.*, at A-7.) DOE's NEPA documents do not demonstrate that environmental impacts necessitating such costly and difficult remedial actions can or will be avoided by the mere provision of NWPA section 180(c) funds. Nor do these documents analyze and lay out for public and NRC review the magnitude of environmental impacts that may occur due to an accident or terrorist incident during transport.

The NEPA documents do not provide a specific description of how DOE will fulfill its obligations under applicable federal law for emergency response and recovery, or an adequate demonstration that funding provided by DOE under the NWPA section 180(c), will enable state, tribal or local government within California to avoid environmental harm from accidents or terrorist incidents during transport. Similarly, there is no analysis as to how state and local government will continue to receive appropriate training in emergency response during the long duration of shipments to the Yucca Mountain repository. Accordingly, DOE's NEPA documents are not practicable for adoption by NRC.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

California has a genuine dispute with DOE, in that DOE contends, and repeats often in its Yucca Mountain FEIS and Repository SEIS and their responses to public comments, that the provision of funding to states and localities by DOE pursuant to the NWPA section 180(c) fully satisfies all of DOE's obligations regarding emergency response to any accident or terrorist incident in California. California contends that compliance by DOE with the NWPA's funding provisions under section 180 (c) does not satisfy, or excuse DOE from complying with, DOE's obligations under NEPA, CERCLA, or the National Response Plan.

The specific portion of the Repository SEIS that is being challenged is Chapter 6 (which does not address this environmental impact), Appendix H, , subsection H.10.4.5 at p. H-33-35, and Appendix L, subsection L.7 at p. L-17-18

CAL-NEPA-21

Failure to Provide a Complete and Adequate Discussion of the Nature and Extent of the Repository's Cumulative Impact on Groundwater in the Lower Carbonate Aquifer

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS or the Repository SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the cumulative environmental impacts on groundwater in the lower carbonate aquifer.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's 2008 Repository SEIS and 2002 Yucca Mountain FEIS are inadequate because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the lower carbonate aquifer. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

This contention raises an issue whether DOE has complied with NEPA, the Council on Environmental Quality (CEQ) regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2) and § 63.31(c), and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been

satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption.[10] The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, namely they have not provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the lower carbonate aquifer in a manner that is consistent with NEPA, the CEQ guidelines and NRC guidance and applicable regulations. This contention challenges compliance with NEPA and therefore raises a material issue.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

Volume I, Chapter 5 of the 2002 Yucca Mountain FEIS and Volume I, Chapter 3 of the 2008 Final Repository SEIS discuss the potential environmental impacts of the proposed repository over the long term. The subject matter of these chapters concerns the potential repository impacts on groundwater and on human health through a groundwater pathway. As components of the engineered barrier system within the repository, including waste containers, slowly corrode and lose their capability to contain their contents, the release of materials, both radioactive and non-radioactive, would then be the source of impacts on groundwater.

DOE is fully obligated under NEPA to provide a complete evaluation and disclosure of the impacts from the proposed repository. 10 CFR § 51.109(c)(2) provides that it is not practicable to adopt any environmental impact statement prepared by the Secretary of Energy in connection with a geologic repository proposed to be constructed if there is "[s]ignificant and substantial new information or new considerations [that would] render such environmental

[10] Notice of Hearing Section IIIB, 73 Fed. Reg. 63031 Oct. 22, 2008

impact statement inadequate." The failure of the NEPA documents to completely and adequately characterize potential contaminant releases to groundwater, including within the lower carbonate aquifer, is a significant new consideration that renders the NEPA documents inadequate.

As noted in the NRC staff's Adoption report[11] DOE's analysis of the post-closure behavior of the repository recognizes that the release of contaminants to groundwater can be expected over the long term. (DOE, 2008b, Chapter 5) Indeed, the NRC staff has concluded that this is a reasonably foreseeable outcome for a repository. The NEPA documents do not provide an adequate analysis and discussion of the impacts to groundwater and of the cumulative amounts of radiological and non-radiological contaminants that may enter the groundwater over time, and specifically how these contaminants would behave in the lower carbonate aquifer and related environment. As the NRC staff noted, "the extent of contamination and accumulation in the aquifer of releases over multiple years is not fully considered."[12]

Further, the NRC staff noted that the NEPA documents "have not provided complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer."[13] They recommend that a supplement analysis should include a description of the full extent of the volcanic-alluvial aquifer, particularly those parts that could become contaminated, and how water (and potential contaminants) can leave the flow system. They noted that the LA describes potential groundwater flow farther to the south of Alkali Flats into the Southern Death Valley subregion of the regional model domain, but this component of the groundwater flow system is not discussed in the NEPA documents. The

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[11] U.S. Nuclear Regulatory Commission's Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, September 5, 2008. [NRC Staff Report]

[12] NRC Staff Report, p.3-10

[13] NRC Staff Report, p. 3-10

reasoning for a supplemental analysis into the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer is equally applicable to the need for supplemental analysis into the nature and extent of the repository's cumulative impact on groundwater in the lower carbonate aquifer, which is a potential pathway for transport of radionuclides and other contaminants to the accessible environment.

The Repository SEIS acknowledges in §3.1.4.2.1, pages 3-29 – 3-38 that a regional lower carbonate aquifer is beneath the proposed repository in the saturated zone and notes that Inyo County's research has led to the conclusion that the lower carbonate aquifer appears to be a significant contributor to the springs in the Furnace Creek area of Death Valley and that this aquifer represents a potentially rapid pathway for contaminants to reach the biosphere.[14] This is a potential pathway for radioactive contaminants that may leak from the waste packages in the repository to reach these springs in Death Valley. As recognized in the Repository SEIS on p. 3-32 (Figure 3-8), Yucca Mountain is located in a subsection of the Central Death Valley regional groundwater flow system called the Alkali Flat-Furnace Creek Groundwater Basin. The Repository SEIS page 3-31 acknowledges that groundwater flows toward Death Valley from Yucca Mountain moving in volcanic and alluvial aquifers to discharge naturally at Franklin Lake Playa, and possibly as spring discharge in Death Valley. It further notes that there is evidence that the carbonate aquifer feeds the line of springs in the Ash Meadows area. Devils Hole, which is a groundwater-filled cave in a fault zone, is in this area.[15] The Repository SEIS further acknowledges on page 3-35 that groundwater flows from the lower carbonate aquifer beneath Yucca Mountain "to discharge at Ash Meadows and is the primary source of spring discharge in

[14] Repository SEIS, p. 3-34

[15] Repository SEIS page 3-31

Death Valley." Moreover, recent scientific work done by the County of Inyo indicates that contaminants entering the carbonate aquifer from the repository could migrate to the springs in Death Valley relatively quickly. These springs are the only source of water for the park workers and the approximately 1.25 million annual visitors to the Death Valley National Park.[16]

In conclusion, neither the NEPA documents nor the LA comply with applicable laws, regulations, and standards requiring an adequate assessment of the potential flow path of radionuclides from the repository through the lower carbonate aquifer to the accessible environment where the contaminants may affect human health and threatened species. In the absence of an adequate assessment in the NEPA documents and the LA of the risk of contamination from the proposed repository reaching the accessible environment through the lower carbonate aquifer and an analysis of the repository's cumulative impact on the lower carbonate aquifer, the Nuclear Regulatory Commission cannot determine "[T]hat there is reasonable assurance that the types and amounts of radioactive material described in the application can be received and possessed in a geologic repository operations area of the design proposed without unreasonable risk to the health and safety of the public" as required by 10 CFR § 31(a)(1), nor can it determine "[T]hat there is a reasonable expectation that the materials can be disposed of without unreasonable risk to the health and safety of the public" as required by 10 CFR § 31(a)(2). For those reasons, this Commission should find the NEPA documents fail to completely and adequately evaluate the nature and extent of the repository's cumulative impact on groundwater in the lower carbonate aquifer.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

This contention challenges DOE's 2002 Yucca Mountain FEIS and 2008 Repository

[16] Death Valley National Park Information Page, http://www.death.valley.natioal-park.com/info.htm

SEIS because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the lower carbonate aquifer. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The specific portion of the LA that is being challenged is the Yucca Mountain FEIS, Volume I, Chapter 5; the Repository SEIS, Volume I, Chapter 3, subchapter 3.1.4.2, and Volume III, Chapter 1, subchapter 1.7.4.

CAL-NEPA-22

Failure to Provide a Complete and Adequate Discussion of the Nature and Extent of the Repository's Cumulative Impact on Groundwater in the Volcanic-Alluvial Aquifer

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS or the Repository SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the cumulative environmental impacts on groundwater in the volcanic-alluvial aquifer.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's 2002 Yucca Mountain FEIS and 2008 Repository SEIS are inadequate because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impacts on groundwater in the volcanic-alluvial aquifer. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The NRC staff has also concluded that the information provided in the NEPA documents does not adequately characterize how potential contaminants may affect groundwater resources in the volcanic-alluvial aquifer, and has ordered supplementation by DOE to ensure the 2002 Yucca Mountain FEIS and the 2008 Repository SEIS are adequate.[17] Absent supplementation, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

[17] U.S. Nuclear Regulatory Commission's Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, September 2008, p. 3-10. [NRC Staff Report]

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

This contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2) and § 63.31(c), and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, namely they have not provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer in a manner that is consistent with NEPA, the CEQ guidelines and NRC guidance and applicable regulations. This contention challenges compliance with NEPA and therefore raises a material issue.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

Environmental impacts of the proposed action over the long-term are considered in Volume 1, Chapter 5 of the 2002 Yucca Mountain FEIS and Volume 1, Chapter 3 of the 2008 Repository SEIS. These chapters discuss the potential impacts on groundwater, and on human health through a groundwater pathway. Estimates of impacts on groundwater are derived from the computer simulated release of contaminants (both radioactive and non-radioactive) from the repository as components of the engineered barrier system of the repository slowly corrode and degrade and lose their capability to contain the radioactive waste. The release of these materials would then be the source of impacts on groundwater.

As noted by the NRC staff, the volcanic-alluvial aquifer is part of the internally-drained Great Basin, and potential contaminants have limited means of leaving the aquifer (radioactive decay is a principal means for lowering the levels of many of the radiological contaminants).[18] They further note that the NEPA documents characterize radionuclide impacts on groundwater by calculating doses and concentrations for an annual contaminant release captured by well withdrawal of a given volume of groundwater. This methodology assumes that the full amount of contaminants released each year is removed by groundwater withdrawal, to avoid possibly underestimating annual peak doses or radionuclide levels for regulatory compliance with 10 CFR § 63. NRC staff further noted that because the annual flux of contaminants is assumed to be removed, the extent of contamination and accumulation in the aquifer of releases over multiple years is not fully considered. The NRC staff concluded that or both radiological and non-radiological contaminants, the NEPA documents do not characterize contamination in the aquifer if annual withdrawal did not occur. [19]

As noted by the NRC staff, the NEPA documents have not provided complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer and require a supplement be prepared that includes a

[18] NRC Staff Report, p. 3-10.

[19] NRC Staff Report, p. 3-10.

description of the full extent of the volcanic-alluvial aquifer, particularly those parts that could become contaminated, and how water (and potential contaminants) could leave the flow system.[20] They noted that the DOE LA describes potential groundwater flow farther to the south of Alkali Flats, into the Southern Death Valley subregion of the regional domain (DOE, 2008, General Information, Section 5.2.2.2). However, this component of the groundwater flow system is not discussed in the NEPA documents.

NRC's NEPA regulations (10 CFR § 51.109(c)(2)) provide that it will not be practicable to adopt any environmental impact statement prepared by DOE for a geologic repository if there is "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate." California agrees with NRC staff's finding that the failure of the NEPA documents to completely and adequately characterize potential contaminant release to groundwater is a significant new consideration that renders the NEPA documents inadequate.[21]

As noted in the NRC staff's Adoption Report, DOE's analysis of the post-closure behavior of the repository recognizes that the release of contaminants to groundwater can be expected over the long term (DOE, 2008b, Chapter 5).[22] The NRC staff concludes that this is a reasonably foreseeable outcome for a repository. The NEPA documents consider impacts to groundwater, but the analysis does not provide adequate discussion of the cumulative amounts of radiological and non-radiological contaminants that may enter the groundwater over time, and how these contaminants would behave in the aquifer and related environment.

[20] NRC Staff Report, p. 3-10.

[21] NRC Staff Report, p. 3-8.

[22] NRC Staff Report, p. 3-8.

A computer simulation can be run assuming that there is no groundwater pumping, with imaginary observation points instead of using wells to monitor contaminant(s) concentrations over time within the plume at different distances from release. A simulation can be run under different hydrogeological conditions, e.g., with and without an upward gradient in the lower carbonate aquifer. In this way the concentrations at the final discharge point(s), like springs in Death Valley, and mass accumulation there can be calculated.

NRC staff concluded that the discussion of groundwater impacts in the NEPA documents is not consistent with NRC regulations for completeness and adequacy of the discussion of environmental consequences of the proposed action [e.g., 10 CFR part 51, Appendix A(7)][23]. In this instance, the incomplete and inadequate characterization itself constitutes a significant consideration, irrespective of the magnitude of potential impacts.

As the NRC staff concluded, the discussion of groundwater impact in the NEPA documents focused principally on those impacts defined for regulatory compliance.[24] Further, NRC staff noted that NRC's NEPA regulations in Part 51 and guidance in NUREG–1748 indicate that compliance with regulatory requirements does not necessarily satisfy the need to consider the environmental impacts of the proposed action. The NRC staff concluded that for impacts on groundwater and from surface discharge, additional analysis is necessary and environmental impact statement supplementation is needed.[25]

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

This contention challenges DOE's 2002 Yucca Mountain FEIS and 2008 Repository

[23] NRC Staff Report, p. 3-8.

[24] NRC Staff Report, p. 3-10.

[25] NRC Staff Report, p. 3-10.

SEIS because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The specific portion of the LA that is being challenged is the Yucca Mountain FEIS, Volume I, Chapter 5; and the Repository SEIS Volume I, Chapter six, subchapter 6.2.2.

CAL-NEPA-23

Failure to Provide a Complete and Adequate Discussion of the Nature and Extent of the Repository's Cumulative Impact from Surface Discharge of Groundwater

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS or the Repository SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the public health and safety and other environmental impacts from the discharge of potentially contaminated groundwater to the surface.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's 2002 Yucca Mountain FEIS and 2008 Repository SEIS are inadequate because neither has provided a complete and adequate discussion and analysis of the nature and extent of the repository's cumulative impact from the discharge of potentially contaminated groundwater to the surface, and how such contaminated groundwater would impact the environment at the discharge sources within California. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

The Commission's regulations in 10 C.F.R. § 51.109(a)(2) and § 63.31(c), and section II, paragraph 1 of the notice of hearing, provide that this issue is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA* 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the public health and safety and other environmental impacts from the discharge of potentially contaminated groundwater to the surface. In fact, NRC staff have ordered supplementation by DOE to ensure the 2002 Yucca Mountain FEIS and the Repository SEIS are adequate. Absent supplementation, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC. This contention challenges compliance with NEPA and therefore raises a material issue.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

California has identified potential impacts from contaminated groundwater in the Death Valley region from the repository. These include impacts on wildlife, habitat, and public parks. Groundwater that flows beneath Yucca Mountain discharges in springs to the south of the proposed repository. The Repository SEIS focuses much of its analysis on the Alkali Flat-Furnace Creek groundwater basin of Death Valley, an area that DOE acknowledges is the area that the proposed repository "could affect the most." (Repository SEIS, Volume I, Ch.3, p.3-31.) NEPA requires that DOE provide a complete evaluation and disclosure of impacts from the proposed action. The Yucca Mountain FEIS and Repository SEIS both fail to assess the public health and safety and other environmental impacts from the discharge of potentially contaminated groundwater to the surface.

The NEPA documents acknowledge the likelihood of future discharges of contaminated groundwater to the surface. As noted in the NRC Staff Report, the NEPA documents indicate possible surface discharge at Franklin Playa, as the result of radionuclide migration through groundwater to surface discharge points (Yucca Mountain FEIS, Section 5.9; Repository SEIS, Sections 5.10 and 5-11.)[26] The discussion in these sections regarding potential impacts from potential groundwater discharges is limited to a statement that no detrimental radiological impacts on plants and animals from the migration of radioactive materials are expected. The Repository SEIS on p. 3-35 notes that DOE's evaluation of geochemical data indicates that the deep underflow of groundwater from the underlying carbonate aquifer that contributes to discharges in the Ash Meadows area is the primary source of the spring discharge in Death Valley (DIRS 177391-SNL 2007). Questions regarding possible locations and impacts of these discharges were raised in comments on the draft Repository SEIS, both from NRC staff and from the Timbisha Shoshone. DOE's responses restate its conclusion that any potential impacts from surface discharges would be no greater than those of the RMEI (reasonably maximally exposed individual) represented by doses associated with groundwater withdrawal and use at the ~18-km (11-mi) location (DOE, 2008b, Volume III, response to Comment RRR000524/0030, page CR–497, and Comment RRR000690/0013, page CR–330, respectively). This reliance on the RMEI standard adopted by DOE has resulted in an inadequate analysis into the potential impacts from future discharges of contaminated groundwater within California.

The NRC staff noted that one of the major areas of potential impacts on the groundwater system that has been insufficiently characterized in the NEPA documents and requires supplementation is in the area of potential impacts from the discharge of potentially

[26]U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, September 5, 2008, p. 3-9.

contaminated groundwater to the surface.[27] The NRC staff further concluded that the NEPA documents have not provided a complete and adequate discussion of the impacts on soils and surface materials from the processes involved in surface discharges of contaminated groundwater and recommended that a supplement be prepared that includes a description of the locations of potential discharge of contaminated groundwater for present and expected future wetter periods (for example, as discussed in DOE, 2008a, Safety Analysis Report, Section 2.3.1.2).[28]

The NRC Staff noted that spring deposits that provide evidence for past discharge of groundwater to the surface are common in the Yucca Mountain region, including fossil deposits that formed during past wetter climates.[29] The paleoclimate record indicates that future wetter periods are reasonably expected for the region (e.g., DOE, 2008a, Safety Analysis Report, Section 2.3.1.2). Future surface discharges during wetter periods may involve larger volume (higher flow rate) of water and contaminants, and different conditions for deposition and removal, compared to present conditions.

While DOE discounts the potential for contaminants to reach the Lower Carbonate Aquifer, DOE's modeling demonstrates that contaminants from the repository could nevertheless find their way to the Death Valley springs even they did not reach the Lower Carbonate Aquifer. (Repository SEIS Volume I, Chapter 3, p.3-24.) Additionally, the U.S. Geological Survey's regional hydrogeologic framework model concludes that the potential exists for the carbonate rocks beneath the Funeral Mountains to provide a pathway for flow from the alluvial aquifers beneath the Amargosa Desert towards Death Valley. (DIRS 173179-Belcher 2004. P. 155)

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[27] NRC Staff Report, p. 3-10.

[28] NRC Staff Report, p. 3-12.

[29] NRC Staff Report , p. 3-11.

Inyo County has conducted extensive groundwater studies, and through their geochemical analysis has concluded that the Lower Carbonate Aquifer, which underlies the proposed repository, has discharge points in the Furnace Creek area of Death Valley National Park within California. The research conducted by Inyo County, as well as DOE's own analysis in the Repository SEIS, demonstrates that groundwater discharged in the Death Valley National Park is mixed with groundwater sources from the Ash Meadows area and the Amargosa Desert. NEPA requires that the discharge points within California must be fully analyzed and evaluated by DOE. California agrees with the NRC staff conclusion that the NEPA documents have not provided a complete and adequate discussion of the impacts from surface discharges of contaminated groundwater.[30]

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

This contention challenges DOE's 2002 Final EIS and Repository SEIS because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact from the discharge of potentially contaminated groundwater to the surface. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts from the discharge of potentially contaminated groundwater to the surface would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The specific portion of the LA that is being challenged is the Yucca Mountain FEIS, Volume I, Chapter 5; and the Repository SEIS, Volume I, Chapter 3.

[30] NRC Staff Report, p. 3-10.

CAL-NEPA-24

Failure to Provide a Complete and Adequate Discussion of the Nature and Extent of the Necessary Mitigation and Remediation Measures for Radionuclides Surfacing at Alkali Flat / Franklin Lake Playa

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS or the Repository SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts from radionuclides surfacing within California.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's 2002 Yucca Mountain FEIS and 2008 Repository SEIS are inadequate because neither has analyzed the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts from radionuclides surfacing within California. The information provided in the NEPA documents does not adequately address the potential for radionuclides to travel through the Amargosa River Drainage. Rather, DOE defers mitigation and remediation planning to such time that "detection of any unusual conditions in groundwater" would assumedly occur. Absent supplementation, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

This contention raises an issue whether DOE has complied with NEPA, the CEQ regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2), 10 C.F.R. § 63.31(c) and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain Repository, namely they have not analyzed the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts from radionuclides surfacing within California in a manner that is consistent with NEPA, the Council on Environmental Quality (CEQ) guidelines and NRC guidance and applicable regulations. This contention challenges compliance with NEPA and therefore raises a material issue.

5. Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]

The discussion of mitigation and remediation measures to protect the public health and safety and other environmental impacts in the NEPA documents is not consistent with NRC regulations for completeness and adequacy of the discussion of environmental consequences of the proposed action [e.g., 10 CFR part 51, Appendix A(7)]. In this instance, the incomplete and inadequate characterization itself constitutes a significant consideration, irrespective of the magnitude of potential impacts.

DOE acknowledged in the 2002 Yucca Mountain FEIS that groundwater from tuff aquifers under the repository comes to the surface at Franklin Lake Playa and Alkali Flat, near

Death Valley Junction, in California. (2002 Yucca Mountain FEIS Volume I, Ch.3, p.3-41) However, DOE does not offer any plan for remediation of those potentially contaminated sites in California. In Chapter 9, p. 9-8 and 9-9 DOE commits to conducting monitoring activities including monitoring groundwater quality, but no details are provided. A groundwater well monitoring program on the west side of Yucca Mountain (California side), as recommended by the State of California in its 2008 comments on the Draft Repository SEIS is needed. California recommends that monitoring wells (and high capacity extraction wells) be strategically located around the repository to detect any early "leaks" into any of the groundwater aquifers. A series of monitoring wells (with high capacity extraction capabilities) should be placed into the aquifers along the California border to track and extract any contamination plumes should radionuclide migration and groundwater contamination occur.[31]

It is DOE's obligation to implement a mitigation and remediation plan for radionuclides transported by groundwater that could surface in California, for example, at Alkali Flat / Franklin Lake Playa, east of the community of Death Valley Junction. Surface water is known to flow from the site of the proposed repository to Forty Mile Wash east of the site, and into the Amargosa River Drainage.[32] DOE has also acknowledged that shallower aquifers follow the same flow path into the Amargosa River drainage, and come to the surface of Alkali Flat and Franklin Lake Playa.[33] The flow paths for surface water within the Amargosa River Drainage terminate in Death Valley National Park. In the Yucca Mountain FEIS, DOE acknowledged that

[31] State of California's Comments on the U.S. Department of Energy's Draft Environmental Impact Statements Related to a Proposed Geologic Repository at Yucca Mountain, Nevada, January 10, 2008, by James D. Boyd, California Energy Commission.

[32] Draft Comprehensive Impact Statement, *Potential Impacts to Inyo County, California from the proposed high-level nuclear waste repository at Yucca Mountain, Nevada*, p.15, Matt Gaffney, Project Coordinator, November 6, 2007

[33] Yucca Mountain FEIS Chapter 3, pages 3-41, 3-45, 3-64 (DOE-EIS-0250) 2002

69,500 people could be exposed to contaminated groundwater at Franklin Lake Playa during the next 10,000 years.[34]

DOE has suggested that it may defer its analysis of the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts until such time that there has been "detection of any unusual conditions in the groundwater."[35] DOE relies on 10 CFR § 63.161 to justify its deferral of its obligation to analyze the appropriate mitigation and remediation measures. That section provides:

> DOE shall develop and be prepared to implement a plan to cope with radiological accidents that may occur at the geologic repository operations area, at any time before permanent closure and decontamination or decontamination and dismantlement of surface facilities. The emergency plan must be based on the criteria of § 72.32(b) of this chapter.

It is DOE's position that they are not required to develop a plan for mitigation and remediation until after the facility has been licensed, rather than during the licensing phase. According to DOE, "[d]uring the active, preclosure phase of the project, DOE would be required by NRC regulations (10 CFR § 63.131) to develop and be prepared to implement an emergency plan to cope with radiological accidents that may occur at the repository operations area."[36] However, 10 CFR § 63.131 also requires that the emergency plan must be based on the criteria of § 72.32(b). That section provides:

> (b) Each application for an MRS that is licensed under this part and each application for an ISFSI that is licensed under this part and that may process and/or repackage spent fuel, must be accompanied by an Emergency Plan that includes the following information:
> (1) Facility description. A brief description of the licensee facility and area near the site.

[34] Yucca Mountain FEIS Chapter 5, pages 5-24-25, Environmental Consequences of Long Term Repository Performance (DOE-EIS-0250) 2002

[35] Repository SEIS Volume III, Comments – Response Document, 1.21.1 (84) Impacts Mitigation, p.CR-527

[36] *Ibid.*, p. CR-527

(2) Types of accidents. An identification of each type of radioactive materials accident.
(3) Classification of accidents. A classification system for classifying accidents as "alerts" or "site area emergencies."
(4) Detection of accidents. Identification of the means of detecting an accident condition.
(5) Mitigation of consequences. A brief description of the means of mitigating the consequences of each type of accident, including those provided to protect workers on site, and a description of the program for maintaining the equipment.

Here, DOE asserts that it may defer its mitigation and remediation analysis until the active, preclosure phase, well after the license to construct the Yucca Mountain repository has been granted. While DOE may be correct that it may not be required to "implement an emergency plan to cope with radiological accidents that may occur at the geologic repository operations area at any time before permanent closure," § 72.32(b) requires that the LA include an emergency plan. Such an emergency plan cannot be developed absent an adequate analysis into the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts.

NRC's NEPA regulations in Part 51 and guidance in NUREG–1748 indicate that compliance with regulatory requirements does not necessarily satisfy the need to consider the environmental impacts of the proposed action. The regulations and guidance recognize that further analysis and discussion may be needed [e.g., 10 CFR § 51.71; 10 CFR part 51, Subpart A, Appendix A(7)].

While surface water is not expected to be impacted by repository operations within the mountain, there will be numerous surface facilities present that will store waste on a temporary basis. DOE must conduct specific analysis of impacts to these facilities in case of a flood event, as any hazardous materials or radioactive waste on the surface carried off by floodwaters would enter the Amargosa River drainage.[37] If DOE waits until the facility is in the "active, preclosure phase" to develop a mitigation or remediation plan, such a plan would do nothing to protect the public health and safety and other environmental impacts in the event of a flood before such analysis were conducted. The NRC must require that the DOE conduct the necessary analysis into these potential impacts as a part of the NEPA documents and LA.

Until DOE has submitted a mitigation and remediation plan for radionuclides that would surface within California at Alkali Flat / Franklin Lake Playa, the analysis in the NEPA documents with respect to public health and safety and other environmental impacts from surface renders the relevant portions of those environmental documents insufficient.

6. <u>Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]</u>

This contention challenges DOE's 2008 Repository SEIS and 2002 Yucca Mountain FEIS because neither has analyzed and discussed the necessary mitigation and remediation measures to protect the public health and safety and other environmental impacts from radionuclides transported in groundwater and surfacing in California, for example, at Alkali Flat / Franklin Lake Playa. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts from the potentially contaminated surface water would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The specific portion of the LA that is being challenged is Yucca Mountain FEIS, Volume I, Chapter 3, Chapter 5, and Chapter 9; and the Repository SEIS, Volume I, Chapter 3, and Volume III, Chapter 1.

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[37] Draft Comprehensive Impact Statement, *Potential Impacts to Inyo County, California from the proposed high-level nuclear waste repository at Yucca Mountain, Nevada*, p.15, Matt Gaffney, Project Coordinator, November 6, 2007

CAL-NEPA-25

Failure to Provide a Complete and Adequate Discussion of the Nature and Extent of the Repository's Cumulative Impacts from Groundwater Pumping

1. Statement of the issue of law or fact raised or controverted [10 C.F.R. § 2.309(f)(1)(i)]

It is not practicable for NRC to adopt DOE's Yucca Mountain FEIS or the Repository SEIS, as is required by 10 C.F.R. § 51.109(c), because they are incomplete and inadequate pursuant to NEPA and NRC regulations at 10 C.F.R. part 51, in that DOE failed to analyze the repository's cumulative environmental impacts from groundwater pumping.

2. Basis of this contention [10 C.F.R. § 2.309(f)(1)(ii)]

DOE's 2002 Yucca Mountain FEIS and 2008 Repository SEIS are inadequate because neither has provided a complete and adequate analysis of the impacts of groundwater pumping and the effects such pumping could have on the upward gradient in the lower carbonate aquifer. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

3. Demonstration that the issue raised is within the scope of this proceeding [10 C.F.R. § 2.309(f)(1)(iii)]

This contention raises an issue whether DOE has complied with NEPA, the Council on Environmental Quality (CEQ) regulations, and the NRC NEPA regulations; pursuant to 10 C.F.R. § 51.109(a)(2) and § 63.31(c), and section II, paragraph 1 of the Notice of Hearing, this contention is within the scope of the hearing.

4. Demonstration that the issue raised is material to the findings that NRC must make to support the action involved in this proceeding [10 C.F.R. § 2.309(f)(1)(iv)]

Before it may determine that the NEPA documents for the Yucca Mountain repository are practicable for adoption, the NRC must find that all requirements of NEPA have been

satisfied. (*NEI v. EPA*, 373 F.3d at 1314.) An attack on DOE's NEPA documents based on substantial and significant new information is a new consideration under 10 C.F.R. § 51.109(c), which makes the NEPA documents not practicable for adoption. (Notice of Hearing Section IIIB, 73 Fed. Reg. 63,031 (Oct. 22, 2008).) The NEPA documents are inadequate and not practicable for adoption because they fail to assess the environmental impacts of the proposed Yucca Mountain repository, namely they have not provided a complete and adequate discussion of the nature and extent of the repository's cumulative impacts from groundwater pumping in a manner that is consistent with NEPA, the CEQ guidelines and NRC guidance and applicable regulations. This contention challenges compliance with NEPA and therefore raises a material issue.

5. <u>Statement of supporting facts, expert opinions, and references [10 C.F.R. § 2.309(f)(1)(v)]</u>

Volume I, Chapter 5 of the 2002 Yucca Mountain FEIS and Volume I, Chapter 3 of the 2008 Repository SEIS discuss the potential environmental impacts of the proposed repository over the long term. The subject matter of these chapters concerns the potential repository impacts on groundwater, and on human health through a groundwater pathway.

DOE is fully obligated under NEPA to provide a complete evaluation and disclosure of the impacts from the proposed repository. 10 CFR § 51.109(c)(2) provides that it is not practicable to adopt any environmental impact statement prepared by the Secretary of Energy in connection with a geologic repository proposed to be constructed if there is "[s]ignificant and substantial new information or new considerations [that would] render such environmental impact statement inadequate." The failure of the NEPA documents to completely and adequately characterize the repository's cumulative environmental impacts from groundwater pumping is a significant new consideration that renders the NEPA documents inadequate.

The Repository SEIS concludes that data from wells in the vicinity of Yucca Mountain indicate that there is an upward hydraulic gradient between the lower carbonate aquifer and the overlying volcanic aquifer in this region. (Repository SEIS, Vol. 1, page 3-44.) (An upward hydraulic gradient means that because of greater pressure in the lower carbonate aquifer, water cannot move from the overlying volcanic aquifer downward into the lower carbonate aquifer.) The upward hydraulic gradient in the carbonate aquifer is important to the performance of the repository because it prevents water in the overlying volcanic aquifer of Yucca Mountain, and possibly in the overlying alluvial aquifer in the Amargosa Desert, from moving downward and entering the lower carbonate aquifer (Repository SEIS, Vol. 1, p. 3-44). This is also important because it restricts the groundwater flow and radionuclide transport pathways by which radionuclides could move, after repository closure, from the overlying volcanic and alluvial aquifers to the lower carbonate aquifer. (Repository SEIS, Vol. 1, page 3-44: LA, Vol. 14, pages 2.3.9-53 and 2.3.9-55.) The Repository SEIS concludes that on the basis of modeling simulations of the Death Valley regional groundwater flow system under past conditions and future wetter conditions, it is expected that the upward gradient will persist during future wetter climates. (Repository SEIS, Vol. 1, page 3-44.)

The applicant acknowledges the upward gradient, and observes that *under current conditions*, contamination from the Yucca Mountain repository is not likely to mix with carbonate aquifer waters and discharge to the surface at Ash Meadows or Devil's Hole. (Repository SEIS, p. 5-23) The Repository SEIS further states that because there would be no contamination of the carbonate aquifer *under current conditions*, it is concluded that no human health impacts or impacts to endangered pupfish at Ash Meadows or Devil's Hole are expected. (Repository SEIS, page 5-23.)

Although the applicant assumes that under current conditions and during future wetter climates the upper gradient will persist, the NEPA documents fail to assess the possibility that local and regional groundwater pumping that is reasonably foreseeable in the future could reduce or eliminate the upper gradient. In the event that future groundwater pumping eliminates the upward gradient, contaminates from the repository could potentially enter the lower carbonate aquifer and migrate to the accessible environment at Devil's Hole, Ash Meadows, Death Valley and Amargosa Valley. Moreover, the Repository SEIS acknowledges in 3.1.4.2.1 pages 3-29 to 3-38 that recent scientific work done by Inyo County has led to the conclusion that the lower carbonate aquifer appears to be a significant contributor to the springs in the Furnace Creek area of Death Valley and that the aquifer represents a potential rapid pathway for contaminants to reach the biosphere

In conclusion, neither the NEPA documents nor the LA comply with applicable laws, regulations, and standards requiring an adequate assessment of the potential flow path of radionuclides from the repository through the lower carbonate aquifer and cumulative impacts to the accessible environment where the contaminants may affect human health and threatened species. In addition, neither the NEPA documents nor the LA comply with applicable laws, regulations and standards requiring an adequate assessment of the possibility that local and regional groundwater pumping, which is reasonably foreseeable, could reduce or eliminate the upper gradient and that contaminants from the repository could enter the lower carbonate aquifer and migrate to the accessible environment at Devil's Hole, Ash Meadows, Death Valley and Amargosa Valley. Without an adequate assessment in the NEPA documents and the LA of the risk of contamination from the proposed repository reaching the accessible environment through the lower carbonate aquifer, the Nuclear Regulatory Commission cannot determine "[T]hat there is reasonable assurance that the types and amounts of radioactive material described in the application can be received and possessed in a geologic repository operations area of the design proposed without unreasonable risk to the health and safety of the public" as required by 10 CFR § 31(a)(1), nor can it determine "[T]hat there is a reasonable expectation that the materials can be disposed of without unreasonable risk to the health and safety of the public" as required by 10 § CFR 31(a)(2). For those reasons, this Commission should find that the NEPA documents fail to completely and adequately evaluate the nature and extent of the repository's cumulative impact from groundwater pumping, and NRC should find the LA inadequate.

6. Information showing that a genuine dispute exists on a material issue of law or fact [10 C.F.R. § 2.309(f)(1)(vi)]

This contention challenges DOE's 2002 Yucca Mountain FEIS and 2008 Repository SEIS because neither has provided a complete and adequate discussion of the nature and extent of the repository's cumulative impact from groundwater pumping. This deficiency is significant and, if it were to be addressed in a satisfactory manner, the disclosure of overall impacts on groundwater would be materially different. As a result, the Yucca Mountain FEIS and Repository SEIS cannot be adopted by the NRC.

The specific portion of the LA that is being challenged is the Yucca Mountain FEIS, Volume I, Chapter 5; the Repository SEIS, Volume I, Chapter 3, subchapter 3.1.4.2, and Volume III, Chapter 1, subchapter 1.7.4.

SUPPORTING ATTACHMENTS

1. Affidavit of Fred C. Dilger and attachments

2. Affidavit of Jan Stepek and attachments

3. Other referenced documents

   National Transportation Safety Board, *Railroad Accident Report, Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989 and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, San Bernardino, California* (PB90-916302, NTSB/RAR-90/02) (1990).

Dated: December 20, 2008

Respectfully submitted,

[Signed electronically]
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SUPPORTING ATTACHMENT 1

Affidavit of Fred C. Dilger

BEFORE THE U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
U.S. DEPARTMENT OF ENERGY	)	Docket No. 63-001
License Application to Construct a Geologic Repository at Yucca Mountain	)	

AFFIDAVIT OF FRED C. DILGER

I, Fred C. Dilger, the undersigned affiant, do hereby make the following statements based upon my own knowledge, information, and belief.

1. My name is Fred C. Dilger, and my curriculum vitae is attached to this Affidavit as Attachment A. I am executing this Affidavit in support of the State of California Petition to Intervene as a Party (Petition) in the above-captioned proceeding.

2. I have been retained by the State of California as an expert in this proceeding to offer opinions on issues relating to the transportation of spent nuclear fuel and high-level radioactive waste from generator sites to the Yucca Mountain repository. In order to offer an expert opinion for the State of California in the instant proceedings, I have reviewed the following documents: the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High –Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F)(2002); *Final Supplemental Environmental Impact Statement Repository for the Disposal of Spent Nuclear Fuel and High –Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (2008)*; Final Supplemental Environmental Impact Statement Repository for the Disposal of Spent Nuclear Fuel and High –Level Radioactive Waste at Yucca Mountain, Nye County, Nevada Rail Transportation Corridor*(DOE/EIS-0250F-S2) (2008); *Final Environmental Impact Statement for a Rail*

Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada (DOE/EIS-0369)(2008); the Petition to Intervene of the State of California, including the accompanying Contentions, and all documents cited to or referred to in the Contentions.

3. Within the Petition are numerous Contentions, each comprised of several paragraphs. I hereby adopt as my own opinions the statements contained within Paragraph 5 of those specific contentions identified in Attachment B to this Affidavit. I understand that attorneys for the State of California will assign unique numbers to each of those contentions just prior to the filing of the Petition and will include those unique numbers in Attachment B. I have prepared the following technical memoranda in support of certain contentions: Technical Memo Supporting California's Contention on the Radiological Region of Influence (Attachment C), Technical Memo Supporting California's Contention on the Collocation of Facilities (Attachment D), and Technical Memo Supporting California's Contention on Rail Industry Routes (Attachment E).

Further, the affiant sayeth not.

____
Fred C. Dilger

The above-named affiant personally appeared before me this ___ day of December, 2008, and executed this affidavit.

____
Notary Public

My Commission expires:________________

Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada (DOE/EIS-0369)(2008); the Petition to Intervene of the State of California, including the accompanying Contentions, and all documents cited to or referred to in the Contentions.

3. Within the Petition are numerous Contentions, each comprised of several paragraphs. I hereby adopt as my own opinions the statements contained within Paragraph 5 of those specific contentions identified in Attachment B to this Affidavit. I understand that attorneys for the State of California will assign unique numbers to each of those contentions just prior to the filing of the Petition and will include those unique numbers in Attachment B. I have prepared the following technical memoranda in support of certain contentions: Technical Memo Supporting California's Contention on the Radiological Region of Influence (Attachment C), Technical Memo Supporting California's Contention on the Collocation of Facilities (Attachment D), and Technical Memo Supporting California's Contention on Rail Industry Routes (Attachment E).

Further, the affiant sayeth not.

Fred C. Dilger

The above-named affiant personally appeared before me this 18th day of December, 2008, and executed this affidavit.

Notary Public

My Commission expires: March 8, 2011

R. TIFFANY
Notary Public, State of Nevada
Appointment No. 07-1845-1
My Appt. Expires Mar 8, 2011

ATTACHMENT A

to the Affidavit of Fred C. Dilger

Fred C. Dilger III
October 2007

1869 Desert Forest Way, Henderson, NV 89012 USA
Phone: 702-290-6990
e-mail: fcd5@cox.net

Education

PhD. Arizona State University, Tempe Arizona. Environmental Design and Planning (Planning concentration). Dissertation title: "The New Nuclear Imperative: A Hazards Planning Process for the Urban Transportation of Spent Nuclear Fuel." Chair Mary Kihl. August 2004.

M.A. University of Nevada, Las Vegas, Nevada. Ethics and Policy Studies: Concentrations included quantitative risk analysis and policy design.

M.A. University of London. Great Britain. Geography. Thesis on Quantitative Risk Analysis of Transportation Systems.

B.A. Pennsylvania State University, State College Pennsylvania. Major in economics.

Professional Experience

Principal, Black Mountain Research. Henderson, Nevada. June 2004 to present.

- Impact Assessment
- Use Planning Support Systems to quantitatively evaluate long-range plans
- Perform GIS-based transportation systems analysis.
- Develop customized travel demand models for transportation impact assessment.
- Quantitative risk assessment for transportation systems

Principal Planner, Clark County Comprehensive Planning. Las Vegas, Nevada. 1993-1994 and April 1998 to June 2004

- Assist in the preparation of regional transportation plans using computer-based transportation models
- Provide policy advice on transportation implications of transporting high-level radioactive waste through the community
- Provide policy advice on transportation planning issues relevant to the rapidly developing community

Graduate Research Assistantships, Planning. Arizona State University. (Fall 2000-Spring 2003)

- Prepared research report for faculty mentors.
- Engaged in professional conference presentations and scholarship development

Executive Consultant. Plangraphics, Muscat Sultanate of Oman 1994-1995.

- Prepared digital geodatabase design to support digital mapping for the Sultanate
- GIS instructor for National Survey Authority management and analyst staff

Transportation Analyst. Nevada State Department of Transportation 1991-1993 and 1996-1998.

- Prepare benefit/cost analysis of statewide transportation Improvement Plan projects
- Prepare GIS maps of Statewide transportation planning projects
- Analyze regional transportation planning reports and studies
- Managed University interns for multiple planning projects-trained interns in GIS.

Professional Affiliations

International Association for Impact Assessment
American Planning Association
National Association of Environmental Professionals

Articles in peer reviewed academic journals

The Next Species of Trouble: Spent Nuclear Fuel Transportation in the United States 2010-2048. American Behavioral Scientist. Winter 2002. (with Robert Halstead).

Using Social Scientific Methodological Approaches to Reducing Risk: How the Risk Reduction Approach Works with Oil and Gas Industries. International Journal of Social Inquiry. January 2008. (with James D. Ballard).

Articles in preparation for peer reviewed academic journals

Alternate Route: Mitigation Planning for Hazardous Materials Transportation. For submission to the Journal of the American Planning Association.

Conference proceedings (peer reviewed)

"State of Nevada Perspective on the U.S. DOE Yucca Mountain Transportation Program" (Paper presented at Waste Management 2008, Phoenix, AZ, with F.C. Dilger & J.D. Ballard)

"Assessing the Vulnerability of Yucca Mountain Shipments: A Threat Matrix for Human-Initiated Events" (Paper presented at Waste Management 2008, Phoenix, AZ, with J.D. Ballard and F.C. Dilger)

"Yucca Mountain Transportation Security Issues: Overview and Update." (Proceedings, Waste Management 2007, Tucson, AZ, with J.D. Ballard and F.C. Dilger)

"Full-Scale Cask Testing Revisited, Again." (Proceedings, Waste Management 2006, Tucson, AZ, with F.C. Dilger)

"Any Way to Run a Railroad: Implications of Dedicated Trains." (Proceedings, Waste Management 2006, Tucson, AZ, with F.C. Dilger)

"Great Expectations: An Examination of Section 180c Funding Allocations." (Proceedings, Waste Management 2006, Tucson, AZ, with F.C. Dilger)

"Railroading Nevada," Nuclear Engineering International Magazine, October 2005 (With F.C. Dilger)

"Hot Time in the City: Which Shipment Mode for High Level Nuclear Waste Affects Urban Areas Most?" (Revised Version of Paper presented at Waste Management 2005, NANP website, with F.C. Dilger)

"Measures of Community Impact for the Transportation of Hazardous Materials: The Case of Indian Tribes and High-Level Nuclear Waste." (Revised Version of Paper presented at Waste Management 2005, NANP website, with F.C. Dilger)

"Integrating Hazards Assessment and Risk Assessment: The Case of the Caliente Rail Corridor to Yucca Mountain." (Revised Version of Paper presented at Waste Management 2005, NANP website, with F.C. Dilger)

"Planning for An Unpredictable Event: Vulnerability and Consequence Reassessment of Attacks on Spent Fuel Shipments." (Revised Version of Paper presented at Waste Management 2005, NANP website, with J.D. Ballard & F.C. Dilger)

"Beyond the Mountains: Nuclear Waste Transportation and the Rediscovery of Nevada." (Proceedings, Waste Management 2004, Tucson, AZ, with F.C. Dilger & J.D. Ballard)

"Testing to Failure: Design of Full-Scale Fire and Impact Tests for Spent Fuel Shipping Casks." (Proceedings, Waste Management 2004, Tucson, AZ, with F.C. Dilger & J.D. Ballard)

"The Next Species of Trouble: Spent Nuclear Fuel Transportation in the United States, 2010-2048," in H.W. Kushner, ed., Nuclear and Radiological Terrorism, American Behavioral Scientist, Vol. 46, No. 6 (February 2003) (with F.C. Dilger)

"Many Roads to Travel: Alternative Approaches to Route Selection for Yucca Mountain Shipments." (Proceedings, Waste Management 2003, Tucson, AZ, with F.C. Dilger)

"Implications of the Baltimore Rail Tunnel Fire for Full-Scale Testing of Shipping Casks." (Proceedings, Waste Management 2003, Tucson, AZ, with F.C. Dilger)

"How Many Did You Say? Historical and Projected Spent Nuclear Fuel Shipments in the United States, 1964-2048." (Proceedings, Waste Management 2003, Tucson, AZ, with F.C. Dilger)

"Rail Access to Yucca Mountain: Critical Issues." (Proceedings, Waste Management 2003, Tucson, AZ, with F.C. Dilger & R.C. Moore)

"Radiological Impacts of Incident-Free Transportation to Yucca Mountain: Collective and Maximally Exposed Individual Doses." (Paper presented at Health Physics Society Annual Meeting, June 2002, NANP website, with H. Collins & R. Gathers)

"Radiological Impacts of Incident-Free Spent Nuclear Fuel Transportation to Yucca Mountain." (Proceedings, Waste Management 2002, Tucson, AZ, with H. Collins & R. Gathers)

"Meet the Maximally Exposed Member of the Public: The Service Station Attendant and SNF Trucks Going to Yucca Mountain." (Proceedings, Waste Management 2002, Tucson, AZ, with H. Collins & R. Gathers)

"Nuclear Waste Transportation Terrorism and Sabotage: Critical Issues," Proceedings of the International Symposium on Packaging and Transportation of Radioactive Materials (PATRAM), Chicago, IL, September 2001, with D. Ballard and F. Dilger)

"State of Nevada Studies of Potential Terrorism and Sabotage Against Spent Fuel Shipments," Proceedings of Waste Management '01, Tucson, AZ, February 2001, with D. Ballard and F. Dilger)

GIS in Regional Transportation Planning. Proceedings of the International Society of Civil and Electrical Engineers. July 1993. (With P. Lima).

A Geographic Information/Transportation Modeling System. Proceedings of the Institute of Transportation Engineers. July 1993. (With P. Lima and R. Souleyrette).

Recent government agency reports

"Terrorist Attacks on Nuclear Power Plants and Nuclear Material Transports." Various co-authors expert report for NATO project grant SST.CLG.978964. June 2004.

"Integrating Hazards Assessment and Environmental Impact Assessment in a GIS Framework" Nevada Agency for Nuclear Projects. August 2004.

"Impacts of Transporting Spent Nuclear Fuel and High-Level Radioactive Waste through Clark County, Nevada." Clark County, Nevada June 2001.

"Risk Assessment for the Transportation of Spent Nuclear Fuel through Inyo County, California." A report for the Inyo County Board of Supervisors. April 2006.

Expert Testimony

Risks Associated with the Transportation of Spent Nuclear Fuel. Minnesota Legislative Committee on Roads and Highways. July 2006.

Truck and Rail Shipments of High Level Radioactive Waste through Nevada. Nevada Legislative Committee on Roads and Highways. June 2000.

Implications of Alternative Rail Alignments on the Yucca Mountain Project. Nevada Legislative Committee on High Level Radioactive Waste. October 1999.

Nuclear Regulatory Commission, Package Performance Study. Spring 1999.

Selected Media Contacts
Interviews with 60 Minutes episode aired in November 2003. The Las Vegas Sun 1998-2004. Washington Post 2000.

Selected State/Local and community presentations

Mitigating Routine High Level Waste Transportation. Presentation to the Western Planning Experience Las Vegas. August 8th, 2003

"Route Selection for High-Level Radioactive Waste Shipments to Yucca Mountain." HAZMAT EXPLO 2003. Las Vegas. December 2003.

High Level Waste Transportation and Tribal Issues. Native American Forum on Nuclear Issues Las Vegas. August 26, 27, 28, 2003.

"Highway Alternatives for Shipping High-Level Radioactive Waste Shipments to Yucca Mountain." HAZMAT EXPLO 2002. Las Vegas. December 2002

ATTACHMENT B

to the Affidavit of Fred C. Dilger

ATTACHMENT B

Contentions Adopted By **Fred C. Dilger** In Accordance With Affidavit	Unique Identifier Assigned by Counsel per PAPO Order
DOE's NEPA Documents Impermissibly Segment The Project By Deferring Analysis Of The Environmental Impacts Of Transportation Of Spent Nuclear Fuel And High-Level Waste Through California To Yucca Mountain	CAL-NEPA-1
DOE's NEPA Documents Impermissibly Segment The Project As To Route Selection And Route-Specific Impact Analysis	CAL-NEPA-2
DOE's NEPA Documents Impermissibly Fail To Analyze And Disclose Different Environmental Impacts From the Mina and Caliente Routes	CAL-NEPA-3
DOE'S NEPA Documents Fail to Adequately Discuss or Analyze Mitigation in California Adequately	CAL-NEPA-4
DOE's NEPA Documents Are Based On An Incomplete And Inaccurate Project Description, Since A Doubling Or Tripling Yucca Mountain' s Capacity Is Reasonably Foreseeable Due To Doe's Request To Congress To Authorize Such A Capacity Increase	CAL-NEPA-5
DOE'S NEPA Documents Fail to Adequately Describe Transportation Impacts on Emergency Services in San	CAL-NEPA-7

Bernardino County	
DOE'S NEPA Documents Fails to Describe the Maximum Reasonably Foreseeable Accident	CAL-NEPA-8
DOE Failed To Comply With NEPA's Procedural Requirements For Full Public Review And Opportunity for Comments in California	CAL-NEPA-9
Failure To Analyze Impacts Of Intermodal Transfers	CAL-NEPA-10
Failure To Evaluate Impacts Within All Radiologic Regions Of Influence	CAL-NEPA-11
Failure to Discuss and Analyze Collocation Risks	CAL-NEPA-12
Failure to Discuss and Analyze Barge Risks	CAL-NEPA-13
Failure To Describe And Analyze Waste Acceptance Criteria	CAL-NEPA-14
By Using Representative Routes, DOE Has Failed to Analyze Environmental Impacts of Probable Routes Railroads Would Use	CAL-NEPA-15
DOE Has Ignored the NAS Recommendation of Independent Examination of the Security of Shipments	CAL-NEPA-16
Environmental Impacts from the Use of Heavy Haul Trucks at Local Sites	CAL-NEPA-17
Failure to Analyze Impacts from the Use of California State Route 299	CAL-NEPA-18
Failure to Analyze Use of TAD Canisters	CAL-NEPA-19
Failure to Adequately Analyze Impacts on Local Emergency Management Responsibilities	CAL-NEPA-20

ATTACHMENT C

to the Affidavit of Fred C. Dilger

Memorandum

To: Susan Durbin

From: Fred C. Dilger PhD

Date: 12/18/2008

Re: Technical Memo Supporting California's Contention on the Radiological Region of Influence

---

This memo describes how the contractor derived the estimates of population, emergency management facilities fire departments, police departments and schools within the radiological regions of influence (ROI) for both incident-free and accident related transportation. The memo describes the software, data, and process used to derive the estimated impacts.

In order to estimate the impacts within the region of influence, two GIS software products were used. First, ARCMAP by ESRI, the second, Maptitude, produced by Caliper Corporation. Both versions are licensed commercial versions of the software. The ARCMAP software was used to derive the estimates, Maptitiude was used to confirm the estimates from ARCMAP-a redundant check on the outputs.

The census data used was from the Bureau of the Census and is provided with the software. The census 2000 numbers were used. There are more recent estimates available, but they are not the decennial census and so were not used. Additional data was from the Federal Emergency Management Agency's (FEMA) MH-HAZUS database. The data in this database was from October 2006.

The process used was:

1) Define the road/rail network from the FSEIS representative routes. Select the routes from the highway and rail data layers to create layers with road and rail routes

2) Define two buffers around each of the segments of the road and rail data. The first buffer is 1600 meters in total width measured from the centerline of the roadway or rail segment (800 meters on either side). This distance reflects the ROI for incident-free transportation. The second buffer is 50 miles on either side of the roadway or rail segment and reflects the ROI for accidents or sabotage.

3) Each buffer is separately overlaid onto a base map containing the following data layers:

    a. Schools

    b. Fire departments

    c. Police Departments

    d. Emergency Centers

    e. Hospitals

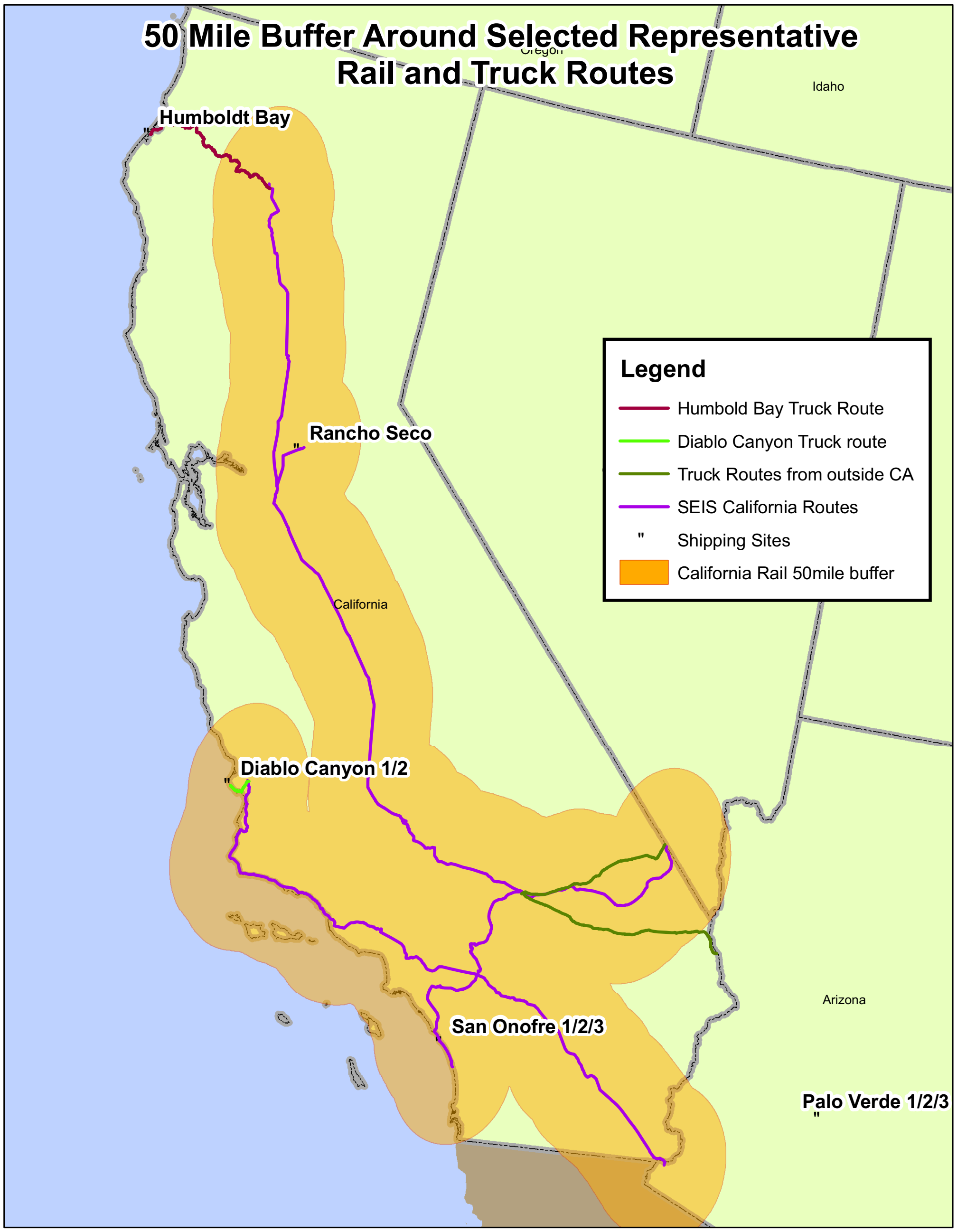
    f. Census tracts

5). The software selects the features that fall within the area of the buffer. For census data the software calculates the percentage of the overlaid area that falls within the buffer and then calculates the percentage of the attribute (in this case population) from the overlaid area that would be affected.

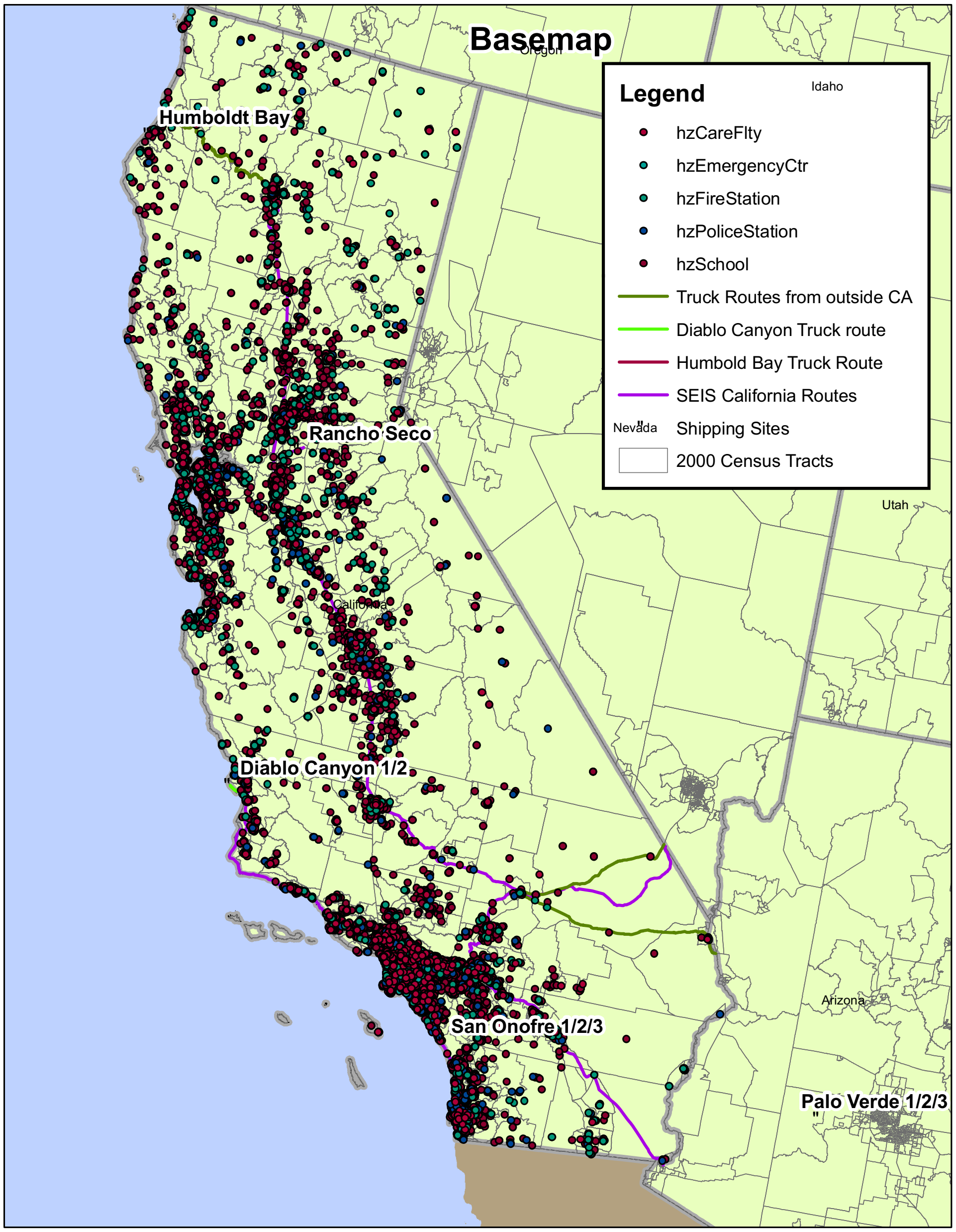
6). The process was then repeated for the other software and the results are compared to determine if there were different results. The process is illustrated below in these sample maps.

1. Identify California representative routes

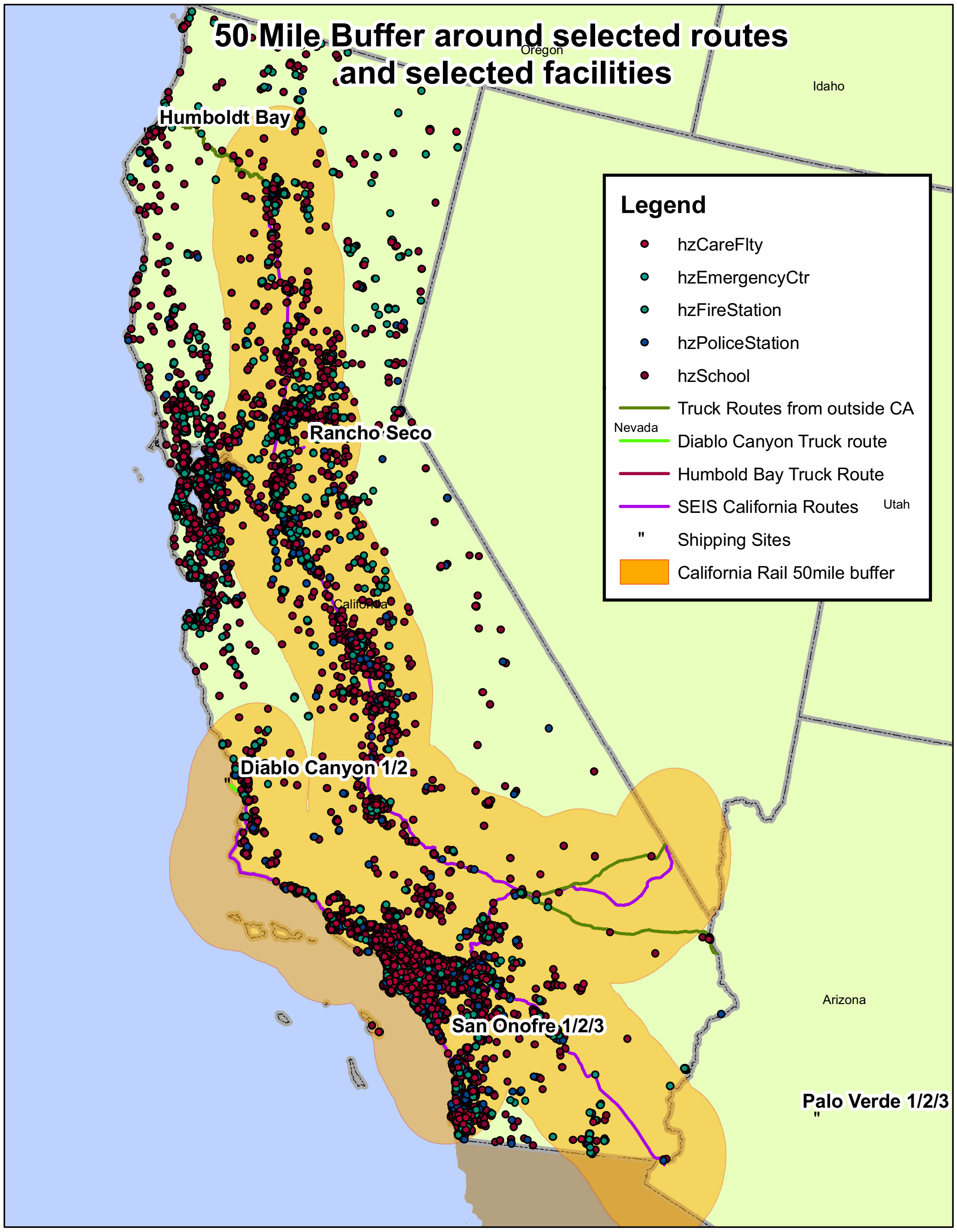
2. Define buffers around representative route features



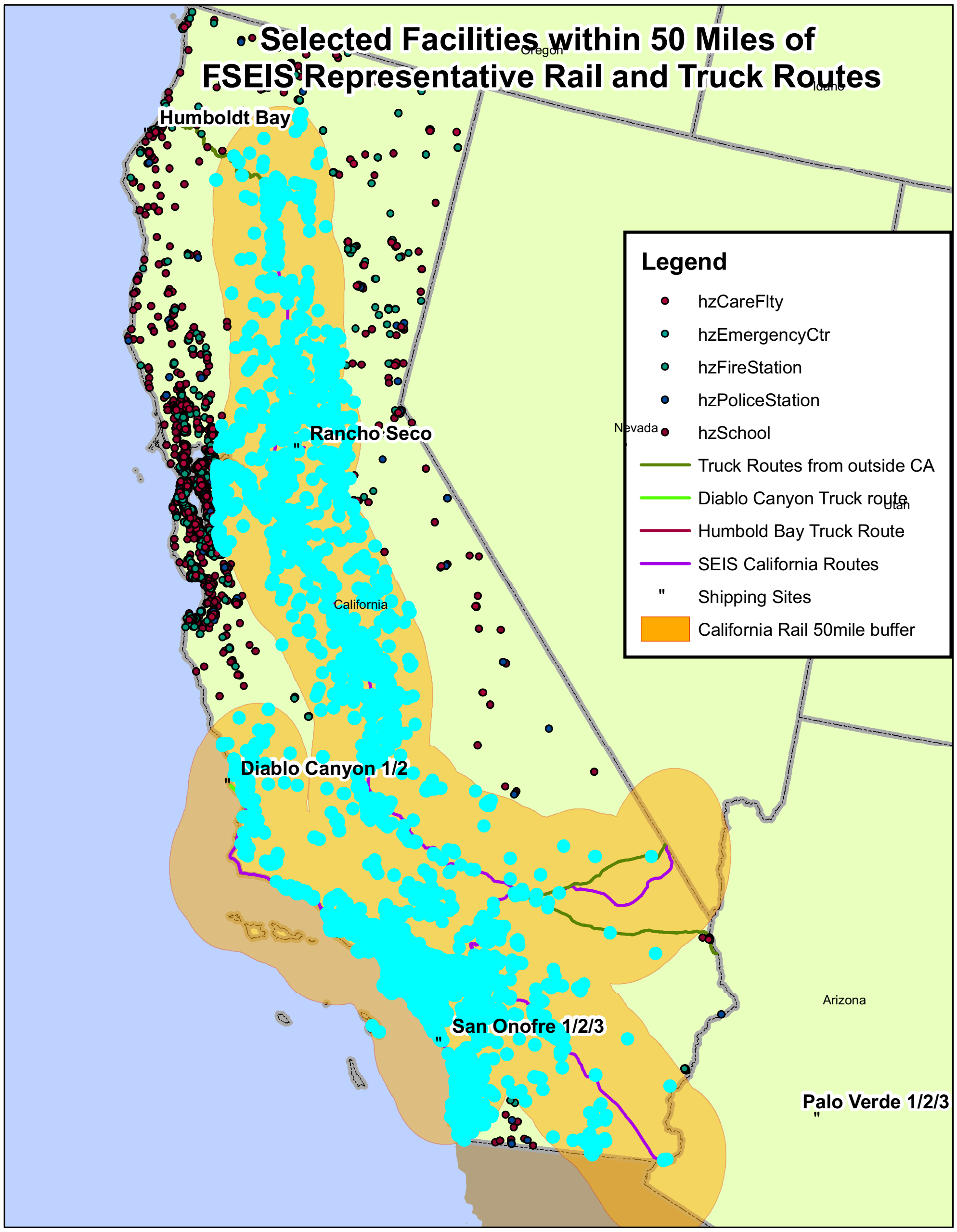
3. Create Base map



4. Perform Overlay and select facilities within buffer areas



Step 5 Select features within the buffers



Step 6: Repeat the process with Maptitude to confirm results

The results of this assessment confirm that a large number of facilities in California fall within both the Regions of Influence for incident-free and incident related accidents. It is important to note that although the Region on Influence for Incidents and Sabotage is 50 miles (100 miles in width); there is no incident that will encompass all of the representative routes shown. However, all of the facilities selected are within that region and are therefore susceptible should an incident of this type occur.

Results of the Analysis are below

Feature	Number within 800 meters	Number within 50 miles
Medical Care facility	35	343
Emergency Center	7	31
Fire Station	53	480
Police Station	99	741
Schools	618	9392
Census Tract Population	1,876,115	28,778,868

Table 1 California features affected by representative rail routes in FSEIS

Feature	Number within 800 meters	Number within 50 miles
Medical Care facility	2	46
Emergency Center	1	4
Fire Station	8	97
Police Station	9	114
Schools	38	1,045
Census Tract Population	53,876	2,563,011

Table 2 California features affected by representative truck routes in FSEIS

In order to avoid double counting features, the buffers were merged together and the features were overlaid using the dame process. The Table below represents the numbers of unique features and the population affected by the incident free and incident related transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mt.

Feature	Number within 800 meters	Number within 50 miles
Medical Care facility	33	364
Emergency Center	6	33
Fire Station	64	534
Police Station	102	773
Schools	631	10,051
Census Tract Population	1,896,837	28,904,799

Table 3 California features affected by representative rail and truck routes in FSEIS

Data comparison

Data were identical for all of the features when the process was repeated using the Maptitude software. There was a slight difference between the numbers calculated for Census Tract populations (less than 2%). This can be attributed to rounding error.

Conclusion

The results of this analysis indicate that there are substantial California populations and sensitive facilities within the Regions of Influence for both incident free and accident or sabotage related transportation routes. Using readily available software and data it was possible to provide very detailed estimates of the impacts of the FSEIS shipping program on California. The FSEIS provided extremely detailed assessment of some of the impacts of the proposed action in Nevada. However, this detailed analysis is not provided for California.

ATTACHMENT D

to the Affidavit of Fred C. Dilger

Memorandum

To: Susan Durbin

From: Fred Dilger PhD.

Date: 12/18/2008

Re: Technical Memo Supporting California's Contention on the Collocation of Facilities

---

This memo describes the process, steps, and data used to examine the degree of collocation of oil and gas facilities in San Bernardino County with the FSEIS representative rail routes. This is a relevant endeavor because there is a history of accidents in the area. A least one of these accidents was made more severe because of the collocation of gas transmission lines with the rail line. The accident prompted the Federal Emergency Management Agency to study the problem of collocation. FEMA found approximately 250 lifeline facilities collocated in the El Cajon Pass region of California. The routes identified by the FSEIS as representative routes traverse all of California, but many of the representative routes merge in San Bernardino County, CA. This is primarily due to the topography. The El Cajon Pass is the best vehicular route through the southern portion of the mountains in that region.

The DOE has not considered that there are unique local conditions that may increase the probability or the severity of an accident occurring in California. The FSEIS relied in statewide accident rates to calculate the risks of the proposed action. The DOE failed to adequately consider the risks in specific locations. This makes the analysis contained in the FSEIS overly generic. It fails to consider the specific implications of the proposed action. For example, what is the accident rate on the specific stretch of railway through San Bernardino County and what have been the consequences of severe accidents in this area.

To highlight this problem, the oil and gas transmission lines from the National Pipeline Mapping System (NPMS) were downloaded from the PMPSHA in December of 2008. The national map is enclosure 1. A map of San Bernardino County was obtained from the same source at the same time. The County map is enclosure 2. The map was provided to a commercial data vendor (Digital Data Services of Lakewood, Colorado) which digitized in the features on the NPMS map. Because the original data was not available, the pipeline features are in approximate locations.

The process used to show the intensity of the collocation was to create a basemap layer of transportation features, including the FSEIS representative routes. The basemap was then overlaid with pipelines. The map of San Bernardino County shows the number of relevant facilities in the area. Because the facilities merge in certain areas, detail maps were prepared to show the areas where the greatest concentrations occurred. These maps are figures 1-5 below

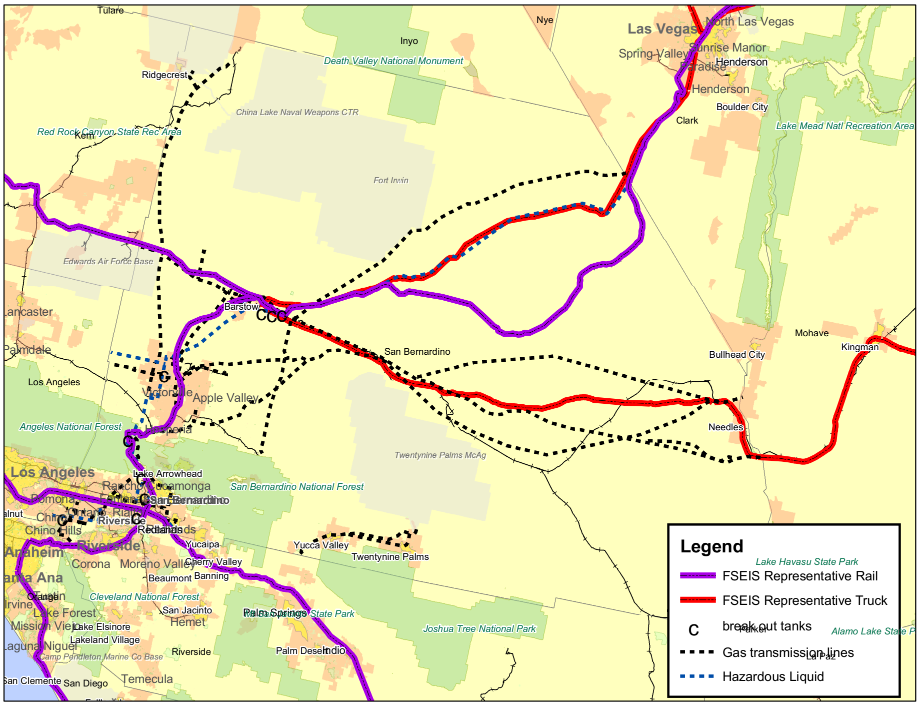


Figure 1 San Bernardino County FSEIS Routes and Hazardous Materials Pipelines

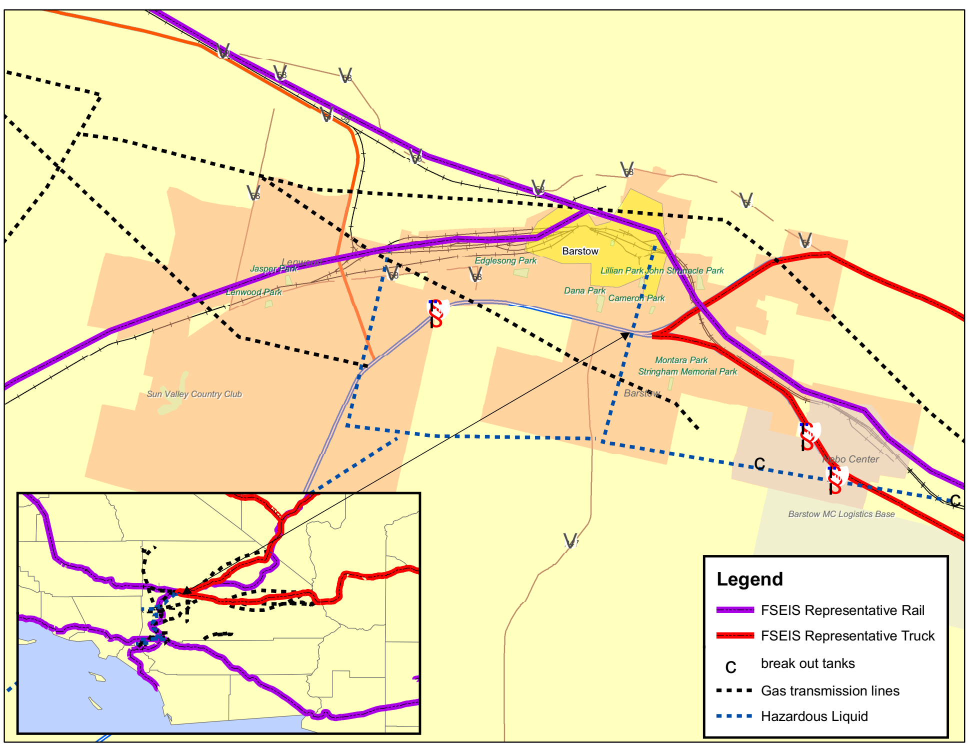


Figure 2 Barstow detail map

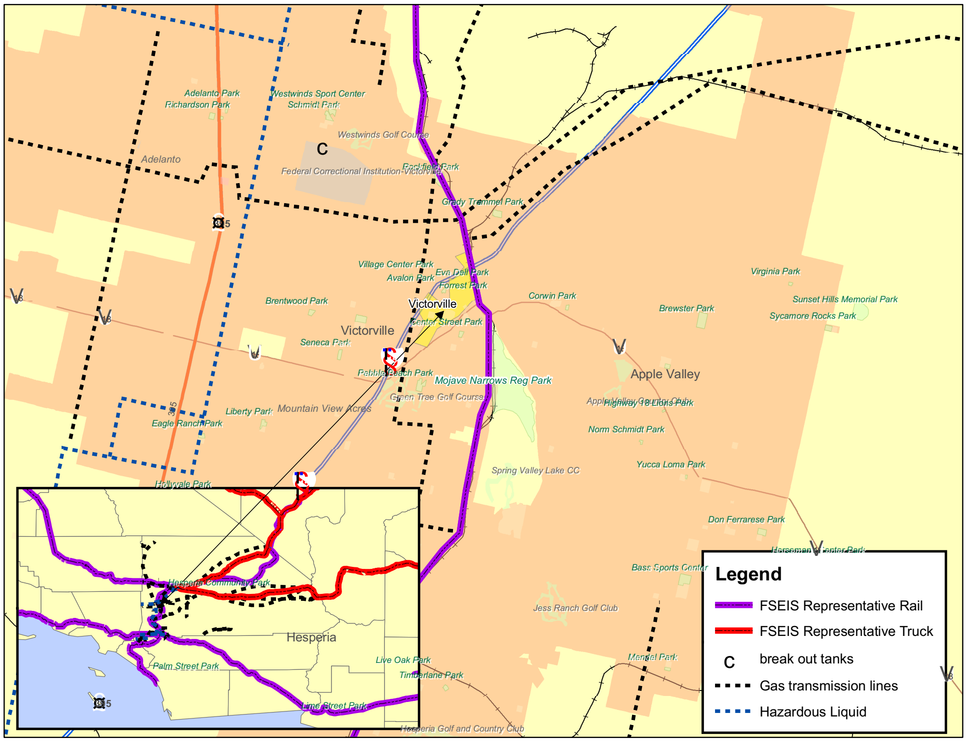


Figure 3 Victorville detail map

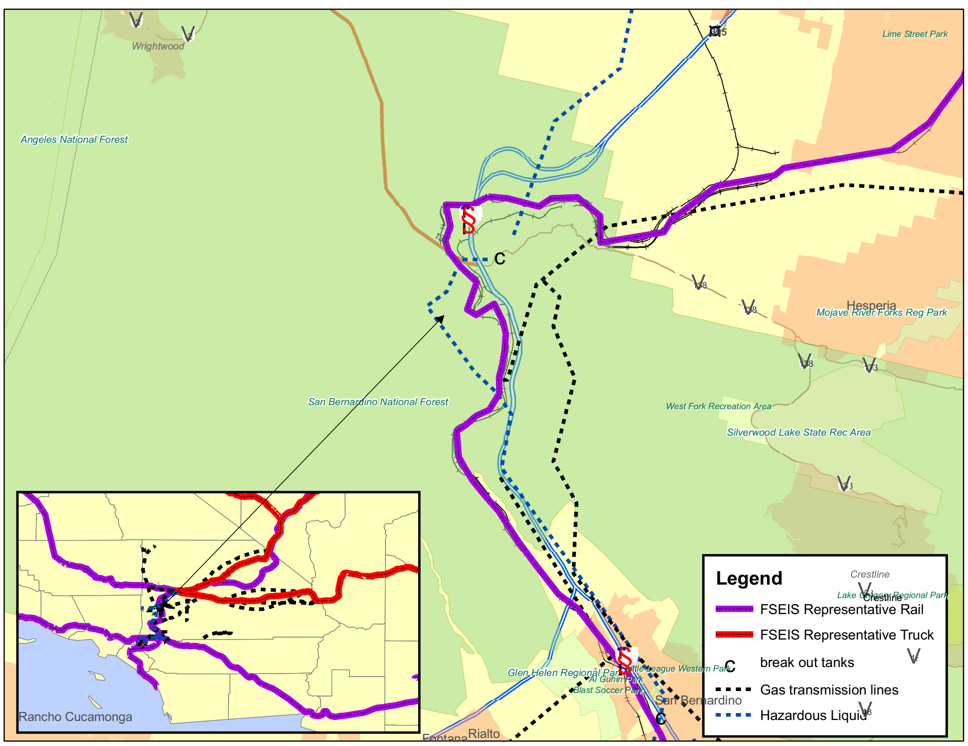


Figure 4 El Cajon Pass

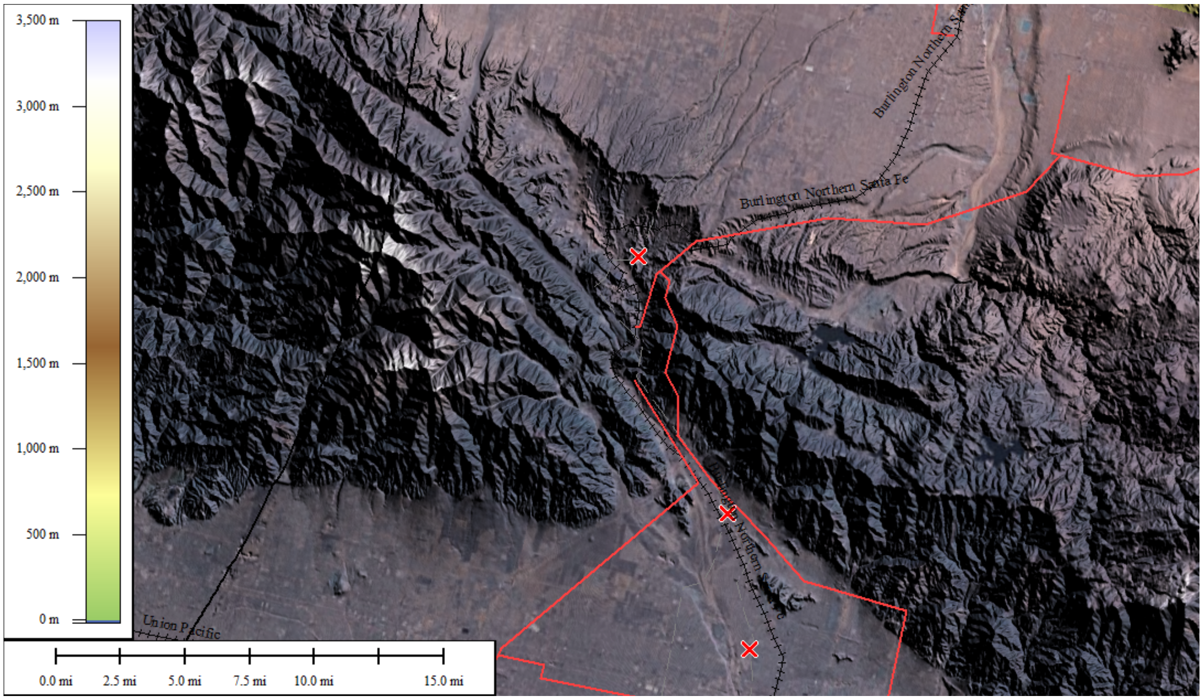


Figure 5 El Cajon Pass Texture Map aerial photos

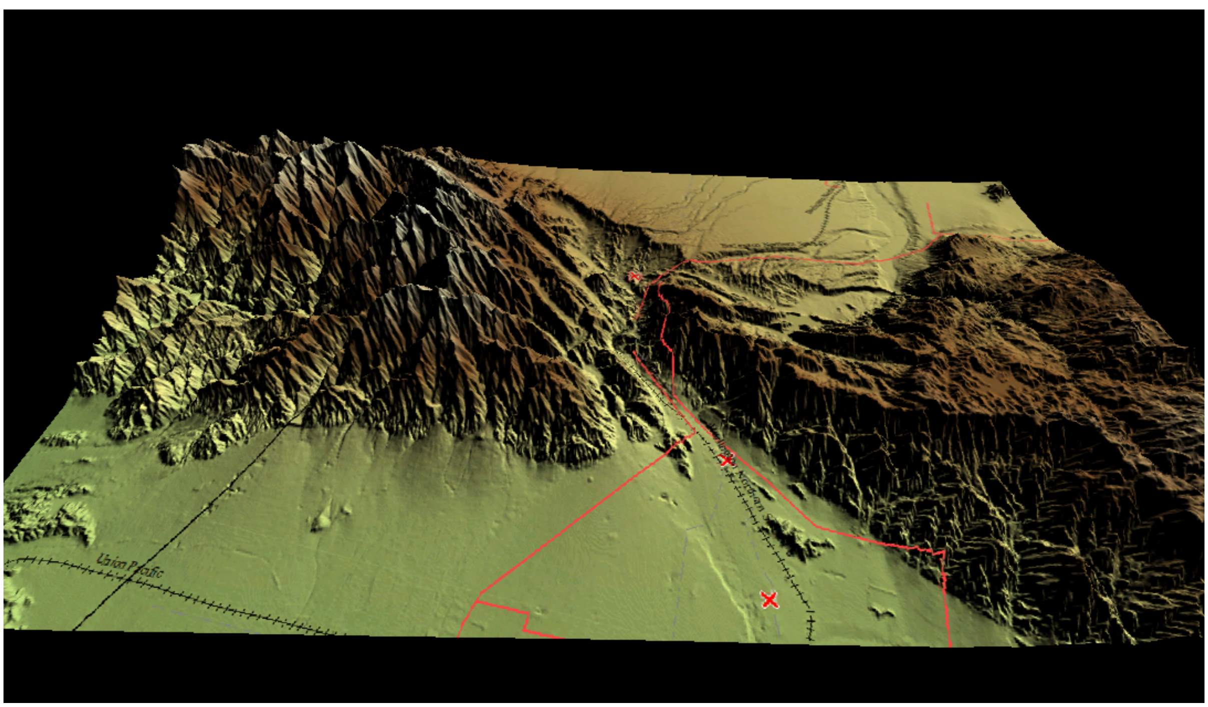


Figure 6 Three dimensional view of El Cajon pass

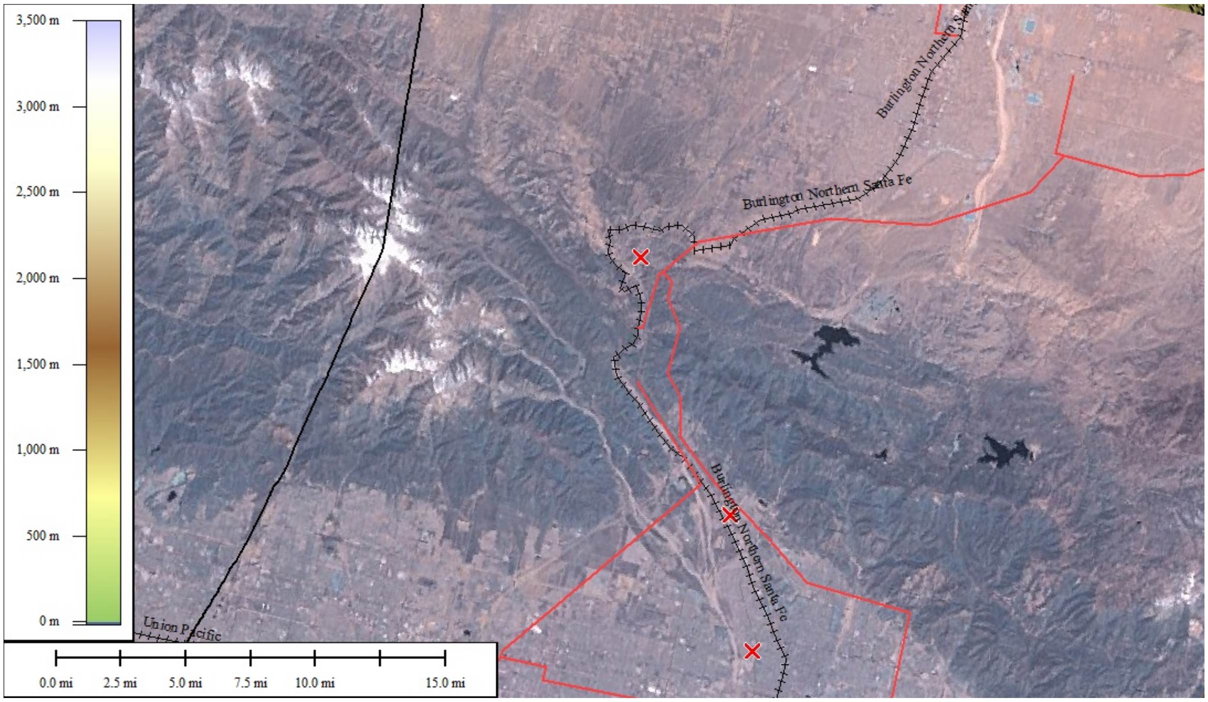


Figure 7 Aerial Photos of the El Cajon area

The area of the El Cajon Pass was studied in additional detail because the area has a history of severe accidents. The maps in figures 4-7 show various views of the pass with aerial photographs and texture mapping. To produce these maps , the shapefiles were loaded into the Globalmapper sofware and the USGS' 30 meter resolution and LandSat 7Global Imagery. The red lines represent gas transmission line and hazardous liquid pipelines. The railroads depcited here are FSEIS routes. The red X's are breaout tanks for hazardous materials.

Mapping only the pipeline facilities in the El Cajon region showed the concentration of pi[peliens and SEIS routes. This area highligths the limitations in the generic approach to accident risk caluclations adopted by the DOE.

Conclusion

The DOE's assessment of the transportation impacts of its proposed action relied on the use of representative routes that may or may not be the actual routes. It also relied on state level accident rates that overlooked or obscured specific areas where severe accidents have recurred. The assessment of accident consequences also overlooks the significance of collocated facilities which may contribute to the probability or the severity of an accident.

The shortcomings of this generic approach are highlighted by the El Cajon Pass in California. According to the FSEIS representative routes, possibly 692 casks comprising 233 shipments will traverse this area over a 30 year period. This is an area where severe accidents have occurred at least three times in the past. It is an area with a significant number of facilities that could make an accident worse or whose disruption could increase the consequences of an accident. The DOE's method of analyzing its proposed action ignores significant local conditions that could effects the consequences of its results.

ATTACHMENT E

to the Affidavit of Fred C. Dilger

Memorandum

To: Susan Durbin

From: Fred Dilger PhD.

Date: 12/18/2008

Re: Technical Memo Supporting California's Contention on Rail Industry Routes

---

This memo describes the process, steps, and data used to compare the FSEIS representative rail routes with the routes proposed by the Union Pacific Railroad's (UPRR) representative Roger Dolson at the Transportation External Coordination Working Group (TEC) meeting in September of 2005 at Pueblo Colorado. Mr. Dolson's presentation is significant for four reasons. First, because it provides a suggested routing method for rail shipments of spent nuclear fuel. Second, because the DOE failed to use the Union Pacific's suggestion in subsequent discussions of rail routing to Yucca Mt. The third reason the presentation is important is because the presentation highlights the small portion of the Union Pacific railroad's total business that spent nuclear fuel shipments comprise. The fourth significant part of the presentation is that it alludes to the resolution of the Aberdeen and Rockfish case which enables the railroads and DOE to set rates for transporting the spent fuel.

The UPRR understands the business of rail shipping and has expertise shipping all varieties of hazardous materials. The routes indicated on the slide provide a basis for calculating a rail routing system for spent nuclear fuel that is suitable for the railroads. This is the first ever specific expression of the railroad industry's routing desires for routes to Yucca Mt.

The DOE has not adopted the rail industry's wishes with regard to these routes and has not adopted them. Throughout 2008, TEC routing group conference calls ended with a desire to receive rail industry input into what the routing for spent nuclear fuel should be. Rather than adopt what has already been proposed. The DOE has essentially failed to consider the rail industry's proposal.

Shipments of SNF to Yucca Mt. comprise a tiny portion of the UPRR's business. In 2004, the UPRR handled over nine million shipments of hazardous material. The 1,100 shipments of spent nuclear fuel are a small percentage of the UPRR's total business. Therefore, conventional models of rail activity probably do not apply to these shipments. The economic impact of the shipments will be too small. Additionally, the risk created by the shipments will outweigh any potential profit. This makes the Union Pacific's routing request more important.

Slide 28 of the presentation alludes to the settlement of the Aberdeen and Rockfish case which sets a basis for shipping rates for the spent nuclear fuel. As the presentation states, it provides a "structure to move forward."

Using the routes contained in the UPRR, it is possible to construct a set of national routes using these routes as a basis. The DOE did not do this in the FSEIS and the DOE has consistently failed to national routes for the shipment of spent nuclear fuel. The failure to define these routes essentially means the affected environment has not been adequately defined.

The map below depicts a set of routes using the UPRR rail routing. In order to develop the maps, the DOE's webtragis program was used to define routes from the eastern origins to the Midwest UPRR gateway sites. Then the routes from the gateways to Yucca Mountain were defined. The outputs from Webtragis were placed into ESRI's ARCMAP software and a map created from the resulting shapefiles.

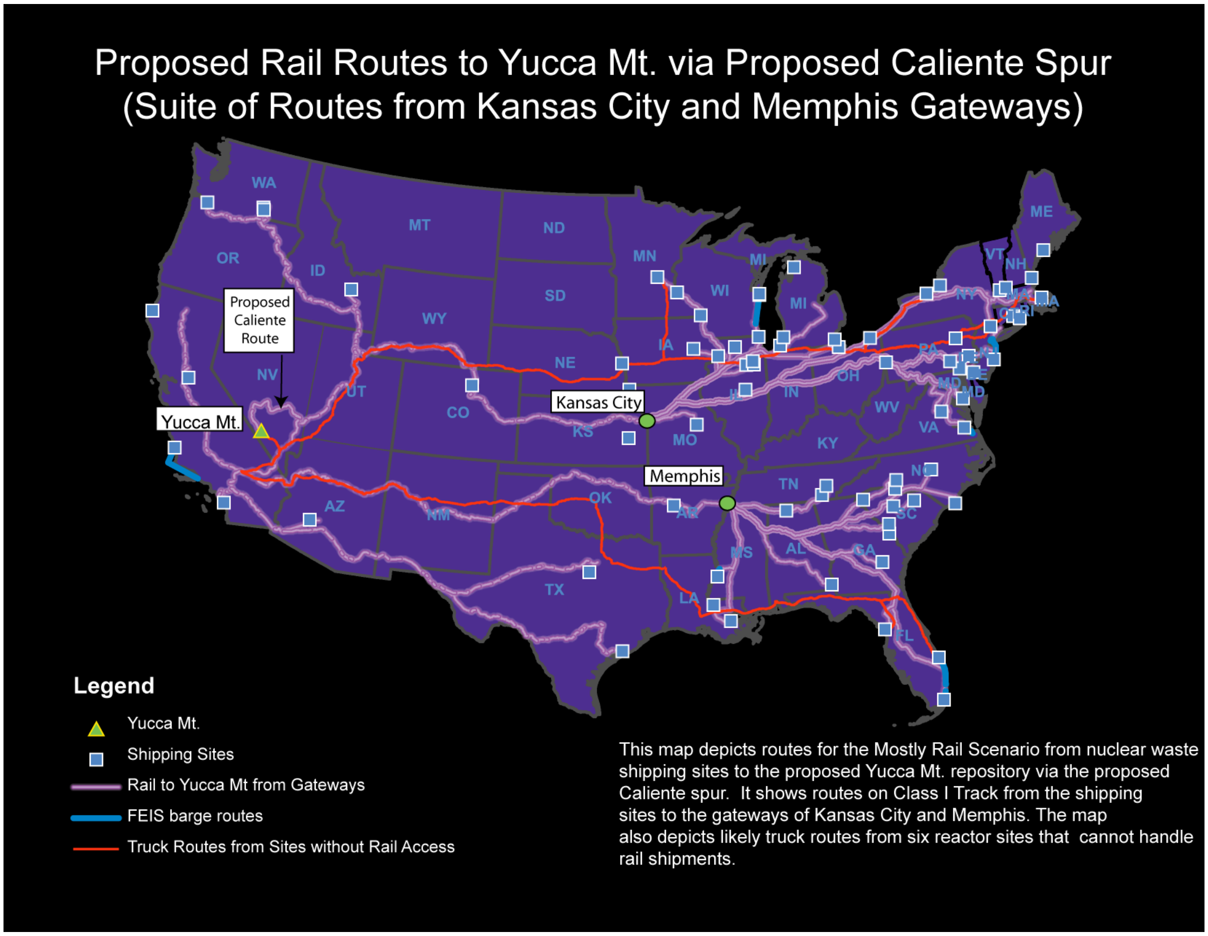


Figure 8 UPRR rail routes from Gateways to Yucca Mt.

This routing method would greatly increase the shipments traversing California and differ significantly from the FSEIS' representative routes. If the FSEIS representative routes are used, California will traversed by shipments from the following generating sites. The tables below do not include truck shipping sites.

Source	Total Casks	Shipments
PaloVerde	199	67
Diablo Canyon	122	41
Humboldt Bay	5	2
Rancho Seco	21	7
San Onofre	151	51
Comanche Peak	99	33
South Texas 1/2	95	32
Total	692	233

Figure 9 FSEIS shipments through California

If the UPRR considered the railroads desires, California will be traversed by shipments from the following generating sites.

Source	Total Casks	Shipments
Browns Ferry	245	82
Farley	130	44
Arkansas	127	43
PaloVerde	199	67
Diablo Canyon	122	41
Humboldt Bay	5	2
Rancho Seco	21	7
San Onofre	151	51
St Lucie	138	46
Hatch	177	59
Vogtle	115	39
River Bend	70	24
Waterford	63	21
Grand Gulf	100	34
Brunswick	84	28
Brunswick	15	5
Harris	64	22
Harris	64	22
McGuire	152	51
Catawba	123	41
Oconee	186	62
Robinson	31	11
Savannah River Site	698	140
Savannah River Site	45	9
Summer	55	19
Sequoyah	120	40
Watts Bar	30	10
Comanche Peak	99	33
South Texas 1/2	95	32
Total	**2894**	**873**

Figure 10 UPRR routes through California

The use of the UPRR routing process could result in a significant increase in shipments through California.

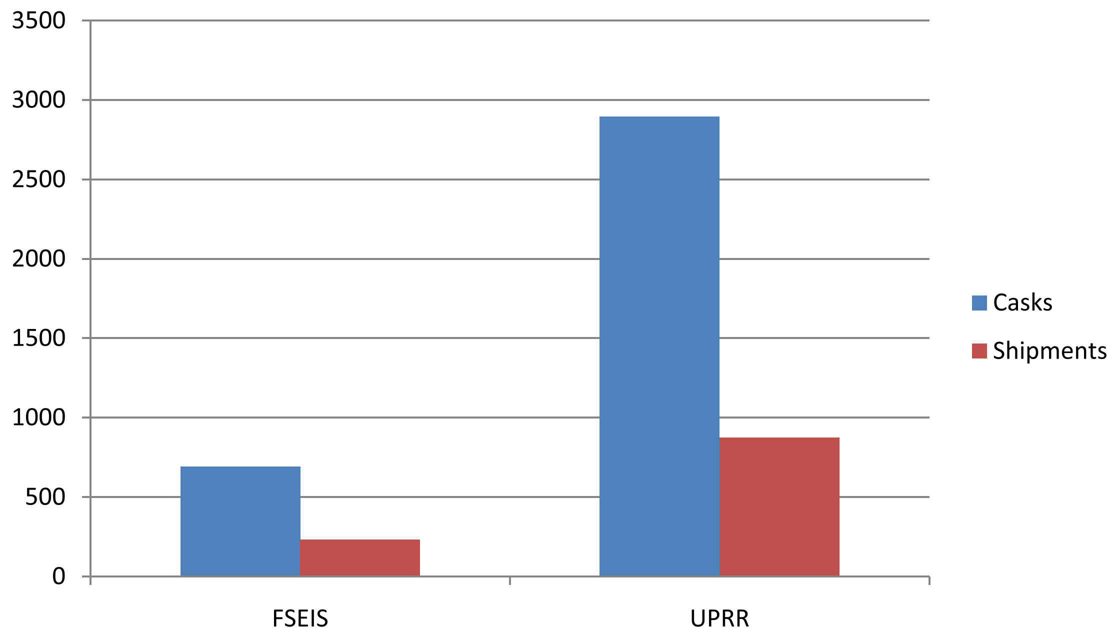


Figure 11 Comparison of shipments through CA-UPRR and FSEIS routing

Conclusions

The FSEIS may substantially understate the numbers of shipments through California. The UPRR has suggested alternative routes, which could increase the impacts on California. The DOE has not specified routes that are reasonably foreseeable. The routes described above are those desired by the primary rail carrier for the spent nuclear fuel to Yucca Mountain. The DOE has failed to define it proposed action adequately.

SUPPORTING ATTACHMENT 2

Affidavit of Jan Stepek

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	Docket No. 63-001
U.S. DEPARTMENT OF ENERGY	)	
	)	
(High-Level Waste Repository)	)	
	)	

AFFIDAVIT OF JAN STEPEK

I, Jan Stepek, the undersigned affiant, do hereby make the following statements based upon my own knowledge, information, and belief.

1. My name is Jan Stepek. I have a Masters Degree in Geology and Mining Engineering. I have thirty years of experience in hydrogeology and geological engineering that includes groundwater resources evaluation (qualitative and quantitative), well design, well construction and aquifer testing, investigation of groundwater contamination, monitoring and remedial action design. I also have several years of experience in evaluation of mining impacts on groundwater quality. I worked for 15 months at the proposed Yucca Mountain nuclear waste repository site investigating transmissive properties of the unsaturated zone as a consultant to the Lawrence Berkeley National Laboratory. I am a registered geologist in Alaska, and a Professional Geologist, Certified Engineering Geologist and Certified Hydrogeologist in California. My curriculum vitae is attached to this Affidavit as Attachment A.

2. I am currently employed by the California State Water Resources Control Board (State Water Board) as an engineering geologist. In my capacity as an engineering geologist with the State Water Board, I have extensively studied the Department of Energy's (DOE) activities and

analyses of the Yucca Mountain site and potential repository impacts and have reviewed the findings of other government agencies and scientific panels as they relate to DOE's site suitability evaluations.

3. I am executing this Affidavit in support of the State of California's Petition to Intervene as a Party (Petition) in the above-captioned proceeding.

4. In order to offer an expert opinion for the State of California in the instant proceedings, I have reviewed and am familiar with the portions of the following documents relevant to my expert opinion: the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High –Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F)(2002); *Final Supplemental Environmental Impact Statement Repository for the Disposal of Spent Nuclear Fuel and High –Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (2008)*;* the Petition to Intervene of the State of California, including the accompanying Contentions as identified as CAL-NEPA-21, CAL-NEPA-22, CAL-NEPA-23, CAL-NEPA-24, and CAL-NEPA-25, and all documents cited to or referred to in those Contentions.

5. Within the Petition are numerous Contentions, each comprised of several paragraphs. I hereby adopt as my own opinions the factual and technical statements contained within Paragraph 5 of those specific contentions identified as CAL-NEPA-21, CAL-NEPA-22, CAL-NEPA-23, CAL-NEPA-24, and CAL-NEPA-25.

6. Attached hereto are comments previously submitted in the matter of the Yucca Mountain High-Level Waste Repository. I assisted in the preparation of these comments regarding the environmental analysis, specifically with respect to groundwater, performed by DOE in this matter. I have read and considered these documents, and am familiar with their

contents. I affirm that the factual and technical statements contained therein with respect to groundwater are true and correct to the best of my professional knowledge, and hereby incorporate them into this affidavit.

Further, the affiant sayeth not.

____
Jan Stepek

The above-named affiant personally appeared before me this ___ day of December, 2008, and executed this affidavit.

____
Notary Public

My Commission expires:________________

contents. I affirm that the factual and technical statements contained therein with respect to groundwater are true and correct to the best of my professional knowledge, and hereby incorporate them into this affidavit.

Further, the affiant sayeth not.

Jan Stepek

The above-named affiant personally appeared before me this 18 day of December, 2008, and executed this affidavit.

Patricia K Long

Notary Public

PATRICIA K. LONG
Commission # 1585457
Notary Public - California
Sacramento County
My Comm. Expires Jun 6, 2009

My Commission expires: 6-6-09

ATTACHMENT A

to the Affidavit of Jan Stepek

Jan Stepek, R.G., C.E.G, C.H.G.
7700 Juan Way
Fair Oaks, California 95628

Phone: (916) 962-9235 home
(916) 341-5777 work
E-mail stepekj@waterboards.ca.gov

CURRICULUM VITAE

SUMMARY

Senior Hydrogeologist/Engineering Geologist, with 30 years of progressively responsible experience with environmental consulting companies, state and federal agencies. Experienced with various phases of environmental projects, including management, design, testing, permitting and regulations. Applying extensive field and computer modeling experience on projects related to soil and ground-water remediation and protection.

PROFESSIONAL EXPERIENCE

ENGINEERING GEOLOGIST May 1999 – present
State Water Resources Control Board -DWQ

Reviewing Waste Discharge Requirement documents, landfill design, evaluating an Environmental Impact Statement for a proposed radioactive waste repository at Yucca Mt., delineating California's aquifers vulnerable to a rapid infiltration of contaminants, developing and implementation of the GAMA (domestic and priority basin, special studies) program.

SENIOR RESEARCH ASSISTANT February 1998 – May 1999
Lawrence Berkeley National Laboratory, Berkeley, CA

Testing and determination of transmissive properties of fractured rock at the proposed radioactive waste repository, Yucca Mountain, Nevada.

- Installed and programmed sensors to monitor moisture, humidity, temperature and pressure during field tests.
- Conducted tests and collected data on fluid and air injection experiments.
- Collected and processed the data, participated in data interpretation and presentation.

SENIOR HYDROGEOLOGIST 1986 - 1997
EA Engineering, Science, and Technology, Inc., Lafayette, CA

Responsible for investigation, and interpretation of hydrogeological and chemical data on contaminated sites, under RECRA and SUPERFUND regulations. Duties included preparation of environmental plans and reports, remediation and monitoring system designs, aquifer testing, overseeing field work and construction activities, flow and transport modeling.

- Conducted field investigations, participated in design and installations of soil and water remediation systems for US Air Force, US Navy, US Army Corps of Engineers, USAID, and private clients.
- Prepared reports, work plans, and permits required by regulatory agency for soil and groundwater investigations and remediation.
- Groundwater flow and chemical transport modeling, using MT3D, MODFLOW, SESOIL and other computer models, in support of risk assessment reports and environmental restoration projects.

Jan Stepek - continue

- Evaluated potential of groundwater quality deterioration and land subsidence due to land development and aquifer overdraft, and recommended mitigation strategies.

- Investigated and evaluated environmental impact of water discharge from a wastewater treatment plant into a lake near Alexandria in Egypt. Also, designed and installed a groundwater monitoring system for a sludge disposal site in Alexandria, Egypt.

- Evaluated potential impact of mine dewatering and surface water diversion on groundwater conditions, stream flows and riparian vegetation.

ESTE, Inc., France
PROJECT ENGINEER 1980 -- 1981

- Design and drafting of automated packing lines for food industries.

Hydro-Geo, Inc., Poland
HYDROGEOLOGIST 1976 --1980

- Responsible for the drilling of exploratory boreholes, soil property evaluation for construction projects, installation of water supply and dewatering wells, interpretation of pumping test data and modeling of groundwater flow.

REGISTRATIONS and CERTIFICATIONS

Registered Geologist, California, 1988
Certified Engineering Geologist, California, 1993
Certified Hydrogeologist, California, 1995

EDUCATION

MS, Mining Engineering and Geology; Institute of Mining and Metallurgy, Cracow;
Numerical Modeling of Groundwater Flow and Contaminant Transport; UC Berkeley
Groundwater Pollution and Hydrology; Princeton Course
OSHA 40-hour, Hazardous Waste Site Operations Training; 1988

PROFESSIONAL AFFILIATION

Association of Ground Water Scientists and Engineers

SKILLS

Computer: MS Office, Graf4win, MODFLOW, MT3D
Instruments: Various Data Loggers, PID/FID, GPS,
Languages: Polish, French,

PUBLICATION

Stepek, J. 1986. Underground Fuel Contamination, Investigation and Remediation: A Risk Assessment Approach to How Clean is Clean. Proceedings of API/NWWA Conference, Petroleum Hydrocarbons in the Subsurface Environment. Co-authored by R.E. Hinchee, H.J. Reisinger, D. Burris, and B. Marks

ADDITIONAL ATTACHMENTS

to the Affidavit of Jan Stepek

CALIFORNIA ENERGY COMMISSION
JAMES D. BOYD
COMMISSIONER and VICE CHAIR
1516 NINTH STREET, MS-34
SACRAMENTO, CA 95814-5512
(916) 654-3787
(916) 653-1279 FAX

January 10, 2008

Dr. Jane Summerson
Mr. Lee Bishop
Environmental Impact Statement Office
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1551 Hillshire Drive
Las Vegas, Nevada 89134

Subject: The State of California's Comments on the U.S. Department of Energy (DOE) Draft Environmental Impact Statements Related to a Proposed Geologic Repository at Yucca Mountain, Nevada
(DOE/EIS-0250F-S1D, DOE/EIS-0250F-SS2D, DOE/EIS-0369D)

Dear Dr. Summerson and Mr. Bishop:

On behalf of the State of California, I am writing to provide comments on the following U.S. Department of Energy (DOE) documents:

- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1D)
- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D)
- *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369D)

Our comments supplement and update those provided by Ms. Barbara Byron, California Energy Commission, at DOE's public meeting in Reno on November 19, 2007, as well as comments that the State of California previously provided on documents prepared by DOE, as required under the National Environmental Policy Act (NEPA) and the Nuclear Waste Policy Act (NWPA), for the proposed repository at Yucca Mountain, Nevada.

Having reviewed these documents, we have concluded that:

- The environmental analyses required under NEPA and the NWPA for the proposed Yucca Mountain high-level radioactive waste repository in Nevada are incomplete until the necessary route-specific transportation analyses and the analyses needed to evaluate the potential groundwater impacts in California, including impacts to the aquifer in the Death Valley region, have been completed.

- DOE has provided insufficient information upon which to make a decision on the suitability of the Yucca Mountain site and to characterize the potential impacts from the proposed actions.

- DOE has provided insufficient information and analyses on the proposed Transportation, Aging and Disposal (TAD) canister system and the at-reactor impacts compared with alternatives.

- DOE's proposal to transport 70,000 metric tons of spent nuclear fuel to Yucca Mountain would have major transportation impacts in California. The transportation of materials to the repository could impact approximately 22 California counties impacted by potential repository shipments if by truck and 24 counties for repository shipments if by rail. In addition, projected large numbers of spent nuclear fuel and high-level waste shipments from out-of-state would traverse major metropolitan areas in California, could have major impacts on transportation hubs and systems including goods movement throughout the state, and could traverse unsuitable back-country roads in San Bernardino and Inyo Counties.

- DOE's proposed action could have significant groundwater impacts in California. Additional studies are needed to fully evaluate these potential impacts.

- The Draft NEPA documents should be revised to fully characterize and bound the potential impacts in California from the proposed action.

Since the 1980s, California has provided comments on various DOE analyses, proposals, and documents related to the proposed repository and its potential impacts from the proposed actions described in these documents. We have raised concerns regarding the potential major impacts in California -- primarily transportation and groundwater impacts -- that have not been adequately addressed and analyzed by the DOE. DOE should address these major concerns in revised Draft NEPA documents and release them for public review and comment before issuing them in final form.

Our more detailed comments and specific recommendations on these documents are attached. If you have any questions regarding these comments, please contact me or Barbara Byron at (916) 654-4976.

Sincerely,

JAMES D. BOYD, Vice Chair and
California State Liaison Officer to
the U.S. Nuclear Regulatory Commission

Attachment: California's Comments on DOE/EIS-0250F-S1D, DOE/EIS-0250F-SS2D, and DOE/EIS-0369D

cc: Dan Dunmoyer, Cabinet Secretary
Mike Chrisman, Secretary for Resources Agency
U.S. Senator Dianne Feinstein
U.S. Senator Barbara Boxer
Jackalyne Pfannenstiel, Chairman
Melissa Jones, Executive Director

<u>Attachment</u>

**STATE OF CALIFORNIA'S COMMENTS
ON THE U.S. DEPARTMENT OF ENERGY'S
DRAFT REPOSITORY SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
AND DRAFT NEVADA RAIL CORRIDOR/ALIGNMENT
ENVIRONMENTAL IMPACT STATEMENTS**

January 10, 2008

INTRODUCTION

The State of California (State) submits these comments in response to the following U.S. Department of Energy's (DOE) documents:

- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F-S1D)*(DSEIS),
- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada—Nevada Rail Transportation Corridor (DOE/EIS-0250F-S2DE)* and *the Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada (DOE/EIS-0369D)* (RA EIS).

Our comments address these three documents together, since the proposed actions described in these documents are inextricably interrelated and have common issues.

The proposed actions pose significant potential new environmental impacts in California that have not been adequately evaluated. These impacts include potential groundwater impacts in the Death Valley National Park region, spent fuel transportation impacts, at-reactor impacts from the proposed new Transportation, Aging and Disposal (TAD) canister system, and potential impacts to wildlife, parks, and natural resources in California.

DOE estimates that the proposed alternate new Mina rail route to the Yucca Mountain Repository could result in 20% of the rail shipments to Yucca Mountain being routed through California. State of Nevada experts estimate that under DOE's proposed "suite of routes" approach for rail routing, 25-50% or more of the shipments to Yucca Mountain could be routed through California. Clearly, in light of such major potential impacts to California, DOE should provide potentially impacted communities along likely corridors in California an opportunity at public meetings to comment on these EISs.

The proposed actions, taken together, comprise major changes to the Yucca Mountain high-level radioactive waste management program. These changes should be adequately characterized and analyzed. These changes affect the waste disposal packages and engineered barrier systems at the repository, the thermal characteristics of the repository, the long-term performance of the waste isolation system for the repository and how it is modeled, as well as the waste packaging, storage and transportation activities at commercial reactor sites and DOE facilities throughout the U.S. and the entire national repository waste transportation system.

Since 1989, California has provided input into the federal nuclear waste management and transportation programs. The California Energy Commission, on behalf of California agencies, testified before DOE and/or provided written comments highlighting major deficiencies in DOE's analyses under the National Environmental Policy Act (NEPA) regarding the potential impacts in California from the proposed repository. The State of California has identified several areas of concern regarding these potential impacts.

In 2000, California agencies completed an extensive review of DOE's Draft Environmental Impact Statement (EIS). Thirteen California agencies with statutory and regulatory authority and/or expertise in transportation, emergency response planning, water quality, hydrogeology, and other environmental areas of concern participated in this review. In summary, California's review concluded that the proposed action described in the Draft EIS will cause significant impacts to California and that DOE's environmental assessment of the repository project was seriously incomplete and deficient both procedurally and substantively under NEPA.

Our comments here are intended to be considered together with the previous comments submitted by the State of California. These include comments on DOE's: (1) Site Characterization Plan Yucca Mountain Site (April 14, 1989); (2) Notice of Intent to prepare an environmental impact statement (EIS) for a geologic repository at Yucca Mountain (September 21, 1995); (3) Draft Yucca Mountain EIS (written comments dated February 10, 2000 and testimony provided February 22, 2000), (4) Supplement to the Draft Yucca Mountain EIS (July 5, 2001), (5) Possible Site Recommendation for Yucca Mountain (October 19, 2001), (6) Notice of intent to prepare an EIS for the alignment, construction and operation of a rail line to Yucca Mountain (May 25, 2004), (7) Amended Notice of Intent to expand the scope of the EIS for the alignment, construction and operation of a rail line to Yucca Mountain and DOE's Supplement to the Final EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste (December 12, 2006), and (8) the Notice of Intent to amend the scope of the Yucca Mountain rail alignment draft EIS and prepare a supplement to the final EIS (testimony November 27, 2006). These documents and the comments they contain are hereby incorporated by reference to the extent that they apply to the unchanged aspects of the currently proposed repository program and analyses in the DSEIS and the RA DEIS.

PROPOSED ACTION

Under the proposed action the U.S. Department of Energy (DOE) proposes to transport approximately 70,000 metric tons of spent fuel and high-level nuclear waste from waste generator and storage sites throughout the U.S. to the proposed repository at Yucca Mountain, Nevada over a 50-year time period. These wastes would include about 63,000 metric tons of commercial spent nuclear fuel and about 7,000 metric tons of DOE spent fuel and high-level radioactive waste. The waste could include surplus weapons-usable plutonium, which DOE would dispose of as part of the high-level radioactive waste inventory. Under the proposed action, spent nuclear fuel and high-level radioactive waste being stored or projected to be generated at 72 commercial and four

DOE sites in 39 states would be shipped to the repository by rail (train) and by truck through 44 states.

Most commercial spent fuel would be packaged at the reactor sites in the proposed new TAD canisters and transported on trains dedicated to these shipments. The TAD canisters have yet to be designed beyond a conceptual level and have yet to be certified by the U.S. Nuclear Regulatory Commission for surface storage, transportation and disposal underground at the repository. DOE cannot use rail transport exclusively, however, because some commercial nuclear power plants lack the ability to load large-capacity rail shipping casks or they are not located adjacent to rail lines. Those sites, for example, Humboldt Bay and Diablo Canyon in California, would use overweight trucks to ship spent nuclear fuel to the repository, or could use heavy-haul trucks or barges to ship spent fuel to the nearest rail line.

At the repository, spent fuel and high-level radioactive waste, sealed in waste packages, would be emplaced underground about 1,000 feet below the surface and about 1,000 feet above the groundwater table. The geologic features of the site and engineered barriers would be designed to help ensure the long-term isolation of the materials from the environment. Under the proposed action DOE would construct and operate a railroad to connect the Yucca Mountain Repository to an existing rail line. DOE's preferred rail corridor is the Caliente rail corridor, which would begin in the southern corner of Nevada near Caliente, Nevada (north of Las Vegas), and would run approximately 330 miles east and then south to Yucca Mountain.

An alternative proposed rail corridor to the Yucca site is called the Mina rail corridor. The Mina line would begin approximately 290 miles northwest of Yucca Mountain, near Wabuska, Nevada (40 miles east of Carson City) and run southeast to Yucca Mountain. Because the proposed Caliente and Mina rail lines would be accessed by entirely different existing rail lines and are separated by hundreds of miles and are at opposite ends of the Yucca Mountain site, which rail alignment that DOE chooses will have a significant impact on the number of shipments through different parts of California (northern versus southern California). The Mina rail route would have greater impacts to northern California with potential high-level waste shipments from Hanford, Washington being transported through Sacramento over Donner Pass to Reno, Nevada. The Caliente route would have greater impacts to southern California, particularly Barstow, San Bernardino County, and the Cajon Pass.

Under the proposed action for disposing of 70,000 metric tons of waste, 9,495 rail casks (about 2,800 trains) and 2,650 truck casks of spent fuel and high-level radioactive waste will be transported to the repository. Under DOE's expanded capacity scenario for the repository (130,000 metric tons), approximately 24,112 rail casks and 5,025 truck casks will be transported to the repository (DSEIS, p. 8-32). The estimated number of shipments for California, under the proposal to dispose of 70,000 metric tons of waste, is 755 rail casks and 857 truck casks using the Caliente Rail Alignment and 1,963 rail casks (20 % of total shipments) and 857 truck casks using the alternate Mina Rail Alignment (DEIS, p. G-64).

Our comments and recommendations on the three new Draft EIS documents are provided below:

NATIONAL ENVIRONMENTAL PROTECTION ACT (NEPA) DEFICIENCIES AND PROCEDURAL CONCERNS

1. **DOE should issue a revised DSEIS for public review and comment before issuing a Final SEIS,**

Major deficiencies that have been identified in DOE's NEPA process for the proposed repository have included DOE's failure to: (1) provide an adequate scoping process, (2) provide a complete and accurate project description, (3) fully disclose the potential transportation impacts and groundwater impacts in California, (4) fully evaluate reasonable alternatives, (5) provide adequate notice of public hearings to affected California communities, (6) perform a comprehensive assessment of potential impacts to the affected environment, and (7) adequately evaluate the potential environmental consequences of the alternatives of the proposed action. Deficiencies and gaps in DOE's evaluation of the environmental impacts from the repository project persist in the three new EIS documents. In fact, these documents and their proposed TAD canister system and description of the alternate rail corridors to Yucca Mountain have only increased the uncertainties and concerns regarding the potential impacts to California from the proposed repository.

In light of these major deficiencies, DOE should first issue a revised DSEIS and RA DEIS for public review before developing and issuing final EIS documents. The purpose of NEPA is to ensure that decision makers and the public are fully informed and have full access to information regarding the potential environmental impacts from proposed actions. Clearly, when the deficiencies of the environmental impact analyses are so severe, the NEPA documents cannot be finalized until these inadequacies are corrected and the public is provided an opportunity to review and comment on the complete analysis.

2. **The DSEIS fails to adequately evaluate the potential impacts to California and provide adequate public notice and opportunity for comment to affected communities in California.**

DOE has failed to meet the requirements under NEPA to fully assess and disclose all potential impacts of the project and provide adequate notice to the communities that would be affected. The DSEIS provides superficial and incomplete discussion of the potential transportation and groundwater impacts in California from the proposed repository as well as the waste generator site impacts in California from using the proposed TAD canister system. It, therefore, fails to fully analyze and consider the project's impacts in our state.

A major flaw in DOE's analysis is that it has yet to identify the rail, truck and/or barge routes for the expected shipments of spent nuclear fuel to the repository. Identifying likely routes is essential to a complete analysis. California has four operating commercial nuclear power reactors (Diablo Canyon Units 1 and 2, San Onofre Generating Station Units 2 and 3), four shut-down commercial nuclear power reactors (Rancho Seco, Humboldt Bay, San Onofre Unit 1, and GE Vallecitos BWR), as well as four operating and four shut-down nuclear test or research reactors. Routes should be identified and route-specific potential impacts evaluated not only for waste shipments originating from these California sites but also from out-of-state.

Potential impacts from large quantity shipments of spent nuclear fuel are significant considering that each TAD rail cask would contain over 650,000 curies of Cesium-137 with a contact surface dose rate of 35,000 rem per hour. Nevada transportation experts concluded that a 1% release of Cesium-137 could result in cleanup costs of $100 million to more than $1 billion. During routine operations, radiation exposure doses to the public and workers, for example workers at reactor sites who repackage and load TAD containers, would be elevated. Also, the TAD canister system would result in increased risk of an accident at reactor sites from handling and repackaging spent fuel these sites. Similarly, state and local accident prevention, security, and emergency response preparedness activities and their associated costs would be significant.

In addition to spent fuel shipments from California reactors, a significant portion of the high-level waste and spent fuel shipments from reactors and DOE facilities located outside California could be routed through California through major urban areas and major rail hubs, e.g., Barstow, to Yucca Mountain. In addition, Nevada experts estimate that under the expanded repository capacity scenario described in the DEIS, there could be about 1,929 rail cask shipments in 647 trains entering Nevada from California. They estimate this could result in 5-13 trains per year for 50 years (Halstead, Dec. 3, 2007, DSEIS comments in Las Vegas).

Repository shipments using the Mina rail route or Caliente rail route could impact major cities in California including Sacramento, San Diego, Los Angeles, San Bernardino, San Luis Obispo, Fresno, Bakersfield and Barstow. An estimated 7.5 million people live within a mile of the likely rail routes in California and over 1,400 schools and 130 hospitals are located within a mile of these routes.

And yet, DOE has failed to adequately notify these potentially affected major metropolitan areas and communities along shipment corridors as well as near reactor-sites in California regarding plans to repackage and transport spent fuel and high-level radioactive waste through their communities. The communities likely to be affected by these shipments have received inadequate or no notice of DOE's analyses of the project and, therefore, have missed opportunities for public input. These communities, therefore, have no way of knowing that they will be impacted by decisions being made regarding the Yucca Mountain project and do not have access to the information needed for their participation in the NEPA process.

In spite of the major potential impacts in California from the proposed repository and requests from California for additional hearings in the state, DOE held only three public meetings/hearings in California on the various EIS documents for Yucca Mountain. A hearing was held on November 4, 1999, in Lone Pine in response to a request by Inyo County and on February 22, 2000, a hearing was held in San Bernardino in response to a request by Senator Boxer. The third public meeting was held in Lone Pine on November 29, 2007, and it addressed the three Draft EISs recently released. It was the only public meeting scheduled in California for the purpose of reviewing these Draft EISs, although the State of California requested hearings at additional locations in the state. It is unclear why so few hearings/meetings were held in California in view of the major potential impacts to the state, and why, of the three hearings/meeting held in California, two were held in Lone Pine. Lone Pine is a small community on U.S. Highway 395 and is located in the Sierra Nevada foothills about 200 miles north of San Bernardino and Los Angeles. No additional public hearings have been held in California, although requested.

Similarly, rather than encouraging information sharing and providing an open forum for public comment during the scoping meetings in 2006, DOE had the citizens individually speak to a court reporter. This approach did not provide a forum for meaningful sharing of information consistent with the spirit of the NEPA process. Finally, considering the size, scope and importance of the three EISs released in October 2007, there was insufficient time to review and provide comments. Review was particularly difficult considering the unclear relationship with the 2002 Final EIS for the Yucca Mountain project. In addition, there is inadequate time for DOE to consider public comments on these documents, given DOE's self-imposed deadline to submit a License Application to the NRC and issue Final EISs by June 2008.

3. The DSEIS and RA EIS fail to identify and evaluate transportation alternatives to the Proposed Action.

The proposed action described in the DSEIS and RA EIS is to transport 90 percent of commercial spent fuel that are packaged at the waste generator sites in TAD canisters (DSEIS, page 2-7) at 68 commercial site origins and ship these packages cross-country by rail in dedicated trains to the repository. The remainder of the commercial spent fuel (goal of 10 percent) would arrive at the repository as uncanistered spent nuclear fuel or in dual-purpose canisters. DOE spent nuclear fuel, high-level radioactive waste, and naval spent fuel would be received in disposable canisters. DOE would place both types of canisters (DOE disposable and TAD) into waste packages before emplacement in the repository. However, these broad assumptions of 90 percent transport by rail in TAD canisters are not supported by analyses. Moreover, sufficiently detailed implementation plans for the transportation program are not provided. For example, there is no rail line currently extending to the Yucca Mountain site and DOE would have to build a railroad linking the site to an existing rail line. The feasibility and costs of constructing a connecting rail corridor are highly uncertain. About 25 reactor sites lack rail access. TADs as currently envisioned are large (hold up to 10 metric tons), heavy (weigh up to 180 tons) and long (18-20 feet long) and many reactor sites lack the necessary infrastructure to handle and repackage spent fuel in TAD canisters.

The TAD canister concept is a proposal to repackage spent fuel at reactor sites and ship by rail. Yet this proposal is highly speculative. The DSEIS does not address the considerable uncertainties regarding this proposal. NEPA requires an adequate analysis of alternatives to the proposed action. In light of the major uncertainties and insufficient information provided on the TAD canister concept (discussed later in our comments) and the fact that developing rail access to Yucca Mountain is highly uncertain, the DSEIS should examine credible alternatives to the Proposed Action to transport 90% of the commercial spent fuel in TADS on dedicated trains. This analysis should include the comparative impacts and risks associated with using alternative canister systems (e.g., existing dual purpose canisters) for transport to the repository in comparison with the proposed TAD system.

DOE analyzes the construction of a rail line to the repository in the RA DEIS. DOE should also analyze the No-Action Alternative that DOE would not construct and operate a railroad. No analysis is provided in the EISs of the implications for the national transportation system of no rail access to Yucca Mountain (RA DEIS, p. 2-11). The revised DSEIS should analyze feasible No Action Alternatives including the "fall-back plan" for cross-country shipments if the rail line to the repository is not constructed and other transportation modes, for example, shipment by legal-weight trucks, are predominantly used.

The DSEIS relies upon the No Action Alternatives described in the Final EIS (2002) which are: (1) spent fuel remains at reactors with institutional controls (care and maintenance of the spent fuel) for the first 100 years and no institutional controls at the end of the 100-year period, and (2) spent fuel remains at reactors for 10,000 years with no institutional controls. These two no-action alternatives are highly unlikely and unlawful for protecting public safety and the environment, which means that these two No-Action Alternatives are unrealistic. These two No Action Alternatives do not address transportation alternatives to the Proposed Action of transporting 90% of commercial spent fuel by rail using TAD canisters. The possibility that during the first few years of repository operation, DOE will need to rely extensively on trucks for transport to the repository should be fully described and examined and the potential impacts evaluated including quantifying the number of truck shipments, identifying truck shipment routes, and describing how the NWPA 180 (c) emergency response assistance will be provided to states, tribes and local governments along the routes in a timely manner and how the state and local needs for emergency response training and equipment will be assessed.

INADEQUATE ANALYIS OF POTENTIAL TRANSPORTATION IMPACTS

4. **DOE has not identified the preferred routes for repository shipments and has failed to adequately evaluate the major potential transportation impacts in California from these shipments.**

Under the Proposed Action, approximately 9,500 rail casks and 2,700 truck casks would be transported in California to Yucca Mountain over a period of about 50 years (DSEIS, p. 8-32) Under the “representative routes” evaluated in the DSEIS, 755 rail cask shipments (about 8 percent of the total) would enter Nevada from California and travel through downtown Las Vegas to the Caliente rail line; and 857 truck cask shipments (about 32 percent of the total) would enter Nevada from California on Interstate-15, then travel through western Las Vegas, on Interstate-215 to US Highway 95 (See p. 2-43, 2-44, and G-64). Under the expanded repository capacity scenario (143,000 metric tons and 2,303 canisters of Greater-than-Class C waste) about 24,112 rail cask shipments and 5,025 truck cask shipments would be transported through California (See p. 8-30).

If the Mina rail corridor is constructed and used, an estimated 1,963 rail casks (21% of the total) and 857 truck shipments (32% of the total) would be transported through California. These would likely include shipments of spent fuel through Sacramento, including shipments possibly from Oregon and Washington, over the Union Pacific Rail Line over the Sierra Nevada mountains through Donner Pass to Reno, Nevada. Nevada’s spent fuel transportation experts have estimated a potential for even larger numbers of rail cask shipments through California to Yucca Mountain for both the Caliente and the Mina rail routing options (greater than 4,400 rail casks or more than 45% of the total shipments).

The DSEIS fails to fully evaluate the potential transportation impacts in California from the proposed shipments. Instead of providing more clarity and description of the routes and transportation modes to be used, the DSEIS and RA DEIS raise additional transportation uncertainties. Since 1989 the State of California has urged DOE to identify the national highway, railway and barge shipping routes for transporting the thousands of tons of high-level waste from reactor locations throughout the country to the proposed repository. However, the transportation analyses provided in Volume I, Chapter 2 and in Appendix G of the DSEIS do not identify the routes to be used. The failure to identify these transportation routes effectively keeps federal, state and local jurisdictions from identifying potentially hazardous conditions along these routes and evaluating the potential for exacerbating the consequences from an extreme accident or terrorist attack.

Although the DSEIS identifies "representative" rail and truck routes, the cross-country rail routes shown in Figure S-9 ((p. S-19) are not consistent with the routes that the major railroads have identified for these shipments. For example, the rail routes in Figure S-9 show rail routes through Nebraska. However, the Union Pacific has indicated it would route cross-country rail repository shipments across Kansas, rather than Nebraska, because of more rail traffic through Nebraska compared with Kansas. The railroad believes that DOE shipments could interfere with the flow of traffic on the more congested rail line. Similarly, the Burlington Northern Santa Fe (BNSF) railroad indicated that it would not route DOE shipments on certain heavily traveled lines during high priority United Parcel Service Christmas traffic. Rail routes shown in the DSEIS do not include routes already identified by Union Pacific and BNSF as "preferred routes" to Caliente. The revised DSEIS should show the likely preferred truck and rail roads.

The DSEIS ignores the potential for rail shipments on the BNSF railroad to San Bernardino. Major transportation impacts from repository shipments are projected for Barstow and San Bernardino County as well as large numbers of potential shipments over the Cajon Pass and Donner Pass. Nevada's spent fuel transportation experts have estimated a potential for approximately 300 rail casks on about 300 barges for shipments from Diablo Canyon to Port Hueneme. DOE's Final EIS issued in 2002 for the repository, however, estimated the potential for 121-132 barge shipments from Diablo Canyon to Port Hueneme.

Nevada's transportation experts estimate the potential for large numbers of legal-weight truck shipments through California if no rail access to Yucca Mountain is developed (over 24,000 shipments or more than 45% of the total number of shipments). A 1996 report by the Planning Information Corporation (PIC) out of Denver, Colorado showed a southern consolidated routing scenario for East-West shipments to Yucca Mountain via California using the Interstate-40 highway and BNSF Railroad. Using this southern consolidated routing scenario, the PIC report estimated that more than 45% of the repository shipments could be transported through California. The DSEIS ignores the potential for more rail cask shipments through California on the Caliente or Mina rail options (more than 4,400 rail casks or more than 45% of the total).

The PIC 1996 report concluded that as many as 79,300 truck shipments would be required to move spent fuel and highly radioactive wastes from reactor sites around the country to a waste facility in Nevada. The report examined "current capabilities" with regard to reactor sites, equipment (for example, the containers or casks that would be used to transport deadly spent fuel and high-level waste), and the existing transportation system. PIC used this information to project transport modes, shipment numbers, and potential routes. Unlike DOE's more optimistic scenarios which assume that spent fuel and HLW can readily be shipped in large rail casks, thereby limiting the number of shipments and the numbers of communities affected, the PIC report examined the capabilities that actually exist with regard to: (a) the availability of rail and highway shipping casks; (b) the ability to handle different size containers at reactor locations; (c) rail access to originating sites for spent fuel shipments; (d) which reactors would ship waste in the first three years and what their capabilities are for handling casks, (e) rail access, and other variables; and (f) mode (rail vs. truck) and routing realities as they exist today. This report concluded that a southern consolidated routing scenario using the Interstate-40 and BNSF corridors for East-West shipments to Yucca Mountain via California, would result in more than 45% of the repository shipments potentially being transported through California.

The potential implications and costs to California state and local jurisdictions as a result of the proposed action are significant, considering the large number of potential shipments by truck, rail and/or barge over the state's transportation corridors. The EISs fail to adequately assess the risk and impacts to state and local jurisdictions from these shipments. California's emergency response training and equipment needs to prepare for these proposed shipments, including accident prevention measures necessary to ensure their uneventful, safe transport (for example, shipment inspections and escorts) will be significant. This is particularly true for major urban areas such as Sacramento, Fresno, Bakersfield, and Los Angeles, and major rail hubs in California, such as Barstow and San Bernardino.

Under DOE's proposed policy (180c policy) for funding states to assess emergency response preparation needs along routes, states would be provided a one-time planning grant of $200,000. This amount likely would not be sufficient to assess emergency response preparation needs along the lengthy potential rail, truck and barge shipment routes in California, particularly through heavily populated large metropolitan areas such as Los Angeles County. Significant training and coordination will be required for the large number of emergency care facilities, emergency centers, fire stations, and police stations located near possible routes in California. For example, within 10 miles of potential rail routes in California are an estimated 33 emergency care facilities, 19 emergency centers, 282 fire stations, 424 police stations and 5740 schools. (Bob Halstead, Nov. 9, 2007; FEMA MH-HAZUS Data base);

The DSEIS should identify the generator sites from which the waste would be shipped along either corridor. The DSEIS should state whether the Donner Pass route or the Feather River Canyon route would be used/preferred for connecting with the Mina Route and whether one route would be a backup for the other route. The DSEIS should describe how the operating parameters imposed on the railroads to ensure shipment safety would be monitored and enforced.

The impacts on tribal lands in California could also be significant. Eight tribes in California would be potentially impacted by rail shipments (Halstead, Nov. 9;) Routine radiation exposure to populations within 1600 meters of the rail route would impact approximately 3.4 million people (Source: Halstead, Nov. 9; census 2005 Block group update). Radiation doses to workers and the public from routine operations, particularly in congested areas where shipments may be delayed, should be evaluated. The DSEIS should also consider the impacts and costs to the state from civil unrest, for example, demonstrations or protests against shipments, or acts of terrorism directed against these shipments. Potential adverse economic impacts from proposed shipments, for example, adverse impacts on tourism in national parks including the Death Valley National Park, should be considered as well.

5. **DOE has failed to describe potential major route-specific impacts in California and identify mitigation for these impacts.**

There is a risk of a major, possibly long-term, disruption of transportation systems and hubs in California, for example, rail ways, rail hubs, and major interstate highways, should a major accident occur along any of California's major transportation corridors. The potential impact on California's rail and highway materials transport system from a major accident should be evaluated in the DSEIS. Rail capacity is already heavily impacted by goods being transported through California's major ports (Oakland, Los Angeles, Long Beach) from overseas. Capacity improvements that the Union Pacific and BNSF are making are intended to serve intermodal and international commerce, especially in California. The DSEIS should evaluate the impact of Yucca shipments, including the use of dedicated trains, on rail service and truck transport of goods in California, in particular, the impact on rail or highway freight transport capacity. Are there assurances that commercial use of rail lines would not be adversely impacted by waste shipments? Would waste trains have priority over commercial shipments? Would waste shipments occur at times and intervals that could disrupt regular commercial traffic patterns? If waste trains travel at reduced speeds, how would this affect commercial railroad traffic, including shipping rates, as well as passenger trains?

The risk assessment of potential transportation impacts should consider route-specific conditions along any likely shipment corridors in California. These route-specific conditions include: (1) increasing rail freight traffic in California due to the increasing flow of goods and imports from Asian countries through the Ports of Oakland, Long Beach and Los Angeles, (2) California's heavily populated and congested major urban areas including Los Angeles, Sacramento, the Central Valley (Los Angeles is the second largest metropolitan region in the country), (3) the steep terrain and heavily weather-impacted rail and truck routes over the Donner Summit to Reno, Nevada, as well as corridors through southeastern California that could be heavily impacted by these shipments, e.g., Cajon Pass, San Bernardino County and Barstow, and (4) certain high risk sections of track in California with prior major derailments and hazardous materials spills. The DSEIS should identify the likely rail and truck routes needed to access the Mina and Caliente routes, as well as communities and environmental resources in California potentially impacted by these shipments, so that any route-specific concerns can be addressed.

The DSEIS should describe how DOE would handle stranded/stalled nuclear waste trains, for example, during bad weather, floods causing derailments, or periods of service interruption.

DOE defines the radiological region of influence (ROI) for incident-free transport as .5 miles on either side of the rail alignments centerline. For accidents and sabotage, the ROI area is defined as 50 miles on either side. The potentially affected environment for transportation radiological impacts, including individuals, businesses, agriculture, and the natural environment should be described and impacts assessed for the (ROI) along potential shipping routes in California, including through major urban areas in Los Angeles, Sacramento, and the Central Valley. DOE should estimate the number of people living, commuting, and working within the ROI for the proposed rail, truck and barge shipment routes in California and evaluate these impacts.

The DSEIS should evaluate route-specific analyses of the companion rail segments to the proposed Caliente and Mina rail corridors. For example, the Caliente corridor could use the Union Pacific mainline that extends from Ogden, Utah, through southern Nevada to southern California. The Mina corridor could extend to Hazen and the impact analysis should include Union Pacific mainline tracks in northern Nevada from Hazen westward to Sacramento. The DSEIS should examine the full range of impacts to all affected communities in California from waste shipments to Yucca Mountain, considering the maximum shipment scenarios and likely truck shipments of waste. The potential impacts of transporting waste on lines shared by passenger service (Amtrak) should also be analyzed.

6. **The DSEIS should consider worst case credible accident scenarios to identify the maximum consequences from a potential accident involving a spent fuel or high-level radioactive waste shipment that exceeds package performance capability.**

The consequences of a severe transportation accident could be much more severe than DOE estimates. The DSEIS does not consider “worst case” accidents in which “all factors combine in the most disadvantageous way,” because DOE considers such combinations of factors “not reasonably foreseeable” (DSEIS, p. G-54). Moreover, the DOE accident analysis did not consider the impacts of human error in the design, fabrication, and loading of shipping casks nor did it consider unique local conditions along rail, barge or truck routes that could result in more severe accidents or consequences. However, DOE acknowledges that clean-up costs after a very severe transportation incident involving a repository shipment resulting in the release of radioactive material could range from $300,000 to $10 billion (DSEIS, p. G-54). Having identified the upper range of clean-up costs, the DSEIS should evaluate the impacts from a credible worst case transportation accident or terrorist attack that led to the high cost estimate.

7. **The DSEIS should examine unique local conditions or credible accident or terrorist attack scenarios that could result in conditions that exceed packaging performance standards.**

Should an accident or terrorist attack occur along certain segments of possible routes in California, a resulting fire could exceed the limits of the spent fuel package to contain the radioactive materials under accident conditions. For example, two recent major highway accidents on California highways (one in the Bay Area in northern California and a tunnel fire in Santa Clarita) are being investigated to determine whether these accidents may have resulted in conditions, in particular fire temperatures and fire durations, which approached or exceeded the limits of packaging performance requirements. The potential for highway and rail accidents resulting in severe conditions in California should be evaluated considering that nearly half of the 16 historic severe accident scenarios that were examined in the National Academy of Sciences’ 2006 spent nuclear fuel transport study occurred in California[1]. These accidents included extreme truck fires in highway tunnels, train derailments, and a rail accident involving a gas pipeline rupture.

[1] Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States. National Research Council of the National Academies, 2006.

The National Academy of Sciences' study recommended that detailed surveys of transportation routes for spent fuel be done to identify potential hazards that could lead to or exacerbate extreme accidents involving very long duration and fully engulfing fires and further recommended that steps be taken to avoid or mitigate such hazards. We fully concur. To be comprehensive, the DSEIS should identify the likely shipping corridors and include route-specific analyses that identify potential hazards along shipment routes. It is vital that the risk analyses should include the potential consequences of a severe accident or terrorist attack involving extreme, long duration fire conditions that exceed package performance limits.

DOE should conduct a systematic inventory of local conditions along the preferred routes that could exacerbate the consequences of a severe accident or attack, for example, tunnels, bridges, refineries, stadiums, congested urban areas, proximity to flammables or explosives in storage or transit. DOE also should conduct an inventory of state/local capabilities along route segments for handling potential consequences of a major accident. This inventory of route segment characteristics and response capability should be available before Section 180c planning and assessment efforts begin.

8. **DOE should evaluate the potential for human error and intentional non-compliance with federal packaging safety standards in exacerbating the consequences of a severe accident or terrorist attacks**.

DOE has concluded that regulations and regulatory practices of the NRC and the US Department of Transportation address the design, manufacture, and use of transportation packaging and that the regulations and regulatory practices are effective in preventing human error by requiring independent NRC review and approval of package design to ensure compliance and NRC's approval and audited quality assurance programs for design, manufacturing and the use of transportation packages. (DSEIS, p. G-52). DOE also said that timely and effective actions to identify and initiate corrective actions for undetected design or manufacturing defects provide assurances that undetected deficiencies would not lead to a meaningful reduction in package performance under normal or accident conditions of transportation. However, human error, for example, an undetected major flaw in the design and certification of transportation packaging (casks) for radioactive material shipments, hidden or undetected defects in the manufacture of these packages, and error in the preparation of these packages for shipment could severely compromise packaging performance during an accident or during routine transport.

DOE should consider the potential consequences of a package not meeting federal packaging safety requirements, for example, due to a manufacturer's intentionally falsifying records in meeting these requirements. In December 2007, the Nuclear Regulatory Commission proposed a civil penalty against Alpha Omega Services, Inc., of Bellflower, California and barred the company president from NRC-licensed activity for deliberately falsifying an inspection report on a Type B package used for transporting radioactive materials. The company was charged with stating in a report of an inspection that the transportation package met NRC requirements even though the company knew the package had been modified and no longer met the specification in its certificate of compliance from the NRC. As a result of the falsified information, the NRC licensee made at least three exports of radioactive material outside of the US in violation of NRC and U.S. Department of Transportation regulations. Although the NRC was not aware of actual safety consequences, NRC considered the potential safety consequences to be significant considering the "potential adverse impact of shipping radioactive materials in the modified and unapproved package design that no longer met transportation package approval standards for both normal and hypothetical accident conditions."

9. **No mitigation is being identified in these EIS documents for potential national transportation impacts outside of the State of Nevada.**

The DSEIS states that, "Shipments of spent nuclear fuel and high-level radioactive waste would represent a very small fraction of total national highway and railroad annual traffic (less than 0.1 percent." (DSEIS Summary, page S-42). From the perspective of all highways and railroads in all affected states, the impact in terms of the number of repository shipments relative to other shipments would be small. However, to adequately determine transportation impacts to a particular state, city, or county, route-specific analyses must be provided, impacts evaluated, and mitigation measures described for major potential impacts.

10. **Under the Proposed Action, those commercial nuclear plant sites lacking the capacity to use rail transport would use overweight trucks to ship material to the repository or could use heavy-haul trucks or barges to ship spent fuel to the nearest rail line.**

The DSEIS states, for the first time, that truck shipments could be made using "overweight" truck shipments without addressing specifically what that entails or any of the implications or impacts of such shipments. The DSEIS should fully evaluate these impacts. Overweight trucks would be subject to permitting requirements in each state through which they traveled. Strict weight restrictions on some bridges, tunnels, or roadways could prohibit their use for overweight trucks, which could result in shipments being rerouted from the interstate highway system to less acceptable roads to avoid those areas. For example, given the increased bridge structural scrutiny and concerns raised following the Minnesota bridge collapse, some states with restrictions on Interstate bridges might force overweight shipments to be routed on less acceptable routes from a safety perspective. Therefore, the reliance on overweight shipments could have significant and unintended consequences. The DSEIS should evaluate the implications of using overweight trucks to transport spent fuel to the repository and fully analyze the potential for rerouting overweight shipments over less acceptable truck routes. It is likely that overweight truck permit requirements could prevent or seriously impede cross-country shipments.

11. **The DSEIS should provide the upward bounds or maximum capacity for spent fuel and high-level waste disposal at the repository and the implications for shipments in California.**

It has been estimated that 140,000 metric tons of spent fuel and defense waste would be generated if all US reactors are given 20-year license extensions. (Approximately half of the US reactors have received license extensions.) The DSEIS should define the maximum number of waste shipments that could potentially be transported to the repository, including assuming that all US reactors receive 20-year license extensions and assuming the potential for new reactor construction in the US. The Proposed Action is for a 70,000 metric tons capacity repository. The DSEIS considers Modules 1 and 2 at 130,000 metric tons of commercial spent nuclear fuel in the expanded capacity case.

However, no discussion is provided on a proposed underground layout for how the expanded capacity could be accommodated.

The period of analysis for shipment impacts should also consider a larger repository capacity scenario. The DSEIS should provide the maximum capacity for spent fuel and high-level waste at the repository given the large amount of spent fuel and defense waste generated for the current fleet of reactors and DOE facilities as well as estimated new reactors planned for construction in the US. New reactor license applications have been submitted to the US Nuclear Regulatory Commission with strong industry and federal support and incentives encouraging additional new nuclear power reactors. The SEIS should discuss the maximum and likely number of rail and truck shipments to the repository should the Nuclear Waste Policy Act be amended to expand the repository capacity beyond its current statutory limit of 70,000 metric ton. If DOE plans to include an expanded repository capacity as a reasonably foreseeable future action, it should provide the technical basis and safety evaluation, including cumulative impacts, supporting a decision for additional repository capacity.

12. **The use of TAD canister systems will increase risks at waste generator sites. The DSEIS should evaluate these at-reactor risks as well as address major uncertainties and concerns about DOE's proposed TAD System.**

The DSEIS proposes the use of a new canister system called the "Transportation, Aging, and Disposal" (TAD) canister to minimize handling of spent fuel at the repository by having waste loaded at the reactor sites in welded TAD canisters. Under DOE's Proposed Action, up to 90% of spent fuel would be loaded into TAD canisters at reactors and welded shut. The remaining approximately 10 percent of spent fuel would be shipped directly to the repository by over-weight trucks. TAD canisters would be inserted into large transportation casks at the reactor sites and shipped by rail to Yucca Mountain for storage and "aging" before disposal underground. These TADs would be large (hold up to 10 MTU) and heavy (weigh up to 180 tons with impact limiters and skids). At reactors (about 25) which lack rail access at the reactors, TADs would be moved by barge or heavy haul truck to rail (for example, Diablo Canyon in northern California). The design for the TAD canister is not complete and it is unclear how the TAD system will interface with the multi-purpose canister system used for spent fuel storage at many reactors. Southern California Edison Co. indicated that the TAD system, which is proposed for only 21 assemblies, increases the need for spent fuel storage space at the compact site at the San Onofre Nuclear Generating Station. The DSEIS should evaluate the impact at reactors from the use of the TAD system.

Use of the TAD canister system would significantly increase workers' radiological exposure and the risks associated with handling bare spent fuel assemblies, as well as loading and welding canisters at reactor sites (routine exposures and accidents). The Draft SEIS should explain how the TAD canisters would be certified and inspected during loading, welding shut, transport and disposal to ensure compliance with NRC regulations.

There are potential problems regarding acceptance of the TAD canisters at the repository and the potential return of rejected TADS to originating sites. For a complete analysis, the DSEIS should thoroughly assess the TAD system regarding its risks and impacts to workers at the reactors and repository, the surrounding communities, the environment, and the populations in transit (along highways and/or railways at or near reactor sites). In addition, the DSEIS should analyze how the TAD system will interface with the dry cask storage system at reactor sites. All four California commercial reactor sites (Diablo Canyon, San Onofre, Rancho Seco, and Humboldt Bay) may have specific problems with the proposed TAD system, since all of these plants are either planning to transfer or have transferred all or a portion of their spent fuel into dry cask storage.

The DSEIS also should assess how the TAD system would work at decommissioned reactors where the spent fuel handling equipment and facilities have been removed and no longer remain onsite. All of the spent fuel at Rancho Seco, which is in the final stages of decommissioning, has been transferred into dry storage using multi-purpose canisters. The DSEIS should evaluate how the TAD system would work at decommissioned reactors, where spent fuel handling equipment and facilities have been dismantled and removed from the site. The DSEIS fails to identify the party or parties responsible for building the facilities needed to house the spent handling operations and it fails to fully evaluate the costs, liability, and impacts associated with transferring spent fuel into TADs at reactor sites. The DSEIS should clarify and analyze these aspects of the TAD system and the financial arrangements for paying for developing the TAD repackaging system at reactor sites. The DSEIS should also evaluate the alternatives if the TAD system does not prove to be suitable, for example, due to its costs, risks, and impacts.

No final TAD designs are available, only the "Proof of Concept". NRC must approve TAD transport and storage components separately (10 CFR Part 71 & 72). Therefore the Proposed Action cannot be evaluated based upon the incomplete information presented. The DSEIS should provide supplemental information on TADs (performance specifications; use of welded closures; future of alternate storage systems currently in use at reactors; need for cask handling infrastructure at reactor sites; need for coordination with utilities; timetable for development and certification; quality control over repackaging and cask loading; need for full-scale testing; costs and benefits of using TADs; how TADs fit into the overall plans for transportation, storage, schedule, and protection against terrorist attacks; and the difference between TADs and the multi-purpose canister concept);

Further, the TAD canister system requires rail transportation, although Yucca Mountain lacks rail access. The proposed Caliente railroad that DOE plans to build to the repository would cost an estimated $ 2.5 to 3 billion and has strong opposition in Nevada that is likely to delay rail access. Further, one-third of the spent fuel shipping sites lack rail access. These challenges result in major uncertainties regarding the feasibility of the proposed TAD canister system.

13. The DSEIS fails to adequately evaluate the potential impacts from a terrorist attack on spent fuel shipments to the proposed repository.

The consequences of a successful terrorist attack could be much more severe than DOE estimates. For example, the National Academies' 2006 spent fuel transport study noted that malevolent acts against spent nuclear fuel and high-level waste shipments are a major concern, especially following 9/11 terrorist attacks. NAS recommended an independent examination of the security of spent nuclear fuel and high-level waste transportation including the threat environment, the response of spent fuel packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high-level waste while in transport.

DOE acknowledges in the DSEIS that both truck and rail casks are vulnerable to terrorist attacks or sabotage involving certain types of military and commercial explosive devices. Nevada-sponsored studies have concluded that a credible attack scenario in an urban area could release enough radioactive material to cause thousands of latent cancer fatalities and require cleanup and recovery costs exceeding $10 billion. However, DOE has chosen not to consider attack scenarios involving a combination of multiple weapons that could The DSEIS should examine, to the extent possible without exposing classified information, the bounded consequences of a terrorist attack against these shipments. The DSEIS should explain how the consequences of a severe attack or terrorist attack can be mitigated through, for example, additional security measures or emergency responder preparedness, i.e., how emergency responder professionals responding to an event or escorting the shipments can respond effectively and in a timely manner to a major terrorist event involving spent fuel and high-level waste shipments.

14. **The Revised DSEIS should fully describe DOE's implementation plan, e.g., DOE's National Transportation Plan, for transporting spent nuclear fuel and high-level radioactive waste to the repository. At a minimum, DOE's National Transportation Plan for repository shipments should incorporate recommendations by the National Academy of Sciences (2006) to enhance the safety and security of these shipments.**

The revised DSEIS should describe DOE's National Transportation Plan for transporting spent fuel and high-level radioactive waste to the repository in sufficient detail to provide assurances that these shipments **will** be transported safely and uneventfully. This transportation plan should be heavily based upon the successful transportation safety plan and program for shipments to the Waste Isolation Pilot Plant that was developed in cooperation with western states and DOE. In addition, DOE should incorporate the following National Academy of Sciences' recommendations for enhancing the safety and security of spent fuel and high-level waste shipments from their 2006 study of spent fuel and high-level radioactive waste transport:

- An independent examination of the security of spent fuel and high-level waste transportation should be conducted before large quantity repository shipments to a repository begin including an evaluation of the threat environment, response of packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high-level waste in transport.
- Transportation planners and managers should conduct detailed surveys of transportation routes to identify potential hazards that could lead to or exacerbate extreme accidents involving very long duration, high temperature, fully engulfing fires; planners should take steps to avoid or mitigate such hazards before shipments begin.
- Full-scale package testing should continue to be used as part of the analytical and testing programs to validate package performance.
- DOE should continue to ensure effective involvement of states and tribes in routing and scheduling of DOE spent fuel shipments.
- DOE should fully implement its dedicated train and mostly rail decision before DOE begins transporting nuclear waste to the repository to avoid the need for a stopgap shipping program using general trains.

- DOE should identify and make public its suite of preferred highway and rail routes for transporting spent fuel and high-level waste to a repository as soon as practicable to support state and local planning, especially emergency response planning and follow the foreign research reactor spent fuel program in involving states and tribes in these route selections to obtain access to their familiarity with accident rates, traffic and road conditions and emergency preparedness.
- There are clear safety advantages from shipping older (radiologically and thermally cooler) spent fuel first. The radiological risk from spent fuel transport drops sharply depending upon the age of the spent fuel. Therefore, the risk from these shipments would drop dramatically as well if the spent fuel generators and owners could be persuaded by DOE to ship their older fuel first. DOE should negotiate with commercial spent fuel owners to ship the older fuel first except where spent fuel storage risks at specific plants dictate the need for immediate shipments;
- DOE should begin shipments through a pilot program involving relatively short, logistically simple movements of oldest fuel from closed reactors to demonstrate the ability to transport this waste in a safe and operationally effective manner.
- DOE should immediately begin to carry out its emergency responder preparedness responsibilities defined in Section 180 (c) of the NWPA. DOE should establish a cadre of professional of emergency responders to work with the Department of Homeland Security to provide consolidated “all-hazards” training materials and programs for first responders, include trained emergency responders on the shipment escort teams, use emergency responder preparedness programs for community outreach along planned routes.
- DOE should work with the Department of Homeland Security, Department of Transportation, and NRC to develop, apply, and disclose consistent, reasonable and understandable criteria for protecting sensitive information about spent fuel and high-level waste shipments. They should commit to the open sharing of information that does not require protection and should facilitate timely access to such information.
- DOE and Congress should examine options for changing the organizational structure of DOE’s spent fuel transportation program to give the transportation program greater planning authority, greater flexibility to support future transportation programs and make the multiyear commitments needed to plan for, procure and construct the necessary transportation infrastructure.

In addition, the DSEIS should commit to developing a schedule, identifying routes and shipment modes and order for shipments from specific sites and how states and local jurisdictions will be notified sufficiently in advance of shipments and provided assistance to allow states, tribes and local jurisdictions to plan, train and prepare for these shipments. If DOE follows the shipment order queue as currently envisioned, there will be a hodgepodge of repository shipments from various sites with spent fuel owners and generators having the option of trading places in the shipment queue with other shipping generators/sites. Routes could open for a few years for a few shipments and then possibly close again for a few more years, with the result that state and local planning and emergency response preparation for these shipments would occur in fits and starts with potential lapses in funding and resources available for retraining and maintaining emergency response equipment appropriate for responding to accidents involving these shipments.

DOE should work with the utilities and affected states and tribes to develop a national transportation plan for repository shipments that includes a reasonable shipment schedule and site shipping priorities taking into consideration state and local needs for an overall predictable schedule and sufficient advance notification of shipments to allow adequate state and local jurisdictions to prepare adequately for these shipments.

15. **If DOE plans to use State Route 127 as an access route for repository shipments by truck, the Draft SEiS should carefully assess the risks and potential impacts from using this route for shipments as well as its potential use for heavy trucks needed for repository construction and operation activities and rail line construction.**

California officials have expressed concern that DOE will route spent fuel and high-level waste shipments on California roads not designated for heavy truck traffic, such as State Route 127 in southern California for spent fuel shipments from eastern states to the proposed repository. SR 127 is the major access route to the Death Valley National Park and is not approved for highway-route-controlled quantity shipments, such as spent nuclear fuel. Concerns about the use of SR 127 for Yucca Mountain shipments include its road conditions, periodic flash floods, seasonal peaks in tourists (Death Valley National Park has approximately 800,000 to 1.25 million visitors each year), the scarcity and remoteness of emergency responders in the region, and the impacts on the road from increased heavy truck traffic.

However, there are limited southern access routes to Yucca Mountain. Concern in California increased with DOE's decision to reroute through California via SR-127 a major portion of DOE's nuclear waste shipments to and from the Nevada Test Site (NTS) through California via SR 127. Beginning in January 2000, DOE began using SR-127 for a major portion of thousands of low-level radioactive waste shipments to NTS. Later DOE transported transuranic waste shipments on SR 127 from NTS to WIPP, although there were shorter, more direct routes in Nevada. U.S. Senators Dianne Feinstein and Barbara Boxer, the California Congressional chairs Sam Farr and Jerry Lewis, as well as Inyo and San Bernardino Counties, and the Cities of Needles and Barstow, strongly objected to rerouting these shipments from eastern states through California over greater distances.

SR 127 was analyzed in the Draft EIS (2002) as part of an alternate route for repository shipments. U.S. Department of Transportation regulations restrict DOE shipments to interstate highways, bypasses or beltways or routes designated by a state or tribe. SR127 was proposed by the State of Nevada as an alternate route and was included for analysis in the Draft EIS (2002) as part of a sensitivity analysis of potential routes. The sensitivity analysis concluded in the EIS that routes using SR-127 (Cases 2 and 3) as comparing favorably to the base case. It appears that California's concerns about the use of SR 127 were not adequately incorporated in the EIS evaluation.   If DOE contemplates using SR 127 as an access route for spent fuel shipments by truck to the repository, the revised DSEIS should carefully assess the potential risks and impacts, including the impacts from heavy truck use along this route during repository construction as well as the construction of the rail alignment to the Yucca site.

16. **DOE should provide details for how it plans to achieve its objective of transporting 90% of the shipments by rail in TADS and explain to what extent truck shipments may be used, as opposed to rail, during the initial**

years of shipment pending construction, completion and operation of a rail line to Yucca Mountain.

The DSEIS should describe how DOE will make-up its dedicated trains at reactor shipment origin sites or nearby rail yards and how it will address infrastructure limitations at reactor sites (e.g., sites which lack spent fuel repackaging facilities and equipment or rail access, etc.) The possibility of shipment mostly by truck should be fully evaluated as an alternative in the DSEIS including truck shipments to Yucca Mountain from all waste generator sites over the life of the project in the event that a rail line is not constructed to Yucca Mountain. DOE should describe the likely ratio of rail use to heavy-haul truck use, describe the procedures and locations for the intermodal transfer of waste, needed safety measures and routes, and assess the impacts. DOE should also describe the possibility of a northern and southern approach to Yucca Mountain that would accommodate seasonal weather or road/rail conditions. DOE should present a range of TAD implementation scenarios and not rely solely on a "90% use of TADs", since there are uncertainties associated with use of TAD at each reactor site (for example, some sites lack cask handling capabilities; more than 10% of the spent fuel may already be packaged and sealed in dual-purpose canisters.)

The DSEIS should describe the safety record of rail transport of hazardous and radioactive materials in the US.

INADEQUATE ANALYSIS OF POTENTIAL GROUNDWATER IMPACTS IN CALIFORNIA

17. **DOE has failed to analyze adequately the potential ground water and other environmental impacts in California.**

In 2000, thirteen California agencies, in a comprehensive review of the Draft EIS for the repository, found serious deficiencies in DOE's evaluation of groundwater and transportation impacts in California. California agencies identified potential groundwater impacts in the Death Valley region, impacts on wildlife, habitat and public parks, as well as transportation impacts in California from the repository. DOE is fully obligated under NEPA to provide a complete evaluation and disclosure of these impacts and provide adequate notice to the communities potentially affected by the proposed project.

Groundwater flowing beneath Yucca Mountain discharges in springs to the south, including Furnace Creek Springs in Death Valley, California. This is a potential pathway for radioactive contaminants that may leak from the waste packages in the repository to reach these springs in Death Valley. The DSEIS should better characterize regional hydrogeology in the Amargosa and Death Valley areas to evaluate groundwater flow and evaluate the potential impact from radionuclide contaminant migration toward aquifers in California. Further, the Draft SEIS should propose mitigation measures, for example, a monitoring program to detect potential radionuclide migration from the repository into California aquifers.

The DSEIS summarizes Inyo County's groundwater studies program and that a primary focus of the County "has been the investigation of the source of water that discharges from the various springs on the east side of Death Valley and whether there is a hydraulic connection between those springs and the groundwater moving beneath Yucca Mountain." The County has concluded that they have strong scientific evidence through geochemical analysis that the Lower Carbonate Aquifer (LCA), which underlies the repository, has several discharge points on the western side of the Funeral Mountains in the Furnace Creek area of Death Valley National Park. The DSEIS and Inyo County's research suggest that groundwater discharged in the Death Valley National Park is mixed with other groundwater sources from the Ash Meadows area and the Amargosa Desert.

DOE assumes that because the volcanic aquifers do not discharge into the Death Valley National Park, that no impacts to the Park are anticipated. Inyo County disagrees and believes that the Park will be potentially affected by contaminated discharge from the LCA, and **not** the volcanic aquifers. DOE concedes that Inyo County, but not the Park, will be impacted from contaminants in the volcanic aquifers. Radionuclides in the volcanic aquifers will surface at Franklin Lake Playa and Alkali Flat, near Death Valley Junction, California. However, the DOE predicts this will happen after any applicable compliance period.

Inyo County observed that "the most glaring omission in the DSEIS is that it contains no meaningful assessment of potential impacts to the LCA." The DSEIS makes no predictions, based upon water infiltration and waste package corrosion rates, or groundwater migration times, of the severity or timeframe for impacts to the LCA, or its discharges points in the Park. Accordingly, the DSEIS contain no impact assessment for plant life, wildlife, wildlife habitat or drinking water supplies in the Park that could potentially be impacted by migrating radiouclides from the repository.

Although the 2002 Final Environmental Impact Statement for a Geologic Repository at Yucca Mountain, Nevada (2002 FEIS) frequently references ongoing groundwater impact studies, the Draft Repository SEIS contains little new information on studies conducted by the DOE, the State of Nevada, or Nye and Inyo Counties. DOE notes that Death Valley proper is the regional hydrological sink for surface and groundwater. However, the Yucca Mountain regional hydrographic map on page 3-33 (Figure 3.9) in the "Affected Environment" section fails to include California in terms of hydrographic areas, even though maps on pages 3-28 (figure 3-7) and 3-30 (Figure 3-8) clearly show California and Death Valley as part of the Death Valley regional groundwater flow system, receiving flow from both the volcanic aquifers and the LCA.

We believe that Inyo County has a legitimate objective to ensure protection for current and future water supplies and its living environment. Issues they have raised concerning potential groundwater impacts in Inyo County should be evaluated, for example, does groundwater pumping in the region for repository construction, operation and closure affect potential groundwater migration from the repository site? Additional information is needed on the impacts of groundwater pumping as well as the potential aquifer contamination and the migration of contaminated groundwater from the Yucca site to eastern Death Valley. In addition, monitoring wells (and high capacity extraction wells) should be strategically located around the repository to detect any early "leaks" into any of the groundwater aquifers. A series of monitoring wells (with high capacity extraction capabilities) should be placed into the aquifers along the California border to track and extract any contamination plumes should radionuclide migration and groundwater contamination occur.

Inyo County has concluded that an upper gradient exists in the LCA, which causes LCA water to move upward into the volcanic aquifers because of a steep down gradient found in the vicinity of Yucca Mountain. They note that the upper gradient is considered to be ephemeral and very fragile and that the upper gradient could be degraded by regional groundwater pumping, both from the LCA and volcanic aquifers. DOE maintains that the future effects of groundwater pumping are highly speculative, and need not be considered in any NEPA analysis. Therefore, they do not propose any analysis of the impacts from groundwater pumping in the region, nor any regulatory measures to maintain the upper gradient. Inyo County strongly disagrees with this assertion and recommends that DOE should consider present pumping rates and its impact on the upper gradient and radionuclide migration. We agree with Inyo County's conclusion that any NEPA analysis of repository performance and radionuclide migration that does not take into account the effects of groundwater pumping is incomplete and completely inadequate. Therefore, we recommend that DOE evaluate the effects of groundwater pumping on repository performance and potential radionuclide migration.

Groundwater is proposed to be used for repository construction and operation. DOE would pump groundwater from wells in the Jackass Flats hydrographic area in Nevada. Groundwater from that area flows into Amargosa Desert aquifers. The Draft SEIS notes that because these aquifers are used for the regional water demand, the potential effects of DOE groundwater use on this down gradient use is of particular concern (Draft SEIS, p. S-24).

18. **DOE should provide a clean-up or remediation plan for potential radionuclides surfacing at Alkali Flat/Franklin Lake Playa**

Inyo County noted that the 2002 FEIS states that water from beneath Yucca Mountain surfaces at Alkali Flat and Franklin Lake Playa, and that 69,000 people could be exposed to contaminated groundwater. The County believes it is the DOE's responsibility to implement a mitigation/remediation plan, and an evacuation plan should the repository suffer a catastrophic failure. We agree.

CONCERNS ABOUT THE SUITABILITY OF THE YUCCA MOUNTAIN SITE AND PROPOSED PROJECT FOR PERMANENT WASTE ISOLATION

19. The Revised DSEIS should address the high level of uncertainty regarding the performance of the engineered and geologic barriers in isolating the nuclear waste from the environment.

Site selection and the geologic barriers at the site are the most important characteristics in determining the performance of a repository in permanently isolating the waste from the environment. The International Atomic Energy Association (IAEA) in 2003 established siting criteria for high-level nuclear waste repositories which include long-term tectonic stability, low-groundwater content and flow, stable geochemistry at depth, including a reducing environment and equilibrium between rock and water, and that the site is excavatable. The Yucca Mountain site violates two of the four IAEA siting criteria. The site is tectonically active (has earthquakes and volcanoes) and has an oxidizing geochemical environment, therefore, requiring more "engineering fixes" to isolate the wastes from the environment. For example, a volcano at the southern tip of Yucca Mountain is 80,000 years old and considered still active. Five Quaternary basaltic volcanoes are located within 20 km of Yucca Mountain. Also the site provides an "oxidizing environment" rather than a reducing geochemical environment, for the waste packages. Oxidizing environments would corrode the metal casks holding the waste. The US is the only country using an oxidizing environment for high-level waste storage, which introduces large uncertainties in the performance of the repository.

The Yucca Mountain site is a complex site geologically with considerable uncertainty regarding its ability to permanently isolate the waste from the environment. Scientists including Dr. Allison Macfarlane, a Massachusetts Institute of Technology researcher, question whether Yucca Mountain is a suitable site for geologic disposal, especially when you extend the time out to1 million years. In addition, the rock at the site has proven to be more porous than previously thought, raising major concerns about contamination of groundwater. In recent years, scientists discovered that radioactive contaminants from nuclear weapons tests in the 1950s at the Nevada Test Site had migrated downward with rain water to more than 600 feet below ground at rates far faster than predicted by DOE. This raises concern about the risk of corrosion of the waste containers in which the waste would be stored, as well as the potential for much more rapid spread of contaminated groundwater.

Because of flaws in the geology of the site, DOE has turned to what are called "engineering fixes" to try to contain the waste. The DSEIS should address concerns over earthquakes and groundwater movement on repository performance as well as the high level of uncertainty regarding the performance of the proposed engineered and geologic barriers in permanently isolating the nuclear waste.

20. **DOE's plan to install drip shields raises uncertainties that should be addressed in the DSEIS.**

DOE proposes to install titanium drip shields during a ten-year period after the NRC has approved a license amendment to close the repository (approximately 90 years from the time of first waste emplacement) or as many as 290 years. It is difficult to predict the condition of the subsurface conditions 100 to 300 years from now, since once waste packages are emplaced in the repository, access to portions of the repository may be limited. Given uncertainties, DOE's plan to install drip shields and their reliance on this plan in their repository performance assessment is not supportable. DOE should evaluate the advantages of installing drip shields as waste is emplaced, rather than postponing it decades to hundreds of years later when access to the waste containers and supplies of titanium may be limited.

21. The Final U.S. EPA Radiation Protection Standard has not been adopted.

The US Environmental Protection Agency's (EPA) role is to determine how the Yucca Mountain high-level waste facility must perform to protect public health and safety. However, EPA has yet to issue a final radiation protection standard for the repository. Congress directed EPA to develop public health and safety standards that would be incorporated into the NRC's licensing requirements for the Yucca Mountain facility. The EPA issued a Draft Radiation Protection Standard (2005) for the repository but it has not yet issued a final standard. Under the proposed new standard, estimated repository performance for the first 10,000 years is a dose limit of 15 millirem per year. From 10,000 to one million years, EPA proposed a dose limit of 350 millirem per year. One million years is consistent with the time period cited by the National Academy of Sciences as providing a reasonable basis for projecting the performance of the disposal system. EPAs proposal would require that DOE demonstrate that Yucca Mountain can safely contain the wastes, even considering the effects of earthquakes, volcanic activity, climate change, and container corrosion over one million years.

DOE does not believe it needs EPAs final radiation protection standard to develop or submit its license application for the proposed repository. However, we believe that DOE cannot demonstrate in the NEPA process whether it can meet a radiation protection standard to protect public health and the environment if that standard has not yet been issued in its final form. Therefore, the DSEIS should use the Final EPA Radiation Protection Standard, rather than the Draft Standard, to evaluate the performance of the repository.

POTENTIAL SOCIO-ECONOMIC AND WILDLIFE IMPACTS IN CALIFORNIA

22. **DOE's analysis of the potential socio-economic impacts from the proposed repository is inadequate.**

The potential economic losses from severe accidents and/or successful terrorist attacks or sabotage against a repository shipment should be evaluated including cleanup and recovery costs resulting from a release of radioactive materials.

DOE considers Inyo County outside of the "region of influence" for socio-economic impact analysis under NEPA. We strongly disagree with this conclusion, as the repository is approximately 15 miles from the California-Nevada border and Inyo County line and the boundary for Death Valley National Park. The Park has approximately 800,000 to 1.25 million visitors each year, many of whom are foreign tourists. Inyo County relies heavily on tourism revenues from the Park, as well as other regional attractions. Inyo County is concerned about reduced tourism revenues, as well as decreases in real and business properties resulting from repository operations and the transportation of nuclear waste through the County. Therefore, Inyo County and California should be considered within the "region of influence" for socio-economic impact analysis because of the proximity to the repository site. Without meaningful analysis in the DSEIS of potential socio-economic impacts to Inyo County, DOE's NEPA analyses for the project are incomplete. The DSEIS should evaluate the socio-economic impacts to Inyo County from the proposed repository.

Finally, the DSEIS should describe and fully analyze the potential impacts from the proposed repository, including transportation and groundwater impacts as well as impacts on wildlife, natural habitat and public use parks in California.

Conclusion

The State of California in cooperation with applicable local jurisdictions reviewed U.S. DOE's Draft Repository Supplemental Environmental Impact Statement and the Draft Nevada Rail Corridor/Alignment Environmental Impact Statements. We concluded that the environmental review of the proposed project is significantly lacking in its project description, analysis of alternatives, and meeting the procedural and fundamental requirements of NEPA.

DOE has not conducted a thorough analysis of potentially significant impacts to California in several areas. We respectfully urge DOE to: (1) augment its NEPA analyses in the areas we have identified, (2) recirculate for public review another revised DSEIS and RA DEIS, and (3) expand the public notice and public meeting opportunity for comment to include the major affected California communities that face potentially significant impacts from the proposed project at Yucca Mountain. The revised EISs should address the deficiencies identified in the NEPA documents for the proposed Yucca Mountain project including the potential transportation and groundwater impacts, as well as impacts on wildlife, natural habitat and public use parks in California.

SUPPORTING ATTACHMENT 3

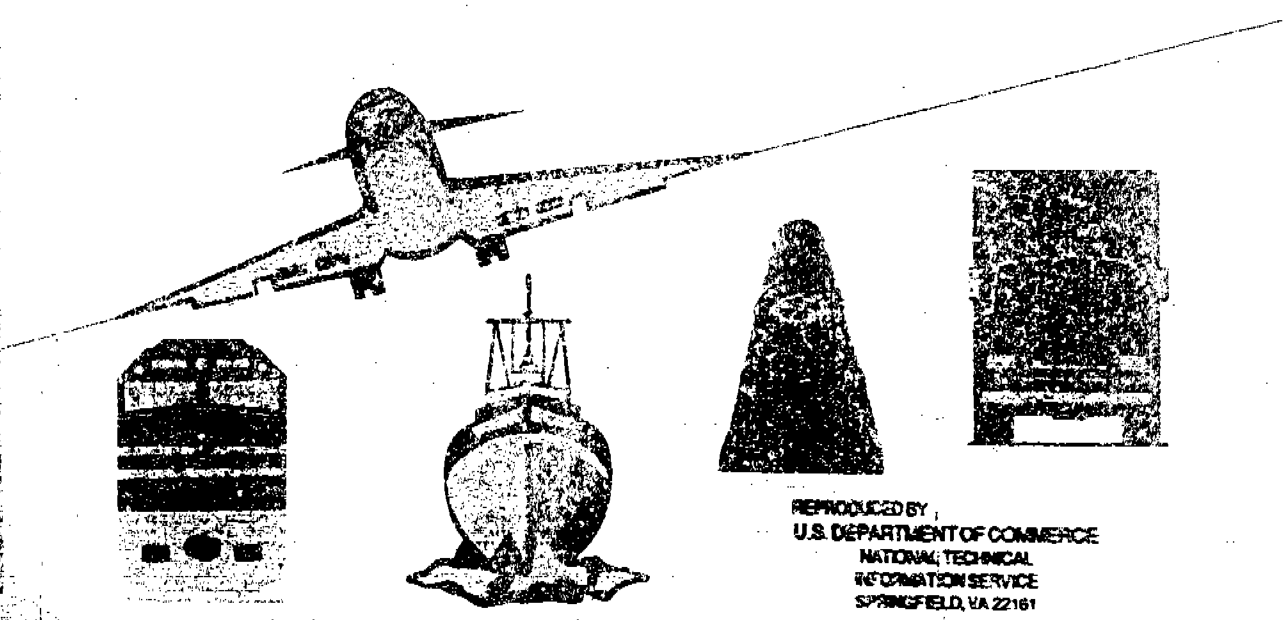
Other Referenced Documents

PB90-916302
NTSB/RAR-90/02

NATIONAL TRANSPORTATION SAFETY BOARD

RAILROAD ACCIDENT REPORT

DERAILMENT OF SOUTHERN PACIFIC TRANSPORTATION COMPANY FREIGHT TRAIN ON MAY 12, 1989 AND SUBSEQUENT RUPTURE OF CALNEV PETROLEUM PIPELINE ON MAY 25, 1989 SAN BERNARDINO, CALIFORNIA



The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable cause of accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation.

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National Transportation Safety Board
Public Inquiries Section, RE-52
800 Independence Avenue, S.W.
Washington, D.C. 20594
(202)382-6735

TECHNICAL REPORT DOCUMENTATION PAGE

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4. Title and Subtitle Railroad Accident Report--Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989, and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, San Bernardino, California		5. Report Date June 19, 1990
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15. Supplementary Notes		

16. Abstract

This report explains the derailment of a Southern Pacific freight train on May 12, 1989, and the subsequent rupture of a Calnev petroleum pipeline on May 25, 1989, in San Bernardino, California. The safety issues discussed in the report are train weight, locomotive brakes, communications, training, operating procedures, wreckage clearing, pipeline surveillance, pipeline integrity, and pipeline check valves. Recommendations addressing these issues were made to the Southern Pacific Transportation Company, the Calnev Pipe Line Company, the Federal Railroad Administration, the Association of American Railroads, the City of San Bernardino, the Research and Special Programs Administration, the National Association of Counties, and the National League of Cities.

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CONTENTS

EXECUTIVE SUMMARY

About 7:36 a.m., Pacific daylight time, on May 12, 1989, Southern Pacific Transportation Company freight train 1-MJLBP-111, which consisted of a four-unit locomotive on the head end of the train, 69 hopper cars loaded with trona, and a two-unit helper locomotive on the rear of the train, derailed at milepost 486.8, in San Bernardino, California. The entire train was destroyed as a result of the derailment. Seven homes located in the adjacent neighborhood were totally destroyed and four others were extensively damaged. Of the five crewmembers onboard the train, two on the head end of the train were killed, one received serious injuries, and the two on the rear end of the train received minor injuries. Of eight residents in their homes at the time of the accident, two were killed and one received serious injuries as a result of being trapped under debris for 15 hours. Local officials evacuated homes in the surrounding area because of a concern that a 14-inch pipeline owned by the Calnev Pipe Line Company, which was transporting gasoline and was located under the wreckage, may have been damaged during the accident sequence or was susceptible to being damaged during wreckage clearing operations. Residents were allowed to return to their homes within 24 hours of the derailment.

About 8:05 a.m., on May 25, 1989, 13 days after the train derailment, the 14-inch pipeline ruptured at the site of the derailment, released its product, and ignited. As a result of the release and ignition of gasoline, 2 residents were killed, 3 received serious injuries, and 16 reported minor injuries. Eleven homes in the adjacent neighborhood were destroyed, 3 received moderate fire and smoke damage, and 3 received smoke damage only. In addition, 21 motor vehicles were destroyed. Residents within a four-block area of the rupture were evacuated by local officials.

Total damages as a result of the train derailment and pipeline rupture exceeded $ 14 million.

The major safety issues include:

Railroad

- the means by which the shipping weights were determined for the shipment of the trona laden hopper cars;
- the dispatching of locomotives without operable dynamic brakes on mountain gradients;
- the information received by the road engineer regarding the weight of the train and the number of operable dynamic brakes;
- the communication between the road and helper engineers regarding the operation of the train, and communication with the dispatcher;

- the engineer's training program, which did not adequately address emergency situations;

- changes in operating procedures made by Southern Pacific after the accident;

Pipeline

- Southern Pacific's wreckage clearing operations in the area of Calnev's pipeline alignment;

- Calnev's oversight surveillance of the train wreckage clearing operations and trona removal in the derailment area;

- Calnev's assessment of pipeline integrity prior to resuming full pressure operation of the pipeline after the derailment;

- the effectiveness of the pipeline check valves used to minimize product release;

- the adequacy of Federal regulations to address the inspection and maintenance of valves for liquid pipelines.

The National Transportation Safety Board determined that the probable cause of the train derailment on May 12, 1989, was the failure to determine and communicate the accurate trailing weight of the train, failure to communicate the status of the train's dynamic brakes, and the Southern Pacific operating rule that provided inadequate direction to the head-end engineer on the allowable speed and brake pipe reduction down the 2.2-percent grade.

The National Transportation Safety Board determined that the probable cause of the pipeline rupture on May 25, 1989, was the inadequate testing and inspection of the pipeline following the derailment that failed to detect damage to the pipe by earth-moving equipment. Contributing to the cause of the pipeline rupture was the severity of the train derailment that resulted in extensive wreckage and commodity removal operations. Contributing to the severity of the damage resulting from substantial product release was Calnev's failure to inspect and test check valves to determine that they functioned properly, particularly after the train derailment.

As a result of its investigation, the Safety Board issued safety recommendations to the Southern Pacific Transportation Company, the Calnev Pipe Line Company, the Federal Railroad Administration, the Association of American Railroads, the City of San Bernardino, the Research and Special Programs Administration, the National Association of Counties, and the National League of Cities. The Safety Board also reiterated safety recommendations to the Research and Special Programs Administration and the Federal Railroad Administration.

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF SOUTHERN PACIFIC TRANSPORTATION COMPANY FREIGHT TRAIN ON MAY 12, 1989, AND SUBSEQUENT RUPTURE OF CALNEV PETROLEUM PIPELINE ON MAY 25, 1989 AT SAN BERNARDINO, CALIFORNIA

INVESTIGATION

Events Preceding the Train Derailment

Loading of Hopper Cars.--The Lake Minerals Corporation, an Owens Lake, California, company involved in the mining and shipment of trona,[1] contracted with the Southern Pacific Transportation Company (SP) to have a shipment of trona transported from the Corporation's rail facility in Rosamond, California (see figure 1), to the Port of Los Angeles. The trona was then to be loaded into a vessel destined for Colombia, South America. Lake Minerals' customer had ordered 6,835 tons of trona. The contract with the SP specified that the railroad would provide 69 100-ton open-top hopper cars; Lake Minerals' payment to the SP was to be based on 100 tons per car.

Because Lake Minerals Corporation did not have rail facilities at its Owens Lake plant, the trona was shipped by truck from there to the rail facility at Rosamond, where the trona was loaded into the open-top hopper cars by a loading contractor hired by the Lake Minerals Corporation. The Lake Minerals Corporation had shipped trona by rail to the Port of Los Angeles on only one previous occasion. The superintendent of Lake Minerals Corporation testified that on that first shipment the company had averaged 88 tons per car when the contract had also called for 100 tons per car. He stated, "We ended up with a significant shortage at the port and did not have enough material to fill the vessel," and "...we ended up with a dead freight charge." For the second shipment, Lake Minerals Corporation requested that the loading contractor install a sensing device on the front-end loader to measure the amount of material that was being loaded into the cars. To test the accuracy of the sensing device, a truck was loaded with the trona and weighed on the truck scale at the loading facility. The device was checked for accuracy after about half the cars had been loaded. The superintendent stated that he was satisfied that the device accurately weighed the loads. He further testified that "we were very concerned with being as accurate as possible." In addition to expressing concern that they did not underestimate the amount of trona loaded, he stated, "At the Port facility there is no way to handle the trona if we had excess material and the vessel was loaded. We would have had to dump it on the ground and haul it back...and we wanted to avoid that at all costs."

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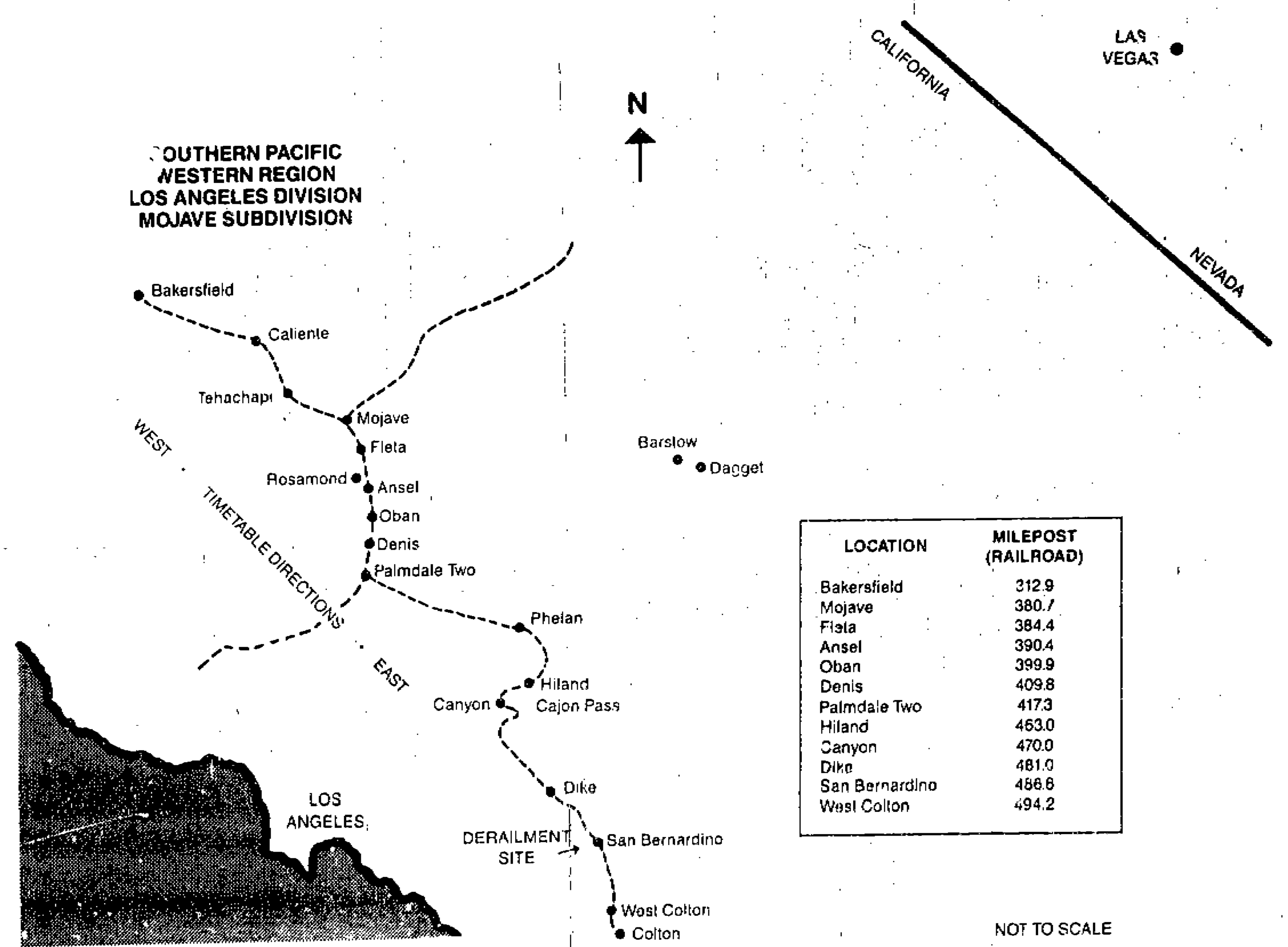
[1] A raw material composed of sodium carbonate, sodium bicarbonate, and water. It is a source for soda ash, pure sodium carbonate, and is used in the manufacture of fertilizer.



LOCATION	MILEPOST (RAILROAD)
Bakersfield	312.9
Mojave	380.7
Fleta	384.4
Ansel	390.4
Oban	399.9
Denis	409.8
Palmdale Two	417.3
Hiland	463.0
Canyon	470.0
Dike	481.0
San Bernardino	486.6
West Colton	494.2

Figure 1.--Mojave Subdivision.

Because the rail facility at Rosamond would not accommodate 69 cars, on May 5, May 6, and May 8, 1989, the SP moved 32, 15, and 22 loaded cars, respectively, from Rosamond to a side track at Fleta (figure 1). After the cars were loaded, yard clerks at Mojave "released" the cars by changing the status of each car from an "empty" to a "load,"[2] in SP's computer system. The computer process required, at the time the status was changed, the entry of an estimated weight of the product. Three different yard clerks, based on their prior railroad experience, entered estimated weights into the car file[3] of the computer system on three separate occasions--each time the groups of cars were moved from the Rosamond facility to the side track at Fleta. (The 32 cars moved on May 5 were estimated at 50 tons each, the 15 cars moved on May 6 were estimated at 75 tons each, and the 22 cars moved on May 8 were estimated at 60 tons each.) The light (empty) weight of the car was programmed into the system, and the system would automatically compute the total weight of each car. According to their testimony, the yard clerks, who had no knowledge of the contents of the contract between the SP and Lake Minerals, believed that the weight they estimated when the cars were released would be automatically replaced in the computer system by the weights shown on the shipper's bill of lading when that document was later received in Los Angeles and the shipper weights were entered into the computer. Testimony by the yard clerks further indicated that estimated weights supplied when cars were released were routinely overridden by shipper weights at later dates, and that they had no reason to believe that it would not be done in this instance. One of the yard clerks, who had worked in that capacity for 17 years with the SP and who estimated the weights of the 15 cars moved on May 6, stated that it was important to estimate as closely as possible the actual weights of the cars; however, he could not offer a precise reason for why it was important. There was no documentation available to the yard clerks that indicated the actual weight of trona (or any other commodity).

<u>Preparing the Shipper's Bill of Lading</u>.--On May 6, 1989, the superintendent of Lake Minerals Corporation submitted a bill of lading for the 69 cars loaded with trona to a shipping clerk at the SP's yard office at Mojave. The bill of lading (appendix C) indicated the total number of cars to be shipped, the destination of the cars, and the car numbers. The weight of the cars was not listed on the bill of lading, and there was no discussion regarding the weight of the cars. The document was reviewed and signed by both the shipping clerk and the superintendent. The superintendent testified that it was an oversight that he did not provide the weights on the bill of lading. He stated, "There was no question about the weights and it was understood, as far as I knew, that they were 100 ton cars, they were loaded and we'd ordered 69 of them." The shipping clerk testified that after the superintendent of Lake Minerals Corporation left the office, he realized

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[2] The purpose in "releasing" or changing the status of a car is to release the customer (in this case Lake Minerals) from the per diem charge for holding empty cars.

[3] Southern Pacific's computer system is composed of various files including a car file and a waybill file. Additional discussion occurs under Method of Operation.

that the SP billing office in Los Angeles would require that a weight be shown on the shipper's bill of lading. He stated that he attempted to contact Lake Minerals Corporation to inquire about the weights of the cars but was unable to obtain the company's telephone number. Based on his experience working for the railroad, he then estimated the weight of the product to be 60 tons per car and wrote the figure of 120,000 pounds per car on the bill of lading (appendix C). He testified, "...I figured these cars were lighter than cement cars and I knew cement cars were 75 tons, so my estimated weight was 60 tons and I entered it." The shipping clerk did not indicate on the bill of lading that the weight listed was an estimated weight. After writing the figure of 120,000 pounds per car on the bill of lading, he sent the document, via a facsimile (fax) machine, to the Los Angeles office. The shipping clerk testified that he had never before received a bill of lading that did not have the weights provided. There was no documentation available to the shipping clerk that indicated the actual weight of trona (or any other commodity) or outlined the procedures to follow when the shipper did not provide weights on the bill of lading. The superintendent of Lake Minerals testified that he believed the weight of 200,000 pounds per car had been written on the bill of lading for the first shipment of trona.

Upon receipt of the document in the Los Angeles office, a billing clerk entered the bill of lading information into SP's computer system information that would later be used to prepare the train (tonnage) profile.[4] According to SP's director of system clerical operations, there are two methods available to the billing clerk to enter bill of lading information into the computer when a unit train[5] is involved. He testified, "One is where the only thing that you show is the total shipment weight, the cumulative weight of all cars and not the individual weights of each car. The second method of entry is where you make the individual weights for the individual cars." Further testimony indicated that if the first method is used, weight information will be entered into the waybill file but that any weight previously entered into the car file will not be upgraded. If the second method is used, the weights estimated and previously entered into the car file of the computer system by the yard clerks would be overridden by the weights entered by the billing clerk. The billing clerk in Los Angeles on May 6, 1989, used the first method for entering the bill of lading information. There was no indication on the document received by the billing clerk in Los Angeles that the figure of 120,000 pounds per car was an estimated weight.

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4 A document provided to the traincrew that indicates, among other information, the tonnage of the train.

5 In a unit train, all the cars are carrying the same product; for example, a unit coal train.

Activities of Extra 7551 East.--At 5:00 p.m., on May 11, 1989, the chief train dispatcher on duty at Los Angeles, California, telephoned a yard clerk at Mojave (see figure 1) and informed him of plans to operate a train to haul the 69 cars of trona from Fleta to West Colton, near Los Angeles. At 9:00 p.m. that evening, a traincrew consisting of a locomotive engineer, a conductor, and a brakeman reported for duty at SP's yard office in Bakersfield, California. At 9:15 p.m. while in the Bakersfield yard office, the conductor telephoned the yard clerk at Mojave and was told about the crew's assignment to operate SP train MJLBP1-11 (designated Extra 7551 East) out of Mojave to haul 69 cars of trona. The crewmembers were transported in a company van from Bakersfield to Mojave where they arrived and entered the yard office at about 10:30 p.m. The crew picked up a clearance form, train orders, train list, and tonnage profile (the latter document is generated by the SP computer system and based, in part, on information in the car file) (appendix D), and departed the office. The documents provided to the crew indicated that the train consisted of 69 loaded cars with a trailing tonnage of 6,151 tons. The engineer testified that neither he nor the conductor had any concern about the paperwork received. The dispatcher on duty at 5:00 p.m. that day had arranged for the crew to take three locomotive units from the Mojave yard to Fleta (3 miles away) where they would couple onto the 69 cars assembled in the siding. They were to then pick up an additional locomotive unit at Palmdale Two (figure 1) to help in ascending the 2.2 percent grade to Hiland.

After departing the office, the crew proceeded to the yard to check out the three-unit locomotive consist. Between 11:00 p.m. and 11:30 p.m., the conductor called the yard clerk and informed him that locomotive unit SP 7551 was "dead-in-consist" and could not be started. The engineer testified that the crew attempted to determine the reason the unit would not start but was unsuccessful. The yard clerk instructed the crew to use another unit (SP 8278) that was in the yard next to the three-unit consist. The yard clerk then informed the assistant chief dispatcher, who had come on duty in Los Angeles at 10:30 p.m., of the condition of SP 7551 and of the use of SP 8278. The assistant chief dispatcher testified that he was concerned that with only three locomotive units the train could not take the 69 loaded hopper cars farther than Denis (see figure 1), and so he decided to alter the plan to supply locomotive power for Extra 7551 East that had been arranged by the dispatcher on the previous shift. Rather than have the crew pick up an additional locomotive unit at Palmdale Two, the assistant chief dispatcher arranged for a helper locomotive to move toward Mojave, meet Extra 7551 East at Oban, and assist the train up the ascending grade to Hiland and through the Cajon Pass.[6] The assistant chief dispatcher testified that he made this decision based on his belief that the tonnage of Extra 7551 East was about 8,900 tons, a figure that he calculated based on his experience with the product. He further testified that even though he had a copy of a yard list prepared by the yard clerks the previous week when they released the cars indicating a trailing tonnage of 6,151 tons, he believed that figure to be an estimated weight that would have been overridden when the bill of lading information was placed in the computer system. According to his testimony,

6 The route through the mountains over which SP trains often operate.

he determined the number of locomotive units that would be needed to move the train up the grade based on the 8,900 tons. He testified also that he had never previously recalculated the tonnage of a train to determine the number of locomotives that would be needed. He stated that he further believed that the crew had been provided with an upgraded weight reflecting the figure of 8,900 tons. He did not communicate with the crew nor did he use the computer system, which was available to him at his desk in Los Angeles, to determine the tonnage figure that had been provided to the crew.

After conducting an initial terminal air brake test,[7] the crew of Extra 7551 East departed Mojave yard (MP 381.3) at 12:15 a.m., on May 12, en route to Fleta (MP 384.4) with a locomotive consisting of units SP 8278, SP 7551, SP 7549, and SP 9340 configured in that order from east to west. (The engineer testified that because he was not told to do anything with unit SP 7551, he kept it in the consist.) The engineer was operating from the lead unit, SP 8278, en route to Fleta.[8] Because maintenance-of-way equipment was occupying the east end of the siding at Fleta, the dispatcher instructed the crew to continue eastward to Ansel (MP 390.4) and enter a side track at that location to clear the main track for traffic. According to the engineer, Extra 7551 East arrived at Ansel at 12:40 a.m., waited for the main track traffic to pass, and departed Ansel at 1:15 a.m. to return to Fleta. On the return trip to Fleta, SP 9340 was the lead unit in the consist, and the engineer operated from that unit. Because the maintenance-of-way equipment was still occupying the east end of the siding at Fleta, the crew was unable to position their locomotive units on the east end of the train to continue their eastbound trip. It was necessary, therefore, for the crew to enter the west end of the siding (see figure 2), couple their units to that end of the 69 hopper cars, return westbound to Mojave yard, reposition their locomotives units at that location, and then continue their eastbound train movement. The engineer testified that before departing Fleta, the train line pressure was charged but an air brake test was not conducted. The engineer stated that while operating from unit SP 9340 on the return trip to Mojave, the dynamic brakes[9] were intermittent: "It would load and then the dynamics would drop out on the unit." (Additional discussion occurs under Mechanical Information.) The engineer testified that after the locomotive consist was repositioned and coupled to the cars in Mojave yard, a test for leakage of the train line pressure and an initial terminal air brake test were performed. According to the engineer, none of the crewmembers expressed concern about the tests. After waiting for an inbound train to clear the main track, Extra 7551 East departed Mojave at about 3:35 a.m. with the engineer operating the train from the lead unit, SP 8278. The conductor was

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[7] The SP air brake rules require that the train air brakes be tested before the train departs its initial terminal.

[8] Train designation is based on the number of the lead locomotive unit. Even though unit SP 8278 was the lead unit in the locomotive consist, the train designation remained Extra 7551 East.

[9] Dynamic braking is an electrical means used to convert some of the energy of a moving locomotive into an effective retarding force.

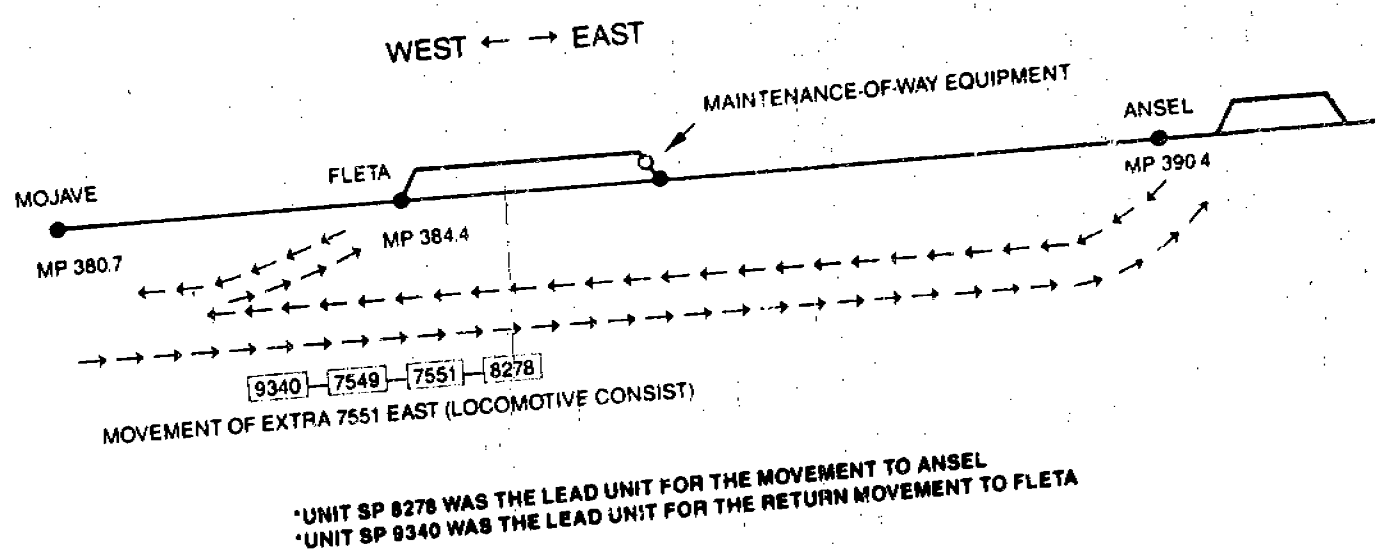

Figure 2.--Siding at Fleta.

seated in the cab across from the engineer; the brakeman was seated in the cab of the third unit, SP 7549. According to the engineer, the brakeman was seated in the third unit to keep warm because the second unit, SP 7551, was not operating. The engineer stated that the dynamic brakes on SP 8278 were "working," and that when he asked the brakeman about the condition of the dynamic brakes on SP 7549, the brakeman replied, "It's revving." The engineer further stated that he did not conduct a visual observation[10] of SP 7549 to determine if its dynamic brakes were operative. Extra 7551 East proceeded to Oban, and the dispatcher instructed the crew to move into the siding at that location to await a westbound train that was being assisted by a helper unit; the helper unit would be cut off and used to assist Extra 7551 East over the Cajon Pass.

<u>Activities of Helper Unit</u>.--At 1:30 a.m., on May 12, 1989, an SP crew, consisting of a locomotive engineer and brakeman, reported for duty at West Colton yard. The crew was transported in a company van from the West Colton yard to Dike (MP 481) (see figure 1), arriving at that location at about 2:30 a.m. The crew took charge of a two-unit locomotive consist, SP 7443 (facing west) and SP 8317 (facing east), that was to be used in helper service (assisting trains traversing Cajon Pass). The crew (hereinafter referred to as the helper engineer and the helper brakeman) was instructed by the train dispatcher to operate from Dike to Palmdale Two (MP 417.3) and then to assist a westbound train, Extra 8240 West, between Palmdale Two and Oban (MP 399.9). The helper engineer had been informed by the engineer whom he had relieved that the dynamic brakes on unit SP 8317 were inoperative. The movement from Palmdale Two to Oban was uneventful, and the crewmembers had no concern about the operation of the train. At about 5:06 a.m., the dispatcher instructed the helper engineer to couple the helper locomotive onto the rear of an eastbound train, Extra 7551 East, that was waiting in a siding at that location for helper service through the Cajon Pass.

The helper engineer testified that he did not receive any information from either the head-end engineer or the dispatcher regarding the tonnage of Extra 7551 East nor did he request that information. There was no SP requirement that he be furnished that information. He stated that he did not normally operate over this territory and, therefore, did not know if it was customary to receive that information. He stated further that for the territory over which he normally operated, he usually received that information, and that if he did not, he would request it.

<u>Movement of Extra 7551 East From Oban to Hiland</u>.--After the helper locomotive was coupled onto the rear of Extra 7551 East, an airbrake test was performed; neither engineer noted any deficiencies in the operation of the brakes during the test. Upon receiving a clear signal, the helper engineer radioed the head-end engineer and informed him that the helper engineer ...

10 The method for positively determining if dynamic brakes are operating is by observing the amperage reading in each locomotive unit. See Mechanical Information for additional discussion.

informed the head-end engineer, by radio, that the trailing units had cleared the siding. The helper engineer testified that his locomotive was in the eighth throttle notch (full throttle) before entering onto the mainline. The head-end engineer and the conductor were still on the lead unit, SP 8278, and the head-end brakeman remained on the third unit, SP 7549. The helper engineer and the helper brakeman were located in the trailing unit, SP 7443, of the helper consist. The helper engineer stated that the trip from Oban to Hiland (MP 463) was uneventful.

The Train Derailment

Testimony indicates that there was no communication between the head-end engineer and the helper engineer from the time Extra 7551 East left the siding at Oban until about 7:03 a.m. when the head-end engineer was cresting the hill at Hiland. The head-end engineer stated that he crested the hill at Hiland (MP 463) at 25 mph or 5 mph below the speed he believed was allowed based on the information he had about the train--6,151 trailing tonnage and four units (two head-end units and the two helper units) with full dynamic brakes and one head-end unit with intermittent dynamic brakes. As he crested the hill, the head-end engineer began using his dynamic brakes and initiated a 6-lb reduction of the air brake pipe pressure. He then asked the helper engineer if he had "...all of your dynamics...." The helper engineer responded, "Yeah, I'm in full." The head-end engineer testified that based on the helper engineer's response he believed that both helper units had operative dynamic brakes and had no reason to believe otherwise. He had not been informed by either the dispatcher or helper engineer that one of the helper units had inoperative dynamic brakes, and he did not inquire about the condition of the dynamic brakes on the trailing units. The helper engineer stated that he did not believe it was necessary for him to alert the head-end engineer of the status of the dynamic brakes on the helper unit because he (the helper engineer) believed the dispatcher would have already made that information known to the head-end engineer. The assistant chief dispatcher, who arranged for the helper unit to assist Extra 7551 East, testified, "I think the normal procedure would be for the helper engineer to relay that information to the road engineer, certainly not the train dispatcher." SP had no requirement that the dispatcher record or disseminate this information.

As the train continued descending the hill, the speed of the train increased to about 30 mph and the head-end engineer increased the brake pipe pressure reduction to 10 psi. According to the head-end engineer, the speed of the train held at 30 mph for a short time and then began to increase. He then increased the brake pipe pressure reduction to about 14 psi. He continued to increase the brake pipe pressure reduction gradually. Each time he reduced the brake pipe pressure, the train's speed would slow slightly and then it would begin to increase again. By the time he reached Canyon, he had reduced the brake pipe pressure a total of 18 psi, but the train was traveling at a speed of 31 mph and accelerating. The head-end engineer stated to Safety Board investigators, "As you're coming down Canyon [MP 469], there are a few places there where it [the train] will run on you, meaning that it's less curvy...you no longer had that resistance of the curves so the train will pick up a little speed, but I was compensating fine." As the train entered straight track, around MP 477, the speed of the train increased, and the engineer began increasing the brake pipe pressure reduction. He stated, "I kept waiting for it [the train] to settle down....I was already up to 20 pounds. Now I knew that was probably enough when that train should start bogging [slowing] down." According to the head-end engineer, he then went to a full service reduction (26 psi). He stated further, "When I made a full service and it wasn't slowing down, we realized that...this train wasn't going to stop." About 7:30 a.m., based on the readout of the event recorder, as the train speed reached 45 mph, the helper engineer, without communicating with the head-end engineer, placed the train brakes in emergency. According to the helper engineer, he did not communicate to the head-end engineer that he was going to place the train brakes in emergency because "at that point there might have been something wrong up there and the speed we were going, corrective action had to be taken and soon...." He further stated that he did not believe that communication prior to that time was necessary because by observing the brake pipe gauge on the rear end, he could tell that the head-end engineer was attempting to take corrective action. According to the head-end engineer, after the helper engineer placed the train brakes into emergency, he placed his brake valve in emergency and the train then began to "surge." According to SP, its locomotives are designed so that when the train brakes are placed in emergency, the dynamic brakes are pneumatically blocked out; both engineers testified that they were aware of this feature. The head-end engineer stated that when the train brakes were placed in emergency he believed there were no longer any options available for controlling the speed of the train.

A motorist who routinely travels on a highway that parallels the railroad tracks for some distance and normally sees trains at that time of the morning testified that she observed "...one train...going a lot faster than some that I had normally seen before." The motorist, who estimated that the highway was about 1/4 to 1/2 mile from the tracks, also testified that the train was engulfed in what she assumed to be smoke, which she described as light blue in color. The helper brakeman testified that after the helper engineer placed the brakes in emergency, he observed smoke coming from underneath the train. The head-end engineer also testified that when he looked back over his train, he saw a "lot of smoke coming from the train."

The speed of Extra 7551 East continued to increase as the train descended the hill. The head-end engineer stated that when he realized the train was not slowing, he instructed the conductor to "get on the phone and tell them we got a runaway train." According to a transcript of the dispatcher's radio log, at 7:33:21, an attempt was made to contact the Saugus dispatcher but was not successful. At 7:33:48, the conductor contacted the assistant general yard master at West Colton and informed him, "We have a slight problem. I don't know if we can get this train stopped. We're coming out of Dike [MP 481]." The helper engineer testified that when he overheard the radio transmission to the West Colton yard, he did not believe that the message conveyed the seriousness of the problem and that "I got on there and I called Mayday Mayday to clear the radio waves." He further stated that because the train speed was rapidly increasing, he positioned himself on the floor behind the control stand with his back and head braced against the back panel and his feet braced against the control stand. He stated that he had the radio in his hand, was calling out the speeds and was attempting to call somebody, and that he remembers "calling out the speed when we hit ninety." The helper brakeman stated that he remained in his seat. The transcript of the dispatcher's radio log indicates that at 7:37:09 the following message was transmitted: "Mayday! Mayday! 7551, West Colton-AGYM [assistant general yard master], we're doing 90 miles per hour, nine zero, out of control, won't be able to stop till we hit Colton." The head-end engineer stated that after the conductor called West Colton, "there was nothing left to do." He further stated that he and the conductor remained in their seats and that he believed the speed of the train reached 100 mph. He stated, "The speedometer only went to 80, but it was way past that....It was as far as it could go."

As Extra 7551 East approached MP 486.6 and entered a 4-degree right-hand curve, the entire train derailed to the outside of the curve; many of the cars crashed into a neighborhood of houses adjacent to the railroad right-of-way (figures 3 and 4).

The dispatcher's radio log indicated that a call from Extra 7551 East stating that the whole train was on the ground was received at 7:37:55. The helper engineer testified that he made the radio transmission after the derailment and that because he had received no communication from the head end, he instructed the helper brakeman to go to the front of the train.

Shortly after 7:30 a.m., two San Bernardino police detectives, who were traveling westbound on Highland Avenue approaching California Street, observed what they stated appeared to be a large flash of light and a large cloud of dust come from the area of Highland Avenue and west of Macy Street. They continued westbound on Highland Avenue, and as they drove past Macy Street, they observed that an SP train had derailed and had crashed into several houses on Duffy Street. One of the detectives used his police radio to advise his dispatcher of the situation and to request emergency personnel. They parked their vehicle on the north side of Highland Avenue and ran up the railroad levee[11] to evaluate the damage. Several other people had also stopped their vehicles and ran up the levee.

A Southern California Gas Company employee stated that he and another gas company employee were about 100 yards west of Highland Avenue when they observed the train derail at a high rate of speed. He further stated that he immediately ran to the site of the derailment and, along with other unidentified people, helped the engineer who was attempting to pull himself out of the lead locomotive unit. According to the gas company employee, the engineer began looking for his "partner" (who was later identified as the conductor) whom he found fatally injured in the same lead locomotive unit. After they helped lay the engineer next to a fence in the rear yard of 2304 Duffy Street to await the arrival of emergency personnel, the gas company employees began shoveling dirt around one of the locomotives in an attempt to prevent the spilled diesel fuel from spreading. They then began shutting

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11 At this location, the railroad tracks are constructed atop a 20- to 21-foot-high embankment (levee).

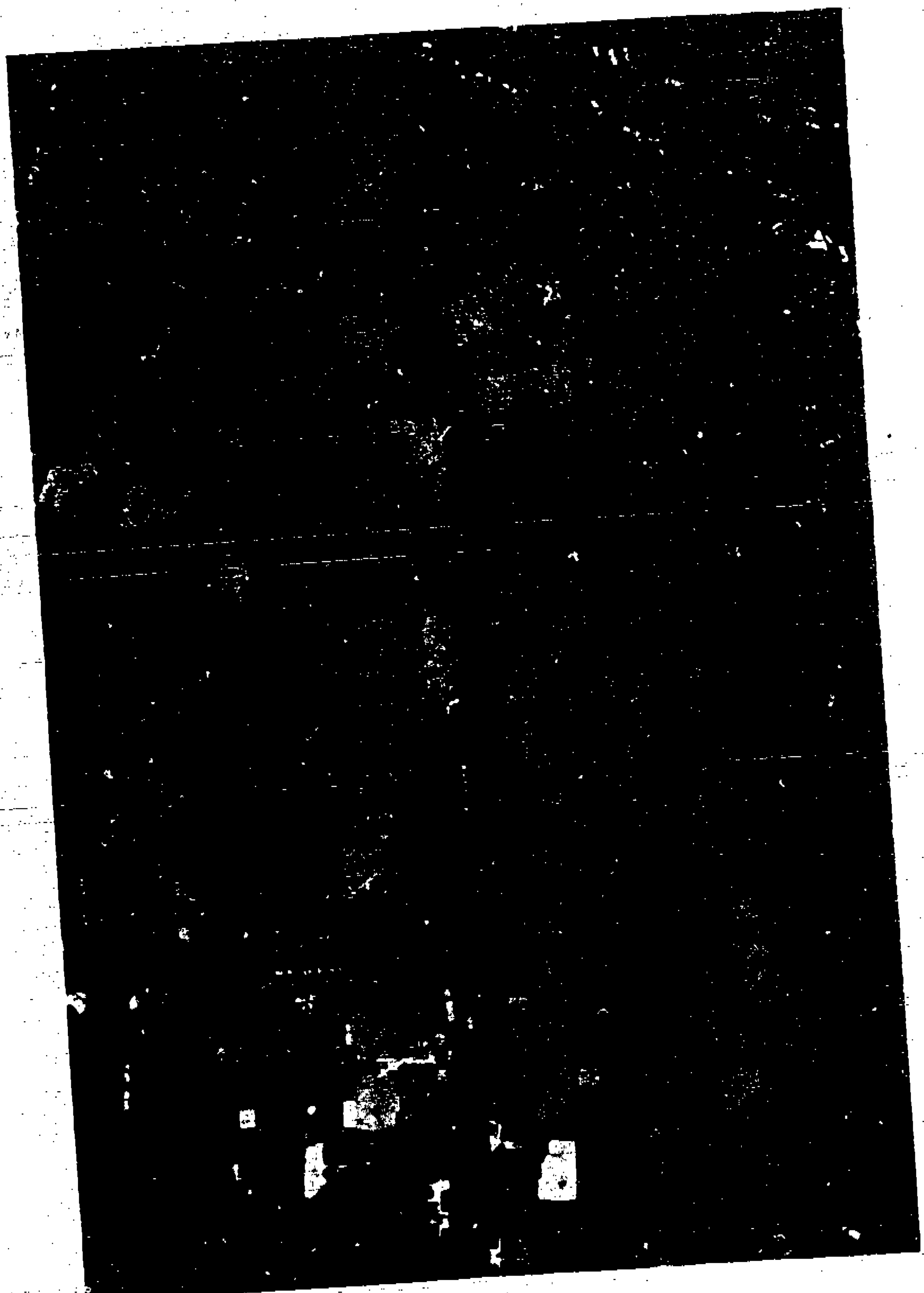
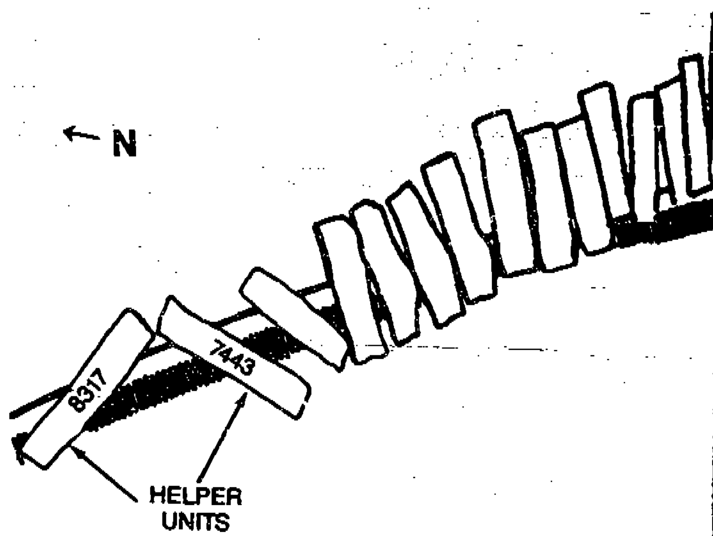
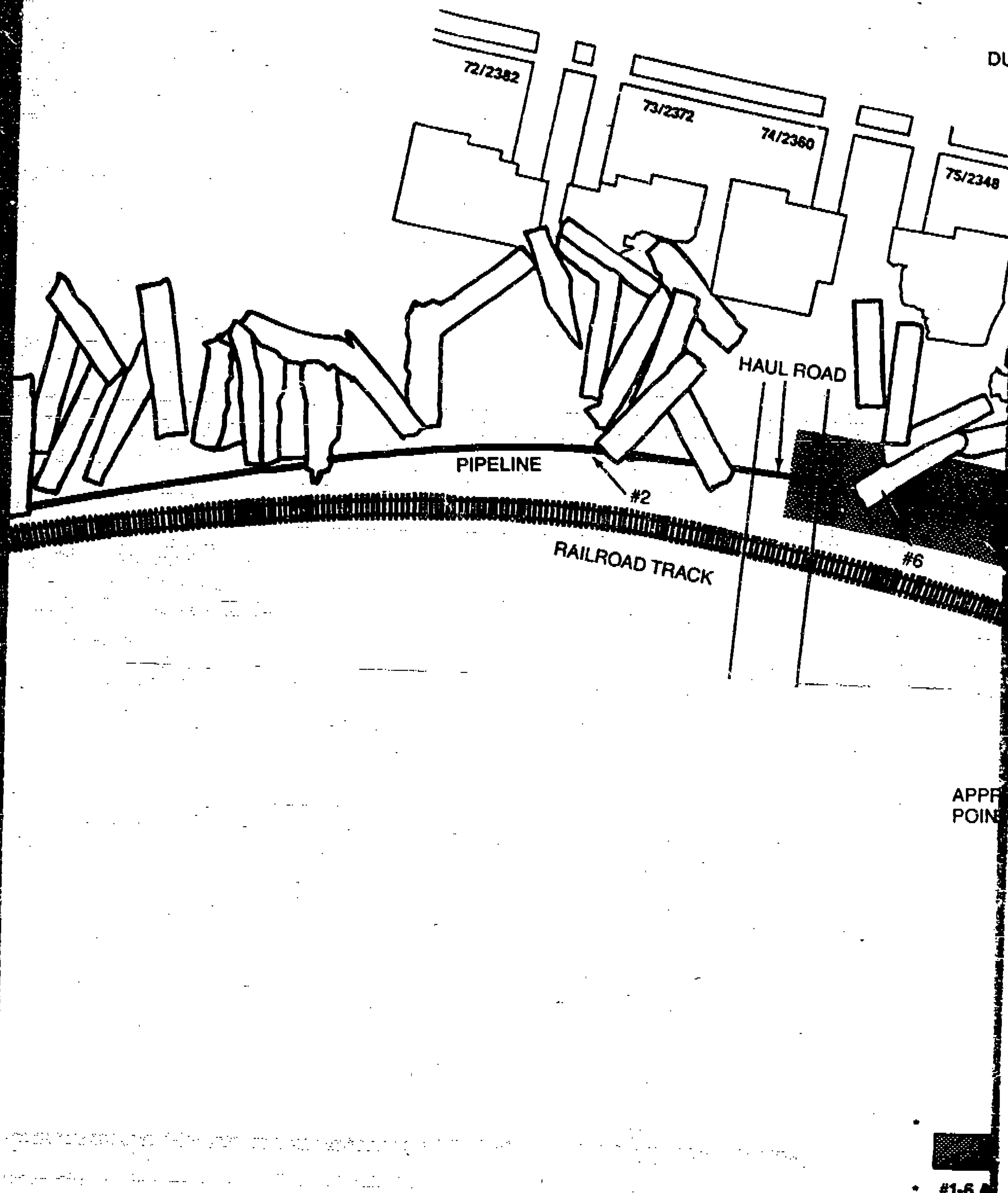


Figure 3.--Aerial view of train derailment.

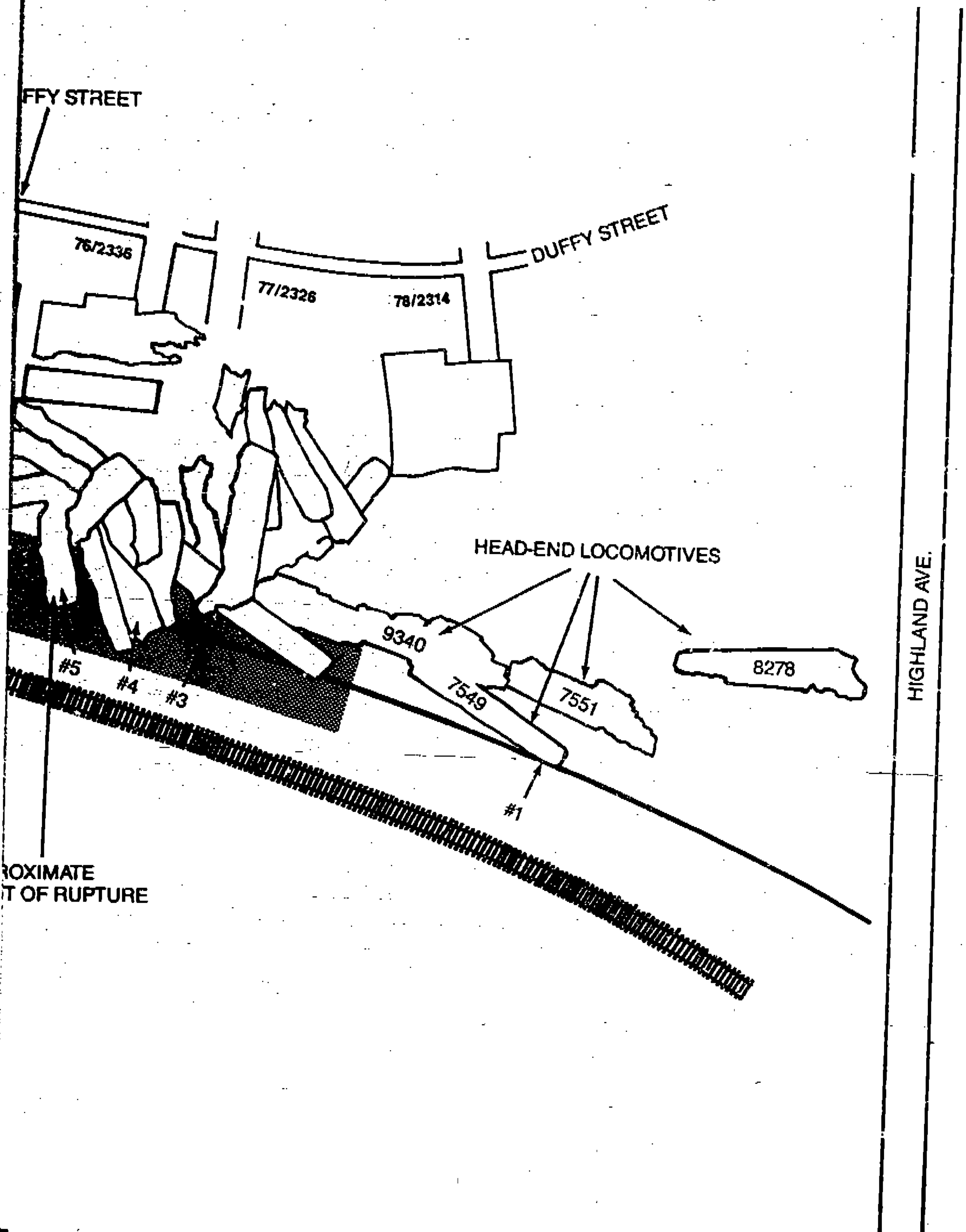


NOT TO SCALE

Figure 4. -- Wreckage distribution and location of



Calnev excavations.



PORTION OF AREA WHERE CALNEV MADE AN 8 FOOT-WIDE PATH THROUGH THE TRONA

PPROXIMATE LOCATION OF SELECTED EXCAVATIONS off gas lines to the houses that were damaged in the derailment. According to one of the gas company employees, there were no fires associated with the spilled fuel oil or the broken gas lines.

Emergency Response to Train Derailment

The San Bernardino County's 911 emergency number was called about 7:41 a.m. by a resident who reported that a train was off the tracks and into some houses.

The San Bernardino battalion chief's unit was the first fire department unit to arrive at the derailment site about 7:48 a.m. The battalion chief stated that in addition to observing the derailed freight train and damaged houses, he noted that a white powdery substance that had been dumped by the train when it derailed was piled over the entire wreckage site. He stated further that he requested a hazardous materials unit to respond to the scene because of the unknown product being carried by the train, the leaking diesel fuel from the overturned locomotives--even though there was no evidence of fire--and the possibility of pipeline involvement.[12] The battalion chief stated that he was aware that a pipeline was in the area of the derailment but was uncertain of its location at that time.

Police units began arriving also about 7:48 a.m. and began setting up road blocks, evacuating occupied houses, and handling crowd control. An estimated 63 persons were ultimately evacuated from 27 houses in the immediate area of the derailment. As other fire companies arrived, they were placed in strategic locations around the accident site. About 7:55 a.m., fire department personnel began a house-to-house search for survivors. About 11 houses had been impacted by the derailing train. At that time, a canvass of the neighborhood and residents found that no one was reported as missing. About 8:01 a.m., however, a parent reported that two children who resided at 2348 Duffy Street were missing. A second search began and about 8:25 a.m., the first child was found dead; about 10:15 a.m., the second child was also found dead.

Meanwhile, about 8:05 a.m., the San Bernardino deputy fire chief arrived on scene, was advised of the situation by the battalion chief, and then assumed control of the emergency as incident commander. He stated that he approached representatives of Calnev and SP, who had arrived on scene between 8:30 a.m. and 9:00 a.m., and informed them that he was the incident commander in charge. He stated further that by the time he had arrived, the city's joint response and mutual aid plan had been implemented as a result of the battalion chief's initial request for additional assistance. The incident commander subsequently established a command post at the corner of Donald and Duffy Streets. The deputy fire chief testified that all subsequent actions by Calnev and SP were coordinated with him. He further testified that because the product that was scattered over the derailment site had been transported in open top hopper cars, he did not believe it was a "serious

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[12] A 14-inch liquid petroleum pipeline, operated by Calnev Pipe Line Company, was buried in the SP's right-of-way.

hazardous material." He was informed initially by SP personnel that the product was potash; later in the day he received a data sheet from the Office of Emergency Services (OES) that identified the product as sodium carbonate.

About 10:40 a.m., the search team was notified that a third person was reported missing at 2326 Duffy Street. Because of the total destruction of the house and the unstable condition of the train cars that were piled up in the area, search and rescue efforts for the missing person at that location were delayed until heavy equipment could be brought in to move some of the damaged structure and train cars.

Representatives from the California OES, which was notified of the accident at 7:45 a.m., through the San Bernardino County Communications Center, arrived on scene about 9:15 a.m., reported to the command post and offered assistance. About 10:15 a.m., OES arranged for two scenting dogs and their trainers to be flown from the San Francisco Bay area. The dogs and their trainers arrived about 3:55 p.m., and the trainers were briefed by the incident commander about the ongoing search and rescue efforts.

Meanwhile, about 2:00 p.m., SP began to set up blocks and tackle to facilitate removal of train debris with a crane. These efforts were halted by the incident commander about 3:00 p.m., before debris removal began, because the incident commander and the OES believed that such efforts might endanger rescue operations. The incident commander decided, and SP and Calnev representatives concurred, that nothing would be moved until the dogs had completed a search of the area.

The dogs alerted rescuers at various times when they sniffed the vicinity of the house at 2326 Duffy Street between 4:20 p.m. and 9:00 p.m. Shortly after 9:00 p.m., the rescue workers located a hand projecting through the debris at 2326 Duffy Street. The surrounding area was immediately stabilized. An opening was cleared by paramedics, who sent down oxygen and took vital signs of the trapped person. With the help of power tools, the resident was eventually freed from the debris about 10:34 p.m., about 15 hours after the derailment.

About 11:20 p.m., a rescuer was alerted by a dog in the vicinity of the third head-end locomotive unit. After removal of debris, the head-end brakeman was found dead in that unit about 3:03 a.m., May 13. The dogs worked until about midnight, examining all affected residences and portions of the train. By early morning on Saturday, May 13, the incident commander determined that all areas had been adequately searched, there were no further reports of missing persons, and, consequently, search and rescue efforts were terminated.

Shortly after noon on May 13, before wreckage removal operations began, SP bulldozers and hundreds of sandbags were used to build a dam at the lowest end of the accident site to help contain gasoline should the pipeline become compromised.

The San Bernardino Chapter of the American Red Cross initially learned of the train derailment on commercial radio about 8:43 a.m. At that time, representatives of the Red Cross responded to the scene where they met with the incident commander and were directed to prepare a shelter for 50 to 100 persons. The Red Cross Disaster Coordinator then contacted the Red Cross chapter office and requested additional personnel and logistical support. A temporary shelter was prepared at the local Job Corps building, a mobile canteen/kitchen was established at the accident site, and damage assessment teams were sent to the scene. The Executive Director for the San Bernardino Chapter of the Red Cross stated that they were equipped to handle the emergency and that they received logistical support from the Los Angeles and the Riverside Chapters in the form of a van, a canteen, and food supplies.

Wreckage Clearance/Pipeline Surveillance Operations Following the Train Derailment

May 12, 1989.--When Calnev's manager of engineering received information regarding the train derailment, he radioed Calnev's Colton terminal, about 6 1/2 miles from the derailment site, and instructed personnel at that location to shut down the 14-inch pipeline immediately. At 8:30 a.m., pumping operations were stopped, leaving a residual pressure of 1,128 psig at Colton. The manager of engineering then notified Calnev's manager of operations and the maintenance superintendent of the train derailment; all three individuals proceeded to the accident site to view the derailment and determine the potential impact to the pipeline. According to the manager of operations, when they arrived at the derailment site, it was obvious the pipeline could have been damaged because the pipeline was under a portion of the wreckage, "...most notably a locomotive that came to rest inverted directly over the pipeline" (figure 4). According to the manager of operations, their concern was that if the locomotive had remained intact, it could possibly have protruded into the ground 8 to 10 feet, and they were unsure at that time of the precise depth of the pipeline at that location. According to Calnev personnel, the derailment prevented Calnev from accessing the pipeline and performing any inspections of the pipeline in that location at that time. Calnev's activities during the morning of May 12, according to the maintenance superintendent, were confined to remaining on site to make sure that no actions occurred on the part of the railroad or other agencies that could further endanger the pipeline. However, Calnev wanted to reduce further the pressure in the pipeline in the area of the derailment. According to the maintenance superintendent, "What we ideally were going to accomplish was to remove all of the product from the pipeline under the derailment area. As events proceeded, it was determined that that was unfeasible."

At 11:30 a.m., a foreman for Arizona Pipeline Company,[13] permanently assigned to work on Calnev projects, arrived on site to assist Calnev personnel in reducing the pressure in the pipeline. The initial plan was to excavate the pipeline at a location 500 to 800 feet south of Highland Avenue (south of the derailment site), install a fitting for the purpose of tapping

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[13] A contract company (rather than a pipeline operating company, such as Calnev) that specializes in the installation, maintenance, and repair of underground lines.

a hole into the pipeline, and withdraw product at that location. According to the Calnev maintenance superintendent, they were aware, by referring to company pipeline maps, that a check valve was installed in the pipeline immediately north (upstream) of the derailment site at pipeline milepost (MP) 6.9[14] (figure 5). Calnev officials stated that they believed that removal of product from the pipeline at the location south of Highland Avenue would cause the check valve to seat (close) thereby isolating the pipeline north of the check valve from the pipeline in the derailment area. Further removal of product would then reduce the pressure in the pipeline in the derailment area. After excavating at the location south of Highland Avenue, Calnev officials determined that the location was not suitable for tapping the pipe because the pipe was buried in the ground at a depth of 14 feet and was inside a steel casing. Calnev officials then moved their activities to the Colton terminal where a 2-inch fitting with a 1 1/4-inch opening was installed on the 14-inch pipeline, and they subsequently began withdrawing product from the pipeline at that location.

According to Calnev's maintenance superintendent, after about 120 barrels of product were removed from the pipeline (and loaded into a vacuum truck), the pressure was reduced about 60 psig at the Colton pump station (MP 0.0) and at Cajon Pass (MP 25.7).[15] Because the pipeline pressure had been reduced by an equal amount on both sides of the check valve at MP 6.9, Calnev personnel determined that they had not been successful in seating (closing) the check valve at that location and, consequently, had not been successful in isolating the pipeline in the area of the derailment. The equal reduction in pressure also indicated that the check valves at MP 14.9 and MP 19.2 had not seated.

Believing that they had been unable to withdraw product at a rate adequate to induce product backflow sufficient to fully seat the check valves, Calnev personnel installed a threaded fitting through the new opening and connected it with high pressure hoses in an attempt to withdraw product at a faster rate. According to Calnev personnel, a second vacuum truck load of product (120 barrels) was then withdrawn and comparable results were observed--an equal reduction in pressure on both sides of the check valve at MP 6.9. As a result, ~~Calnev knew~~ that the check valve at MP 6.9 was not closing. Calnev's maintenance superintendent stated that he then recommended that additional pressure reduction could be achieved by closing the block valve at the Cajon Pass pump station. After the block valve was closed, a third vacuum truck load of product (120 barrels) was withdrawn from the pipeline and a 200-psig reduction in pressure was achieved. Once again, however, the pressure readings at the Cajon station and at the Colton station

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14 Milepost numbers for the pipeline do not correlate with the milepost numbers for the railroad.

15 The static pressure in the pipeline varies with the elevation of the line. Therefore, the pressure reduction, rather than the pressure reading, was the critical observation at the two locations.

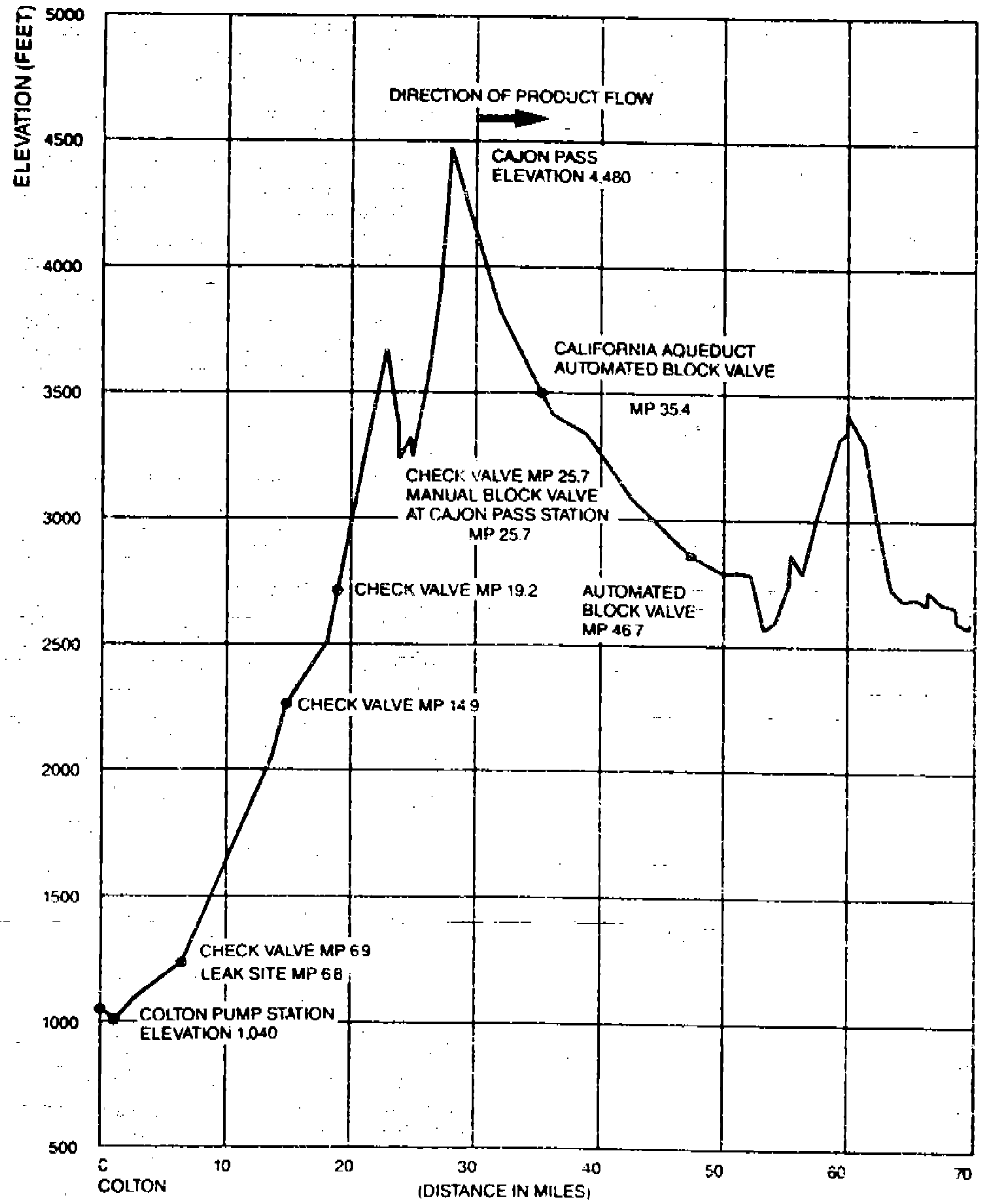

Figure 5.--Elevation of Calnev pipeline.

indicated that the pressure had been reduced by equal amounts, which indicated to Calnev personnel that the check valves still had not seated. The 200-psig reduction also indicated that the remaining pressure on the line was due to the weight of the liquid and, as the maintenance superintendent stated, "that additional efforts would be only minimally successful in reducing the pressure at the Highland Avenue location [derailment site]," because backflow sufficient to seat a 14-inch check valve clapper could not be induced by withdrawing product through a 1 1/4-inch opening. As a result, Calnev suspended activities to reduce further the pressure on the pipeline, which at 10:00 a.m. on May 12, was 800 psig at Colton, or about 50 percent of the maximum operating pressure established by Calnev. According to Calnev's manager of operations, Calnev did not at that time consider the possibility that the check valves were malfunctioning, but believed that the check valves did not close because of the inadequacy of the method used to induce backflow.

Meanwhile, SP's division mechanical officer and other SP personnel had arrived on site and in consultation with Calnev and the incident commander began discussing plans for removal of the railroad equipment. According to the division mechanical officer, "the plan was to remove the cars and in no way affect the pipeline." The plan included cutting a breach (road) in the railroad levee through which the railroad equipment would be moved to the other side of the track. According to the San Bernardino Fire Department and Calnev, SP was advised that when the cars were to be removed, all cars were to be lifted and not dragged over the pipeline. Calnev's manager of operations testified that he was aware of an accident in Montclair, California, in the latter part of 1988, during which wreckage removal operations possibly caused damage to a pipeline and that he wanted to avoid a repeat of such an incident. According to Calnev's manager of operations, he did not discuss with the Fire Department or SP at that time what actions Calnev would take to inspect its pipeline after the cars were removed. Search and rescue operations continued until late in the evening on May 12, and efforts to begin removal of the wreckage were delayed until the following day.

<u>May 13, 1989</u>.--On the morning of May 13, SP removed 50 to 75 feet of track in preparation for making the breach (road) through the railroad levee that would be used for removing the railroad wreckage from the east side of the track to the west side. According to SP's division mechanical officer, the site of the breach was determined by a break in the distribution of wrecked cars on the east side of the track (figure 4). Once the breach had been made, two 225-ton cranes and several bulldozers and front-end loaders came through the breach from the west side of the track, crossed over the pipeline, and were positioned at various points around the wreckage (figures 6 and 7). SP's division mechanical officer testified that a lot of the trona that had spilled from the train was used to cover the ground and that with the trona and the fill removed from the levee, there was about 6 to 7 feet of cover over the normal level of the ground in the area through which the equipment was moved. At the time the breach in the levee was made, the exact depth of the pipeline below natural grade had not been determined. During the morning of May 12, Calnev personnel used a line locator and yellow paint to mark the location of the pipeline throughout the derailment area. Later

Figure 6.--Equipment used during wreckage removal.

Figure 7.--Equipment used during wreckage removal.

that morning, with a backhoe and shovels, Calnev personnel dug two holes on either side of the locomotive engine that came to rest inverted over the pipeline and determined that the depth of the pipeline in that area was between 7 and 8 feet.

According to the testimony of Calnev's maintenance superintendent and SP's division mechanical officer, in removing the cars, the cranes would pick the cars up and swing them around to the breach in the levee. From that location, front-end loaders would then carry the cars to the west side of the track (figures 8 and 9). Testimony further indicated that equipment continuously operated through the haul road over the pipeline and that it was

Figure 8.--Equipment used to lift cars during wreckage removal.

Figure 9.--Equipment used to move cars to west side of track.

necessary on many occasions to re-mark the location of the pipeline with yellow paint. As Calnev's maintenance superintendent testified, "...trona...was a very light, loosely compacted material...once you made a mark on it, it would take a very small amount of activity by heavy equipment to totally erase that mark."

SP's removal of the wrecked cars, which were spread over a large area and stacked two and three cars high at some locations, continued throughout the day. A Calnev representative was on-site to monitor the operations and to keep SP personnel aware of the location of the pipeline. The incident commander kept fire engines and foam units on alert status with lines charged whenever a piece of wreckage was moved from a critical location over the pipeline. Calnev's maintenance superintendent testified that it was his understanding that removal of the wreckage would proceed during daylight hours only. When SP continued their activities after dark, Calnev's maintenance superintendent notified his supervisor who then returned to the site. After the situation was discussed with the incident commander and SP personnel, it was agreed that operations would be discontinued. Activities were halted about 11:00 p.m. that evening. The incident commander stated that he believed the cooperation exhibited by both Calnev and SP was exceptional.

May 14, 1989.--Removal of the rail cars resumed about 6:00 a.m. and continued throughout the day. Again, a Calnev representative was on site to monitor the operations and keep SP personnel aware of the location of the pipeline. According to SP's division mechanical officer, the cars were removed "...in the manner in which they had been stacked...using two hooks with one crane. We picked them all straight up and then moved them out." He further testified that none of the cars were dropped in this process. He observed that debris including car components, axles, and pieces of rail remained in the area after the cars were removed; the visible debris was then also removed from the site. According to Calnev's maintenance superintendent, it appeared that the debris had not penetrated the natural ground cover. SP's division mechanical officer testified that no contact with the pipeline was observed during removal of the debris and "there was no rail sticking in the ground." Equipment operators working during the clearing of the train cars stated that many pieces of heavy construction and excavation equipment, including front-end loaders, cranes, and bulldozers worked simultaneously throughout the derailment area.

May 15 and 16, 1989.--When activity resumed on the morning of May 15, SP began making preparations to move the locomotives; all rail cars had been removed from the east side of the track. Calnev's maintenance superintendent noted that the trona was scattered in varying depths throughout the area and over the pipeline to a point near, but not reaching, the engine (unit SP 7549) that lay inverted over the pipeline near the toe of the railroad embankment. To remove the locomotive units from the east side to the west side, SP personnel used two cranes to lift each unit and place it in the breach where one of the cranes, with the help of a front-end loader, carried the unit to the open field on the west side of the tracks. Each time a locomotive unit was moved, it was necessary for one of the cranes to cross through the haul road over the pipeline. Calnev personnel agreed that the crane could cross over the pipeline in this location. Calnev's maintenance superintendent testified, "I did not see any activity which I believed damaged the pipeline. Any time you are using large pieces of excavating type equipment near a pipeline, you certainly have the potential for danger." According to SP's division mechanical officer, who was in charge of the wreckage removal, he did not perform or know of any calculations that were performed to determine the stress imposed on the pipeline due to the weight of the cranes and the cars that were carried across it.

When the locomotive that came to rest inverted over the pipeline was removed by SP, Calnev personnel observed that the entire top of the locomotive had been sheared off and that it had been resting at grade level. There was nothing visible protruding into the ground. Calnev, however, decided to excavate the portion of the pipeline that had been under the locomotive. Using a backhoe equipped with a 24-inch bucket, Calnev personnel excavated an area approximately 80 feet in length parallel to and about 2 feet east of the pipe to a depth about 4 inches lower than the depth of the pipe in the area. Pipe depth was reported to have been about 8 feet at the southern end of the excavated area and 6 1/2 to 7 feet at the northern end. According to Calnev personnel, the soil surrounding the pipe was removed by hand so that the pipe was exposed from the 6 o'clock position to the 2 o'clock position facing south (see figure 4, excavation # 1). Calnev's manager of operations testified that he personally entered the excavation, inspected the pipe, and found no damage to the coating or to the pipe.

Calnev officials then decided to excavate in an area north of the breach where, according to Calnev's manager of operations, "...bulldozers had been repeatedly going off the end of the haul road" (figure 4, excavation # 2). According to the Arizona Pipe Line Company foreman, who performed the excavation, about 1 foot of pipe length was exposed from the 1 o'clock to 3 o'clock position looking north. When asked if any damage to the coating or pipe was noted, the foreman replied, "Couldn't really tell by a visual look, and we didn't bother exposing anymore due to our objective was to determine depth and alignment of the pipeline at that time." The depth of the pipe at this location was determined to be about 7 feet. With respect to the depth of the pipe, Calnev's manager of operations testified, "...it was sufficient to where I was no longer concerned about any damage from the bulldozer activity."

By late afternoon on May 15, the wreckage had been removed and SP began to demolish the houses that had been damaged during the derailment. SP planned to close the breach that evening, relay their tracks, and begin removing the trona on the following day, May 16. According to Calnev officials, it was at this point that they began to formulate the next step of their inspection plan. Calnev understood that if SP began removing the trona on Tuesday, inspection of the pipeline would be delayed until the trona removal was completed. According to Calnev's manager of operations, "At that point, we were still unsure of the integrity of the pipeline. It was still in a stable situation. It had not lost any pressure nor were there any signs of leakage. But yet we could not verify the integrity of the pipeline before then." Calnev's plan was to move in additional equipment, remove all of the trona over the pipeline down to native soil, and excavate and inspect the pipeline at any location where debris was found and appeared to have penetrated the native soil. According to Calnev officials, by removing the trona from over the pipeline, SP personnel would not have to work directly over the pipeline when they began hauling away the trona on the following day. According to Calnev's manager of operations, this plan was discussed with SP officials and the incident commander, and no recommendations or modifications to the plan were suggested.

Using a John Deere 690B excavator and working from south to north, Calnev began making a path about 8 feet wide through the trona beginning at a point near where the locomotive came to rest inverted over the pipeline (figure 4). According to Calnev's maintenance superintendent, the excavator was followed by a front-end loader to complete the removal of the trona. He further testified that a few inches of natural soil was removed and that as much as 12 to 16 inches may have been removed at any one point, but that he still believed that he had plenty of cover over the pipeline.

In making the 8-foot-wide path, Calnev piled the trona that was removed from over the pipeline to the east of the pipeline at a distance, estimated by Calnev's manager of operations, to have been 2 to 4 feet. He testified, however, that "we found that the trench [path] did not place the pipeline right in the middle. There was an area where the pipeline kind of hugged the side of the trench [path], so it [pile of trona] could have been as close as 2 feet in that area."

Calnev's maintenance superintendent, who supervised the trona removal activity from about 8:00 p.m., on May 15, to about 4:00 a.m., on May 16, testified that several pieces of debris, including portions of truck assemblies [from a train car] and two pieces of rail--one about 3 feet in length and one about 10 feet in length--were found during removal of the trona. He further testified that while he was supervising the removal of the trona, two excavations of the pipeline were performed where debris had been found at natural grade level. He stated that he could not be specific about the locations but estimated that the first excavation was near the north edge of lot 77 and that the second excavation was between lot 77 and lot 76 (figure 4, excavations # 3 and 4). For both excavations, the depth and the alignment of the pipe were determined by digging with hand shovels. A Case 580C backhoe was then used to excavate on the east side (Duffy street side) of the pipeline. According to the maintenance superintendent, no damage to the coating or the pipe was observed.

SP personnel had positioned lights on the railroad levee. According to Calnev's maintenance superintendent, even though the lighting cast shadows in the excavated area from west to east, lighting was not an issue in determining whether the pipeline had been damaged or in evaluating the depth of cover over the line. He stated, "I was comfortable with the level of lighting, and I spent a considerable amount of time in the trench closely observing the excavation." He also testified that it would have been possible to detect the difference between hitting debris with the backhoe and hitting the pipeline with the backhoe. "...it was never a concern of mine that we were going to hit the pipeline with the backhoe because we were monitoring the depth of cover over the pipeline. We were not excavating in an area such that we would be getting close enough to the pipeline to hit it."

In addition to the two excavations, the pipeline was potholed[16] at several other locations. At one location where the pipeline was potholed, a truck assembly [rail car] was found to have penetrated the natural soil. Calnev's maintenance superintendent marked this location and later advised Calnev's manager of operations of the need to perform a more thorough inspection of the pipeline at that location. By 4:00 a.m., on May 16, the path through the trona had extended north 300 to 400 feet to a point where the breach in the levee had been made.

The deputy fire chief testified that when he terminated his role as incident commander around 10:00 p.m. on May 15, Calnev's manager of operations assured him that the pipeline was safe to operate.

Calnev's manager of operations, who relieved the maintenance superintendent about 4:00 a.m. on May 16, supervised the remainder of the trona removal from over the pipeline. A foreman for Arizona Pipe Line Company arrived on site about 6:00 a.m. and relieved the backhoe operator who had worked through the night. According to Calnev's manager of operations, two additional excavations of the pipeline were performed; he estimated the first excavation to be near the middle of lot 76 (figure 4, excavation #5), where the maintenance superintendent earlier had found a truck assembly, and the second location to be near the northern edge of lot 75 (figure 4, excavation #6). At both locations, the excavation was performed on the west side of the pipeline, a 20- to 25-foot section of the pipe was exposed from the 6 o'clock position to the 2 o'clock position looking north, and no damage to either the coating or the pipe was observed by Calnev personnel. The depth of pipe was determined to have been about 4 feet at the first location and 5 feet at the second location.

According to the testimony of Calnev officials and the backhoe operators, all the excavations were immediately backfilled after the coating and pipe were inspected for damage. Further testimony indicated that about 6 inches of debris-free native soil would be used to manually cover the pipeline before the backhoe was used to fill the remainder of the excavations, and that compaction of the soil was accomplished by "wheel-rolling" rather than by use of the backhoe bucket.

Beginning about 10:30 a.m. on May 16, Calnev began performing soft dig excavations[17] of the pipeline about every 50 feet throughout the derailment area. At each location, an 8-foot-tall stake marked at 1-foot intervals was placed on top of the pipe, the top of the stake was surveyed to determine its

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[16] According to the Arizona Pipe Line Company employee operating the backhoe, all potholes were dug manually using shovels. According to Calnev's maintenance superintendent, "The primary function of a pothole is to determine the depth and location of the pipeline. An excavation would be a larger hole, a more complete excavation where you are actually attempting to visually ascertain the condition of the pipeline."

[17] A process by which vacuum-type excavation equipment makes about a 1-foot-diameter hole from ground level to the top of the pipeline.

elevation, and the hole was backfilled. Calnev personnel testified that as a result of these soft dig excavations, the pipe was exposed from the 10 o'clock position to the 2 o'clock position at each soft dig excavation and that before the holes were backfilled, the pipe was inspected for damage; no damage was observed at any of these locations. According to Calnev, the purpose of the stakes was to provide information to SP regarding the location and depth of the pipeline when SP began removing the trona from the derailment site. SP was advised by Calnev to preserve the stakes until all grading of the area was completed. Calnev's manager of operations observed, based on the placement of the stakes, that the pipeline depth below natural ground varied from 4 to 8 feet through the derailment area.

Calnev's manager of operations testified, "On Tuesday, the 16th, we .d by then accomplished full trenching [8-foot-wide path] over the top of the pipeline in the affected area. We had removed or had caused to remove any debris that we had found. We had investigated every area that debris had penetrated the native soil. ...Based on that assessment...my opinion was that the pipe had not been damaged by the train derailment." Clearance was given at 11:28 a.m. by Calnev for the restart of the pipeline; operations were resumed about noon on Tuesday, May 16. The pressure was initially increased to about 1,200 psig, at which point, according to Calnev's manager of operations, the dispatcher on duty watched for signs of loss of pressure in the system. The pressure held constant for about 15 minutes after which the pipeline was brought up to normal operating pressure (about 1,600 psig) and regular operations were resumed.

The Safety Board received conflicting testimony regarding a request to expose completely the pipeline prior to resuming operations. The incident commander (San Bernardino deputy fire chief) testified he requested that Calnev fully expose the pipeline in the derailment area. According to Calnev's manager of operations, such a request was not made by either the San Bernardino fire department or the SP. He did state that several options had been considered, including the use of an internal electromagnetic inspection instrument for detecting defects in the pipe wall and a hydrostatic test of the pipeline. He stated further that it would not have been practical to run the inspection instrument through the line because "...the line would have had to have been brought up to full operating pressure and operated in that state for about 5 days to push [the instrument] through to the other end." He elaborated that because of the mountains between Colton and Las Vegas [the end of the line], it would be necessary to operate at full pressure just to get the instrument over the mountains. Calnev's manager of operations also stated that, "[A] hydrostatic test would have been performed had there been some doubt as to the integrity of the pipeline. We found no reason to doubt the integrity of the pipeline upon completion of our inspection and did not perform a hydrostatic test."

SP contracted with the International Technology Corporation (IT) to have the trona removed from the derailment site; removal of the trona began during the afternoon of May 16. According to the project manager for IT, cleanup of the trona began in the area closest to Duffy Street and then continued through the derailment area from south to north. Equipment operators testified that to remove the trona that had been piled east of the pipeline as a result of the 8-foot-wide path that had been made through the trona, the operator of a front-end loader would reach over the pile of trona with the bucket of the loader and drag the material back toward Duffy Street where the trona could then be loaded into trucks. According to the IT project manager, the front-end loader worked perpendicular to the pipeline during this operation.

At 4:00 p.m. on May 16, SP opened its line to resume train movements through the area.

May 17, 18, and 19, 1989.--Removal of the trona continued throughout the day on May 17 and 18. Because trona contrasts with the color of the native soil, operators of the equipment were told by IT to visually inspect the area to assure that they had removed all of the trona and about the top 2 inches of native soil. On May 18, a track-mounted (crawler type) excavator was brought to the site to begin removing the trona from the railroad embankment. The excavator was positioned east of the pipeline with the tracks parallel to the pipeline. A smooth steel grading blade was welded to the teeth on the bucket of the excavator. The blade enabled the operator to drag trona that was covering the railroad embankment without removing excessive amounts of material and to leave behind a smoothly graded surface. Testimony by equipment operators in the area at this time indicated that the operator of the excavator would drag the trona down the side of the railroad embankment and across the pipeline to the east side where front-end loaders would pick up the trona and load the trucks. However, according to IT's project manager, the operator of the excavator would drag the trona down the embankment and build a stockpile of trona on the west side of the pipeline. At that point, a front-end loader would come in, keeping the tires on the east side of the pipeline, scoop up the material, and then back up to a point where the material could be loaded into trucks. Testimony by equipment operators further indicated that the smooth-edged blade welded to the teeth on the bucket of the excavator broke off several times and that the equipment continued to be operated without the smooth-edged blade. According to IT's project manager, the excavator made two "passes" on the embankment, one pass from south to north and one from north to south.

By early afternoon on May 19, 1989, all the trona had been removed and the fencing of the area that began during the morning was completed. The last piece of equipment used for the cleanup operations, a motor grader, was brought to the site to smooth out the surface and to remove tire tracks. After this operation was completed at 6:00 p.m., locks were placed on the two 20-foot-wide gates that were installed with the fence, and the area was secured. According to SP's contractor, no equipment was used in the area after May 19, 1989.

IT's project manager testified that when he left the site on May 19, he believed that there were 2 to 3 feet of ground cover over the pipeline. When asked, "Could it have been your work that removed that cover from the 4 to 8-foot level down to the 2 to 3-foot level?" He replied, "Yes."

According to Calnev, a Calnev representative was on site through May 19, during the removal of the trona, to observe the operations, to point out potentially dangerous situations to the railroad and its contractor, and to make certain that the stakes that had earlier been located over the pipeline remained in place. No concern was voiced by Calnev during the removal process.

Events Preceding the Pipeline Rupture

Calnev's dispatch center at the Colton Pump Station is equipped with a monitoring system that scans and records, among other system parameters, pipeline pressures. When normal operations resumed on May 16, the pipeline pressure had increased to 1,667 psig. Between May 16 and May 23, the pipeline was operated at pressures ranging between 1,690 and 1,060 psig (normal operating ranges established by Calnev) and was subjected to various pressure changes during this time. Operations during the next couple of days showed only smooth pressure transitions until about 8:05 a.m.[18] on May 25, 1989.

Pipeline Rupture

Pipeline Operations on May 25, 1989.--During the early hours of May 25, 1989, the three 1,000-horsepower (hp) mainline pumps at the Colton Terminal were operating at maximum output (2,300 to 2,400 barrels per hour), and the pressure on the pipeline was relatively constant at 1,620 psig. About 4:03 a.m., with the completion of a product delivery at Daggett (see figure 1), a gradual increase in pressure to 1,680 psig occurred over an interval of about 17 minutes at which time the pressure decreased within 5 minutes to 1,669 psig. The pressure then remained relatively constant until 8:05 a.m.

At 8:05:25, based on a readout of the information recorded by the monitoring system, a low suction pressure (15.188 psig) alarm[19] and a low discharge pressure (257.644 psig) alarm were received in the dispatch center at Colton Pump Station on Calnev's computer system. At 8:05:38, the three 1,000-hp mainline pumps were shut down by the computer system. At 8:05:39, the dispatcher acknowledged[20] the alarms. According to testimony of the dispatcher on duty at the time, when changes in operating conditions occur: (1) an audible alarm will be sounded, (2) the word "alarm" will appear and flash at the top of the dispatcher's computer terminal screen, and (3) information regarding the specific condition (in this case, "low suction pressure" and "low discharge pressure") will be highlighted in a particular

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[18] The monitoring system at the Colton Terminal scans various pipeline parameters, including pipeline pressure, at 13-second intervals. Thus, an event (in this case, a pressure reading) may have occurred up to 13 seconds earlier than the recorded time (and the time cited in the discussion).

[19] According to Calnev and OPS officials, the word "alarm" in the pipeline industry is not used to denote an emergency situation, but rather a change in operating conditions.

[20] The dispatcher acknowledges the alarm by pressing a key on his computer terminal keyboard.

color and continue to flash until acknowledged by the dispatcher. Testimony further indicated that if more than one condition occurs on the same page [screen], the word "alarm" and the audible alarm are terminated by one stroke on the computer keyboard.

The dispatcher testified that he noticed on his terminal screen flashing lights indicating that the pumps were shutting down and that he had a "low suction pressure" color alarm (blue). He did not notice the "low discharge pressure" color alarm (blue) on the same page. The dispatcher stated that he believed that the pumps had shut down as a result of a low liquid level in the storage tank from which he was pumping. He was aware that a similar situation had been experienced by the dispatcher whom he relieved, and the pumps were eventually restarted. According to the dispatcher, the normal procedure for the condition of a low liquid level in a storage tank is to restart the pumps after the suction pressure again returns to normal. According to the dispatcher, normal suction pressure is between 26 and 50 psig. The suction pressure rose to 37.1429 psig, and at 8:06:02, the dispatcher commanded the restart of the 100-hp booster pump. At 8:06:11, the command was acknowledged by the computer. At 8:06:22, the computer reported the status of the booster pump[21] as "off."

At 8:06:53, the dispatcher again commanded the computer to start the booster pump, and at 8:06:57, the command was acknowledged. Operating parameters were automatically checked and found satisfactory, and the system attempted to restart mainline pumps Nos. 2 and 3. At 8:07:09, the computer acknowledged the command. At 8:07:10, another low suction pressure (17.2932 psig) alarm was given to the dispatcher who knowledged the alarm, and at 8:07:22, mainline pump No. 2 registered status "off," as did mainline pump No. 3 at 8:07:23. Also, at 8:07:23, the suction pressure was 46.1654 psig and at 8:07:55, the booster pump reported status "off."

At 8:08:10, the dispatcher acknowledged the shutdown alarms and again commanded the start of the booster pump. At 8:08:18, the booster pump acknowledged the command and at 8:08:19, pump No. 3 acknowledged the command. At 8:08:20, a low suction pressure (20.9023 psig) alarm was provided to the dispatcher. Pump No. 3 reported status "off" at 8:08:32, at which time suction pressure was recorded as 90.9774. At 8:09:15, the booster pump reported status "off." At 8:09:18, the shutdown was acknowledged by the dispatcher. The dispatcher stated that because he was not successful in restarting the pumps, he left his station to request assistance from another dispatcher who was on duty as a supervisor at the time and located down a hallway from the dispatch center. The supervisor acknowledged the request.

While returning to his dispatch area, the dispatcher encountered the senior systems specialist and asked him if he knew of any reason why the pumps would not come back on. The dispatcher stated that the systems specialist advised him to "pinch down" on the station control valve to bring

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[21] A small capacity pump activated first to bring the pressure up slowly to prevent surging when the mainline pumps are activated.

the pumps on slowly. The dispatcher stated that as he was doing this, they received a phone call from the San Bernardino County Communication Center asking if Calnev's pipeline was involved in a fire. The systems specialist then observed through a station window a cloud of smoke in the direction of the pipeline route through San Bernardino, advised the caller that it likely was Calnev's pipeline, and then instructed the dispatcher to leave the pumps down.

After notifying Calnev locations currently taking delivery of products at Las Vegas, Nevada, that the pipeline was being shut down, the dispatcher began remotely closing valves to isolate the pumps and the storage tanks from the pipeline. In addition to closing the valves at the terminal, he shut down the Baker booster pump station at MP 146.2. After the pressure sensor indicated zero psig pressure at the summit of Cajon Pass, the dispatcher remotely-closed the valve at California aqueduct (MP 35.4) which is located on the north side of Cajon Pass. He also stated that notification was made to personnel who had to close other valves manually. The first downstream valve that had to be closed manually was located at MP 25.7; the maintenance supervisor reported that this valve was closed at 9:00 a.m.

Witnesses' Observations.--A resident at 2395 W. Adams Street stated that she was in her backyard between 7:45 a.m. and 8:00 a.m. and noticed a "white colored rain" falling on the house behind hers on Duffy Street. She further stated that after she went back inside her house, she heard an explosion and "then her windows blew in" and the entire house was on fire. Another resident at 2446 San Benito Street stated that he was outside around 8:00 a.m. on May 25, heard a train go by, and about 5 to 10 minutes later heard a "rumble." He stated that he then looked up and saw a "cloud of flame about four houses wide come over the houses...the flame was about 10 feet higher than the rooftops" (figure 10). Several witnesses stated that they saw a white vapor and then heard a loud explosion; this was followed by black smoke and intense heat and flames. A resident at 2385 Mesa Street recalled that a friend, who had arrived at her residence to transport her children to school, "pointed to a spray vapor shooting up into the sky," that was coming from the direction of where the train had derailed. A motorist, who was filling his automobile with gasoline ~~near Macy Street~~ and Highland Avenue, stated that he heard a "rumble," then saw what appeared to be a "geyser" of liquid shooting up in the air near the site of the train derailment. He stated further that within a few moments "it exploded." In addition to the resident on San Benito Street, several residents recalled hearing a train pass by 5 to 10 minutes before the explosion; residents also recalled smelling gas before the explosion. Two residents, one at 2327 Duffy Street and one at 2315 Duffy Street, were fatally burned as a result of the explosion and fire.

Emergency Response to Pipeline Rupture

On May 25, 1989, at about 8:00 a.m., a firefighter leaving his assigned fire station on Highland Avenue noticed a large column of black smoke in line with Highland Avenue, about 2 miles from his location. He returned to the fire station and notified the battalion chief.

Figure 10.--Fuel burning after the pipeline rupture.

The battalion chief, in turn, notified his dispatch office about 8:08 a.m. and requested fire department personnel and equipment to respond to Highland and Duffy Streets. En route to the site, the battalion chief observed flames and black smoke rising straight up in the air with no apparent wind. He arrived on-scene about 8:13 a.m. Mutual aid agreements were activated when the dispatch center was notified of the accident. As emergency response units and fire department personnel and equipment from adjacent jurisdictions arrived on scene, the battalion chief positioned them around the involved area. He had surveyed the accident area and determined that seven houses were fully engulfed in fire and that two houses were partially on fire. Being concerned with the downed power lines and the possibility of ruptured residential gas lines, the battalion chief requested the utility companies to shut down their respective lines. He also requested the water department to assist in building dikes to prevent the product from flowing into surrounding areas. The battalion chief ordered an evacuation of residents in the area; police personnel eventually evacuated about 170 persons in a four-block area. According to the deputy fire chief, because of fuel remaining on the ground, some residents were unable to return permanently to the area until August 6, 1989.

At 8:30 a.m., the deputy fire chief, who had been the incident commander during the response to the train derailment, arrived on scene and assumed the role of incident commander for this accident. By the time he arrived, fire-fighting operations and treatment and transportation of the injured to local hospitals had begun. At 10:05 a.m., a command post was set up at 2359 Mesa Street. According to testimony of the deputy fire chief, the mutual aid emergency response plan was implemented as planned. Although the deputy fire chief's role as incident commander ended on May 28, fire department personnel and equipment remained on scene as a safety measure until May 31, 1989.

Pipeline Surveillance Operations

After Calnev's maintenance superintendent observed the fire from his office window shortly after 8:00 a.m., he immediately notified the manager of operations who, along with other company personnel, proceeded to the accident site. Upon arrival at the accident site, the manager of operations introduced himself to the incident commander and was directed by the incident commander to fly with a police officer in a helicopter to observe the fire. Calnev's manager of operations stated that while in the air, he observed a large stream of flaming liquid exiting the ground eastward at an angle of about 60 degrees from the horizontal. He stated that he observed substantial fire damage in the direction of the burning stream of liquid, a small pool of liquid burning around the rupture, and a small grass fire burning south of Highland Avenue. The manager of operations stated that he then advised the incident commander to allow the fire to burn itself out. According to the incident commander, the fire burned out by 3:30 p.m. on May 25.

According to Calnev's manager of operations, when the fire was out, the rupture site was inspected and the damaged pipe examined (the damage is described in the section "Damage," "Damage to the Pipeline"). At least four pieces of railroad debris--a brake arm, an approximately 8-inch section of I-beam from a locomotive, a piece of metal cowling from a locomotive, and a short section of rail--were found near the rupture. The brake arm and the rail section were about 2 to 3 feet in length. The brake arm was found 8 inches above the pipeline and the other parts were within 2 feet of the pipeline. Testimony by Calnev's manager of operations and by equipment operators who had worked at the site following the derailment indicates that the depth of cover they observed over the pipeline at its point of rupture was from 2 to 2 1/2 feet, whereas the depth of cover they had observed after completing work, following the train derailment, was from 4 1/2 to 6 feet. Calnev's manager of operations testified that the location of the rupture was very near if not at the exact location where the excavation #5 had been performed across from the middle of lot 76 (figure 4).

According to Calnev's manager of operations, Calnev's plan to repair the pipeline after the rupture and place it back in service evolved over many days "...during which many discussions were held with many interested parties as to how best to return that pipeline to service [and] make the repairs necessary." Calnev's maintenance superintendent testified that when the pipeline rupture occurred, he notified the National Response Center, the California Office of Emergency Services, the California State Fire Marshal's Office, and the Underground Service Alert System. Representatives from these agencies, as well as an engineer from the U.S. Office of Pipeline Safety (OPS), responded to the accident site.

On May 26, 1989, OPS issued a Hazardous Facility Order, CPF No. 5987-H to Calnev (appendix E). This Order included preliminary findings, among others, that the pipeline within the area of the derailment had not been completely exposed and visually examined for damage, that the structural integrity of the portion of the pipeline potentially affected by the derailment had not been ascertained by Calnev, and that Calnev had not determined if there had been damage to the pipe coating as a result of the cleanup operations. OPS required Calnev to expose the pipeline around its circumference for the length of pipe between a point 50 feet north of the casing beneath Highland Avenue and the south end of the levee adjacent to the check valve at MP 6.9, to conduct a thorough visual inspection of the exposed pipe to locate any damage to the pipe or to its coating and make appropriate repairs, and in accordance with applicable requirements of 49 CFR Part 195, to hydrostatically test to 1.25 times its maximum operating pressure the pipe located between a point 100 yards south of the check valve on the downstream side of the derailment impact area and a point 200 yards upstream of the road crossing at Highland Avenue.

On May 30, 1989, based on its preliminary findings, OPS found that "if placed into service under the same circumstances as existed after the rupture, that portion of Respondent's [Calnev's] pipeline subject to the required corrective actions prescribed [on May 26, 1989] would be hazardous to life and property." Consequently, as a result of conversations with Calnev, the OPS Order was amended to require excavation of the pipeline located between a point 10 feet north (downstream) of the casing beneath Highland Avenue and the south (upstream) rise of the Muscoy Levee, that the excavated pipe be visually inspected to determine any damage to the pipe or its coating, that the pipe be replaced with new pipe, that a block valve be installed between the check valve and the Muscoy Levee, that the new pipe be tested as previously required of the existing pipe, and that all activities be performed in accordance with applicable requirements of 49 CFR Part 195. The revised Order also stipulated that OPS would review and approve Calnev's hydrostatic testing and inspection program, that OPS would monitor the test, and that the pipeline could not be returned to service until OPS had determined that all required actions had been successfully completed.

By letter of June 6, 1989, Calnev requested relief from the requirements of the Order because it discovered that a bend in the pipe made it impractical to tie into the new pipe 10 feet north of the Highland Avenue casing, the location required by the amended Order. As there was no apparent damage to the pipe at that location and because the line would be hydrostatically tested before returning it to service, on June 6, 1989, the OPS again amended the Order to allow the tie-in to be made at a location determined acceptable by Calnev and concurred with by a representative of the OPS so long as the tie-in was made between the point 10 feet north of the Highland Avenue casing and a point about 35 to 40 feet north of the casing.

About 600 feet of the pipeline through the area of the previous derailment was removed and replaced. The pipeline was refilled with product on June 9, 1989. More than 9,400 barrels of product were required to refill the pipeline. A mile of pipeline of the size installed will hold 917.69 barrels of product, based on information provided by Calnev.

Injuries

	Train Derailment		Pipeline Rupture			
Injuries	Extra 7551 East	Residents	Residents	Firefighters	Others[22]	Total
Fatal	2	2	2	0	0	6
Serious	1	1	3	0	1	6
Minor	2	0	16	1	4	23
None	2	-	--	-	-	2
Total	7	3	21	1	5	37

Damages

Train Derailment.--Five locomotive units and the entire consist of 69 hoppers cars were completely destroyed as a result of the derailment; the rear-end locomotive was extensively damaged. About 680 feet of track were destroyed by the derailing locomotive units and cars.

Following the derailment, a building inspector from the City of San Bernardino Department of Building and Safety inspected the houses that incurred damages as a result of the derailment. The inspector's assessment of damages is listed in Appendix F. The inspector recommended that dwellings at 2314 Duffy Street through 2382 Duffy Street be demolished immediately (figure 11).

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22 These persons were involved in a traffic accident while attempting to avoid the fire caused by the pipeline explosion.

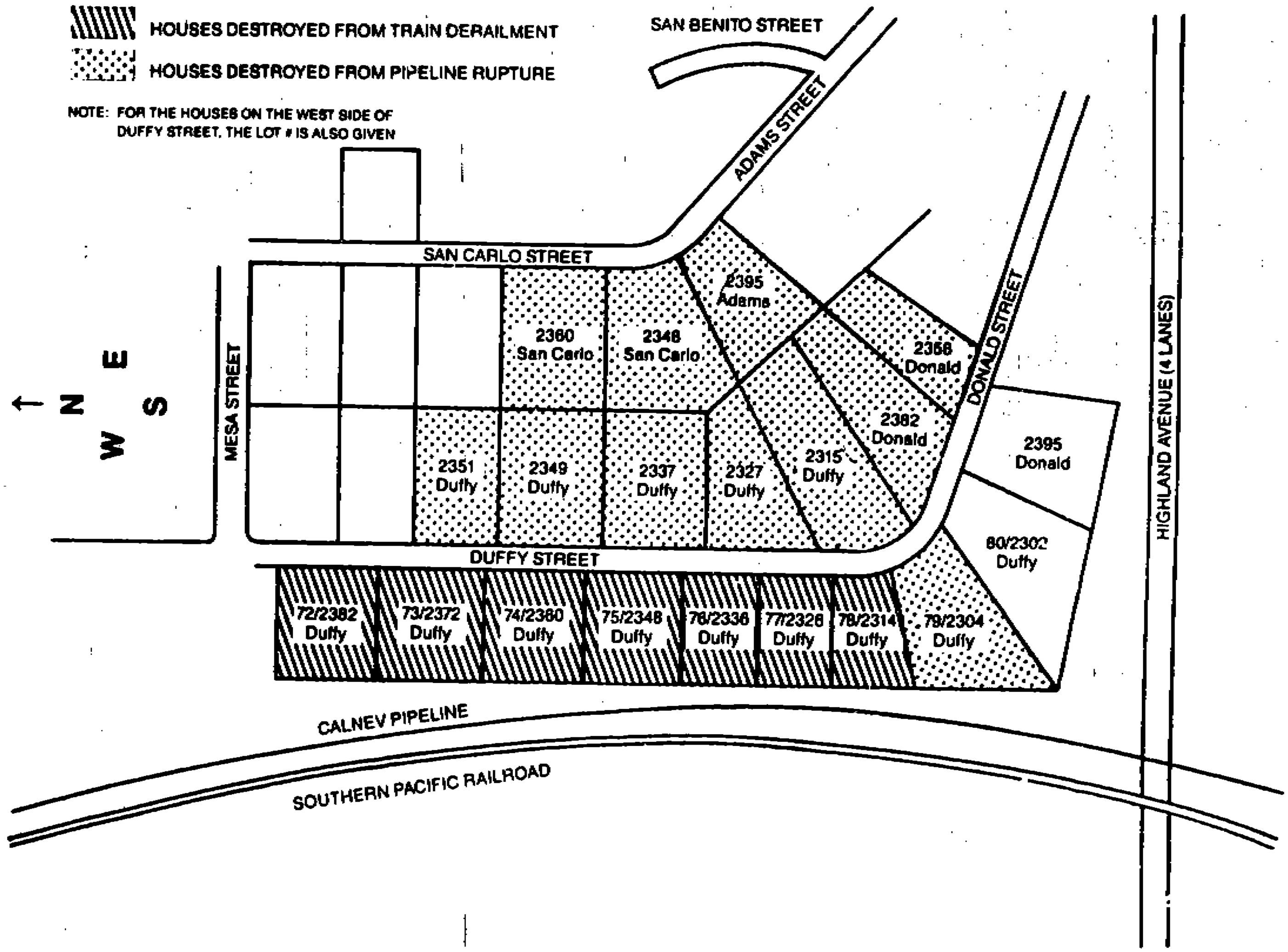

Figure 11.--Damages to residences.

<u>Pipeline Rupture</u>.--Eleven houses and 21 motor vehicles were destroyed by fire from the pipeline rupture and fire (figures 11 and 12). Four houses received moderate fire and smoke damage, and three houses received smoke damage only. Appendix F lists the residences and the damages incurred.

The costs incurred from the train derailment and the pipeline rupture, as reported by SP, follow:

Equipment	
69 Cars	$ 1,550,407.00
5 Locomotives	*7,506,000.00
1 Locomotive repair	85,001.00
Track	14,922.00
Wreckage Clearing	1,968,867.00
Lading	242,830.00
Houses	
Derailment (9)	592,831.00
Rupture (7)	453,433.00
Total	$ 12,414,291.00

* The dollar figure is based upon comparable locomotives available today for replacement.

Calnev reported the following costs as a result of the pipeline rupture:

Pipeline Repair	$ 500,000.00
Commodity	300,000.00
Environmental	1,060,000.00
Total	$ 1,860,000.00

Total reported costs from the train derailment and the pipeline rupture were: $14,274,291.00.

<u>Damage to the Pipeline</u>.--The 14-inch-diameter pipeline ruptured at about MP 6.9. A 25-foot, 1 7/8-inch-section (301 7/8 inches) of the pipe that included the rupture area was cut from the pipeline to make a temporary repair. The 25-foot section was removed about 5:00 p.m. on May 26, 1989, and was replaced with a section of sound pipe.

After the 25-foot section of pipe containing the rupture was removed, it was torch cut into 5 smaller sections. Beginning at the south end, the first section was 44 7/8 inches long and contained no areas of damage. The next 41-inch section contained two longitudinal, parallel areas of damage. The next 44 1/2-inch section contained the rupture. These last two sections of pipe were taken to the Safety Board's laboratory in Washington, D.C., for testing (figures 13 and 14). (Additional information is provided under "Tests and Research.") The next section was 6 inches long and contained no damage. The last section was 165 1/2 inches long and contained damage to the coating along the side of the pipe at the 3 o'clock position (looking north).

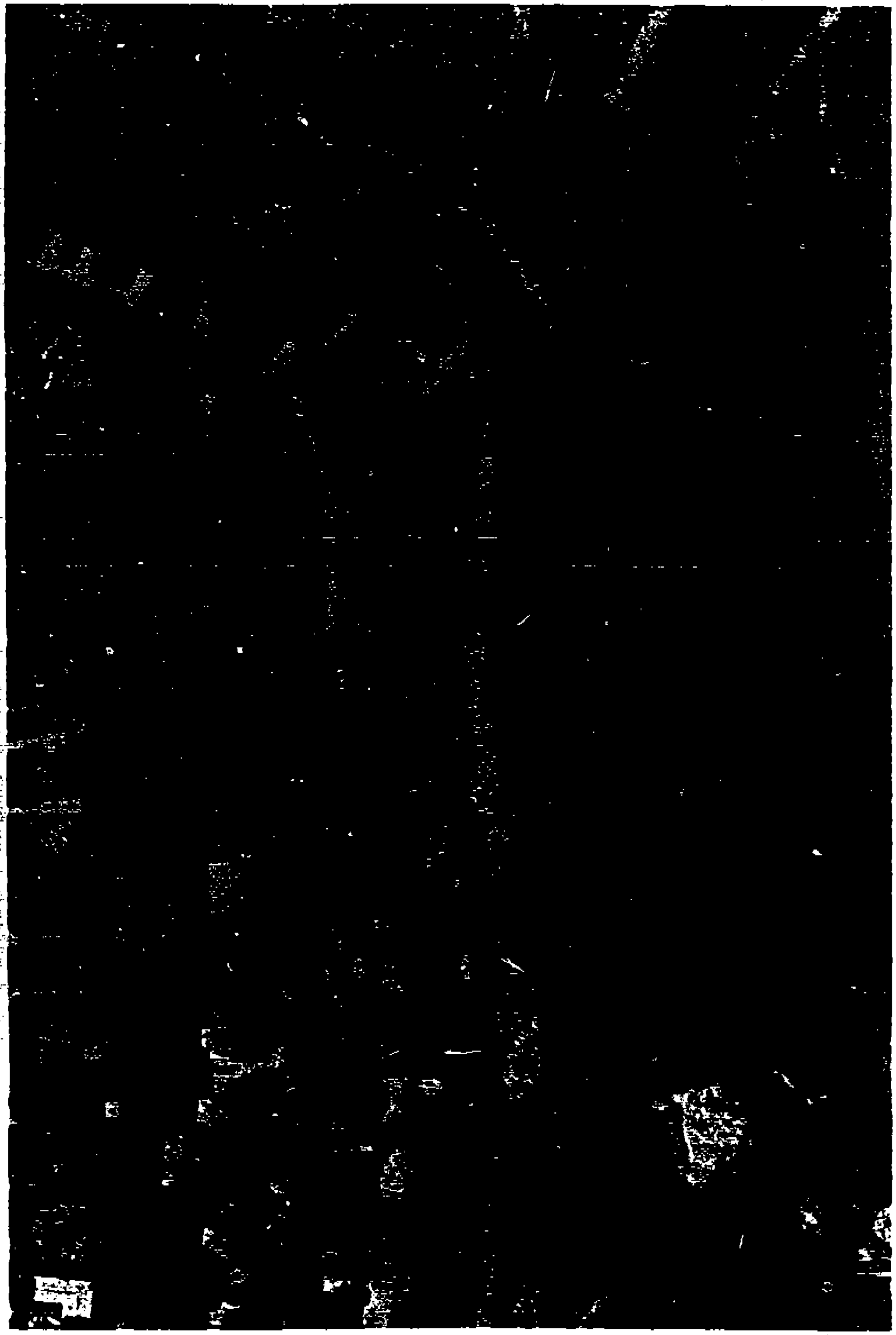

Figure 12.--Damages to residences following pipeline rupture.

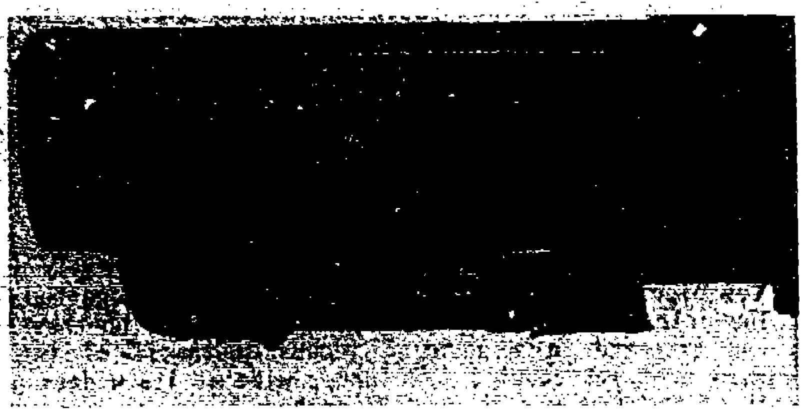

Figure 13.--Section of pipe removed from rupture area.

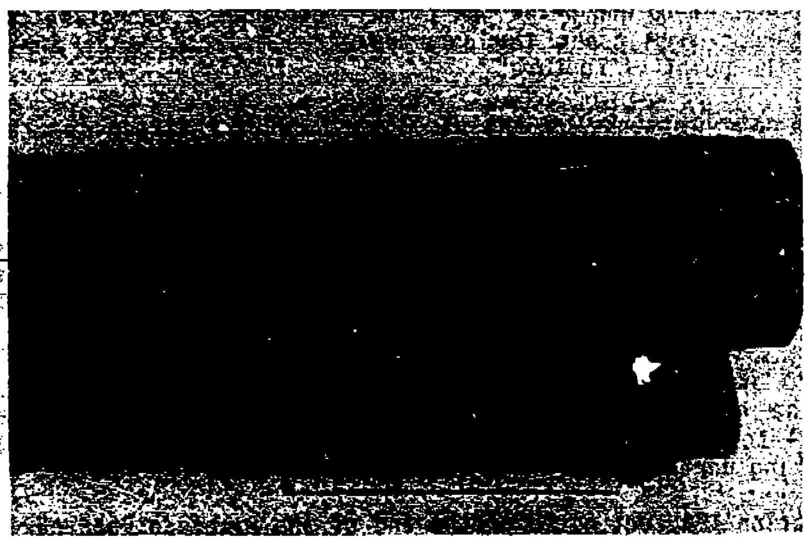

Figure 14.--Section of pipe containing the point of rupture.

The rupture was about 29 inches long and, with respect to the circumference, was located about 5 inches to the east of the top of the pipe as installed (about the 1:30 o'clock position looking north). The electric resistance welded seam was located about at the top of the pipe. Examination of the area indicated that there was plastic deformation (bulging of the pipe) associated with the rupture and that the rupture produced a "fish mouth" type opening of about 4.2 inches at its widest point (see figure 14). There was no apparent visual evidence of pipe material or manufacturing deficiencies.

Plastic deformation (denting) was present in the area of the rupture. The primary "dent" extended approximately 27 inches longitudinally along the top portion of the pipe; the dent angled slightly from the longitudinal axis of the pipe. The primary dent began at a point 20 inches northwest of the rupture point and extended to a point 7 inches southwest of the rupture point. The primary dent was about 1 3/8 inches wide at its widest point and the deepest depth of the dent was about 0.07 inches.

The primary dent produced a protrusion (bulge) on the inside surface of the pipe and localized wall thinning. The minimum wall thickness, as measured in this area at the accident site, was 0.249 inches and was located about 4 inches from the point of rupture. Additional wall thinning was near the point of rupture ("Tests and Research," "Metallurgical Testing").

Nearly parallel to and below the primary dent was a mark/scratch on the pipe that extended from about the same downstream location as the primary dent to about the point of rupture.

A second pair of marks on the pipe was located upstream (south) about 36 inches south of the point of rupture. The pipe had been damaged (gouged) in an area about 5 inches below (east) the top of the pipe. The longer mark was about 36 inches long and located closer to the top of the pipe; a 2 1/2-inch-wide section of the coating had been removed revealing a 1 1/2-inch-wide mark on the metal. The second mark began slightly north of the first; the maximum width of damage to the coating was about 2 inches and the length of damage was about one half that of the upper mark.

About 120 inches north of the point of rupture, some damage to the coating on the east side of the pipe was observed. Coating in widths varying from 4 to 7 inches had been removed from the pipe at the 3 o'clock position (looking north). No damage was apparent to the pipe metal.

At a location 188 feet north of the end of the Highland Road casing, two areas of damage to the pipe were found at the time the pipe was being removed for replacement. The section of pipe containing these two areas of damage were sent to the Southwest Research Institute for metallurgical examination ("Tests and Research," "Metallurgical Testing").

Track and Signal Information

Track.--The train derailment occurred on the single mainline track in San Bernardino, California, near railroad MP 486.8. Approaching the derailment site from the west, the track grade descended between 2.0 and 2.2 percent for 22 miles before it transitioned to a 0.0-percent grade at the derailment site. In the 22 miles of descending grade, there were 56 curves which varied in degree of curvature from a maximum of 6 degrees to a minimum of 30 minutes.

The track was constructed of 119-pound continuous welded rail (CWR) on tangent track and 136-pound CWR on most of the curves. The 4-degree curve at the derailment site was laid with new 136-pound CWR in 1986. The rails rested on double shouldered tie plates and 9-foot hardwood crossties and were restrained with two rail-holding spikes on the gage side of the rail, one rail-holding spike on the field side of the rail, and one plate-holding spike on each side of the rail. The rail was box-anchored every other tie. The ties were laid in a ballast of crushed rock.

The 4-degree right-hand curve (based on the direction of movement of Extra 7551 East) at the derailment site was constructed on a fill (levee) with a maximum height of about 21 feet. The curve was 2,474 feet in length, including a 376-foot spiral on each end, and had a 1-inch superelevation.

According to SP Timetable No. 2, the authorized maximum timetable speed for the curve was 30 mph. The Federal Railroad Administration allows a maximum operating speed of 38 mph for a 4-degree curve with a 1-inch superelevation.

About 680 feet of track were destroyed during the derailment. Because of the extensive track damage, there were no distinguishable marks to indicate the point of derailment.

Signals.--Trains on the single mainline track are governed by a traffic control system using colored lights on wayside signals. An inspection of the signal equipment in the area of the derailment was conducted on May 13, 1989. The inspection revealed no problems with the signal system.

Train Information

At the time of the accident, Extra 7551 East consisted of, from front to rear, 4 road locomotive units (SP 8278, SP 7551, SP 7549, and SP 9340), 69 open-top hopper cars loaded with trona, and 2 helper locomotive units (SP 8317 and SP 7443).

Locomotive Units.--All of the locomotive units were manufactured by the Electro Motive Division (EMD) of General Motors Corporation. These units were six-axle, SD models with 26L automatic brake valves and extended range dynamic brakes.[23]

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[23] With extended range dynamic brakes, as compared to standard range, more retarding force is available from 6 mph up to a speed between 18 and 25 mph depending on the gear ratio.

Train brakes were controlled by the road engineer in the lead unit, SP 8278. Dynamic and independent brakes were controlled separately by each engineer in their respective units, helper or road locomotive.

Based on statements by the head-end and helper engineers, the dynamic brakes of units SP 8278 and SP 7443 were known to be functioning. Unit SP 7551 was dead-in-consist with no dynamic brakes or power. The dynamic brakes of unit SP 8317 were tagged and out of service, but the unit pulled in the power mode and had pneumatic brakes. The head-end engineer stated that he believed "the third unit (SP 7549) had fairly good, I think they were good dynamics." The event recorder printout for SP 7549 did not show any amperage in the dynamic mode after the train departed Cban where the helper units were added. The fourth unit, SP 9340, was reported by the head-end engineer to load in and out of dynamics intermittently.

The automatic and independent brake valves from units SP 8278 and SP 7443 were bench tested on May 15, at the SP diesel shop in Los Angeles in accordance with the requirements of the manufacturers and the Association of American Railroads. All valves performed within design specifications.

The controlling locomotive units at the head end and rear end of the train, SP 8278 and SP 7443 respectively, were equipped with multi-channel radios that broadcast on 30 watts of power at 72 volts. The road channel was 161.550 MHz. Both radios were bench tested on May 14 and 15, at the SP radio facility at Colton Yard. Both radios functioned according to design and Federal specifications (49 CFR Part 90). On May 12, an on-scene functional test of the radio from unit SP 7443 transmitting to the Colton roundhouse was performed; communication was loud and clear.

The first three head-end locomotive units of Extra 7551 were equipped with Pulse 8 event recorders; the fourth head-end unit and the helper units were not equipped with any event or speed recorder. None of the units were required to be equipped. According to SP's general road foreman, all new locomotives being purchased are equipped with event recorders, and event recorders are being installed on existing locomotives during a major overhaul. The helper units had not recently been through a major overhaul maintenance program. The Pulse 8 event recorder cartridges record speed, time, distance, direction, amperage, braking, throttle position, and independent brake application. All three event recorder cartridges were recovered and taken by Safety Board personnel to its headquarters in Washington, D.C., for restoration (the cartridge from unit SP 8278 was heavily damaged) and printout. (See "Tests and Research," "Event Recorders.")

<u>Hopper Cars</u>.--Of the 69 open-top hopper cars in the consist of Extra 7551 East, 38 cars were owned by the SP. These cars were 48 feet 9 inches in length, had a light weight of 60,300 lbs, a maximum lading capacity of 202,700 lbs for a maximum weight per car of 263,000 lbs. The remaining 31 cars were owned by the Denver & Rio Grande Western Railroad (DRGW). These cars were 51 feet 8 inches in length, had a light weight of 63,500 lbs, a maximum lading capacity of 199,500 lbs for a maximum weight per car of 263,000 lbs. The total light weight of the 69 cars was 2,130 tons.

Each of the SP cars was equipped with an "empty load" (EL) device. When the car is empty, this device reduces the brake cylinder pressure to prevent the wheels from sliding. According to timetable instructions in effect at the time of the derailment, loaded cars with empty load devices were to be considered the equivalent of one and one-half cars in determining tons per operative brakes (see Southern Pacific's Method of Operation). The chief mechanical officer for SP testified that the SP cars with empty load devices had a "normal braking ratio of 1." He further testified that at the time of the train derailment, the operating rules had not been changed to reflect this. The DRGW cars were not equipped with EL devices. All 69 hopper cars were equipped with composition brake shoes.

Following the derailment, many wheels and brake heads were inspected. This was a random inspection of available parts because many parts were buried and almost none of the parts could be identified as belonging to any particular car or part of the train. Of a possible 552 brake heads on the train, 160 were examined with the following conditions noted: 36 had been burned away, 102 showed signs of heavy heat and excessive braking, and 22 showed light or no signs of excessive braking although most of these showed signs of service wear. According to SP's chief mechanical officer, some showed no signs of heavy braking because of "...the variation in the brake shoe thickness, the thickness of the wheels...and braking forces. They are not exactly the same on all cars." He further testified that braking forces are not evenly distributed even on one car. Of a possible 276 wheel sets, 142 were inspected of which 109 showed obvious evidence of overheating from heat buildup by excessive or heaving braking. The chief mechanical officer testified that based on SP's postaccident inspection of the wheels and brake heads, he believed that the brakes on Extra 7551 East were effective and that the brake pipe was intact.

Locomotive wheels and brake shoes showed heaving braking and heat on every unit. Some brake shoes had been burned away and the backing plate had begun to melt.

Mechanical Information

Use of Dynamic Brakes.--According to the Association of American Railroads' Director of Safety and Operating Rules, many Class I railroads emphasize the use of dynamic brakes to control a train, thereby conserving fuel and minimizing brake shoe wear. Rule 58F of the SP Air Brake Rules and Train Handling Instructions states, "The dynamic brake must be used whenever practicable in reducing and controlling train speed...." Rule 58I further states, "Where the available dynamic brake will not properly control the speed of the train, the automatic air brakes must (then) be used to an extent which will allow the dynamic brakes to be reduced to a value where it will be flexible enough to control changes made in speed due to physical characteristics of the road." The Safety Board is aware that similar rules exist on other railroads. Rule 501B of the Burlington Northern Air Brake and Train Handling Rules states:

> Train handling must be performed in a manner that will be most fuel efficient consistent with good train handling. Therefore, maximum

use must be made of the trottle modulation, throttle reduction and dynamic braking methods for slowing, controlling, and stopping trains. Unless rules specify otherwise, DURING PLANNED BRAKING OPERATION, IF ONE OR MORE OPERABLE DYNAMIC BRAKES ARE AVAILABLE, THE POWER BRAKING METHOD WILL NOT BE USED."

Of SP's road fleet of 2,100 units, 1,800 units, according to the chief mechanical officer, are equipped with dynamic brakes. SP locomotives are designed such that when the train brakes are applied in emergency, an interlock will nullify the dynamic braking. According to SP's chief mechanical officer, the system is designed in this manner "...to prevent train handling problems in the case of a break in two [a separation of two cars] and to prevent wheel slide because of excessive braking which would be the combination of the electric [dynamic] braking and the independent brake...." He could offer no explanation as to why some railroads have modified the system to retain dynamic braking when the train brakes are applied in emergency. He stated that the SP had checked with the manufacturer and that the manufacturer "...will not make that modification for the SP or any other railroad." He further stated that the SP was not considering modifying the locomotives. The Safety Board contacted one manufacturer who indicated that any specifications requested by a carrier, as long as they were in compliance with Federal regulations, would be made. The Safety Board is aware that the Union Pacific and the Burlington Northern have their own retrofit program to eliminate the interlock feature.

Maintenance Reports and Reporting of Defective Locomotive Units.--SP Rule 2A requires the engineer to report locomotive defects to the dispatcher and to fill out a form outlining the defects. This form remains in the locomotive cab until the locomotive reaches an appropriate facility where mechanical department personnel can make the repairs. The head-end engineer testified that he complied with both parts of this rule with respect to the inoperative dynamic brakes on the lead locomotive unit, 7551. The helper engineer testified that he did not inform the dispatcher that the dynamic brakes on one of his helper units were inoperative because the dynamic brakes were inoperative when he began his tour of duty and he believed that the engineer whom he had relieved had reported the defect to the dispatcher. The assistant chief dispatcher who assigned the power (locomotive units) for the movement of Extra 7551 East testified that he does not request information from engineers and that he does not query the computer system[24] about the status of dynamic brakes on locomotive units. He further testified that it is the responsibility of engineers to inform him of any locomotive defects. He also stated that there are no written procedures that specifically address what to do with information received from engineers regarding defective locomotive equipment.

The chief mechanical officer testified that engineers, in addition to reporting defects to the dispatcher and filling out the appropriate form, will occasionally report defects directly to the roundhouse (engine repair

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[24] SP's computer system contains a listing of all locomotive units and the status of any defects reported.

facility) foreman. He further testified that mechanical department personnel, if they become aware of any defects, will update the computer with information. According to the chief mechanical officer, the dispatcher, once he receives information from engineers regarding defects, has the responsibility to update the computer. The assistant chief dispatcher testified that he often updates the computer when he receives reports of defects, although he believed it was not his responsibility to do so, or he will give the information to a clerk who will then update the computer when time is available.

A review of maintenance records and failure reports by Safety Board investigators revealed that on May 4, an engineer had filed a failure report on unit 7549, the third unit in the head-end consist, noting that there were no dynamic brakes. According to the maintenance record, the motor braking switch was stuck and the repair was made. The chief mechanical officer testified it was not a major repair and that there was a possibility that a defect of that type could occur again. With respect to unit 9340, the fourth unit in the head-end consist and the one that the head-end engineer reported as "intermittent" in dynamic braking, maintenance records indicated that it had received extensive repairs to the dynamic brake on April 27 and 29, 1989. According to the chief mechanical officer, the extensive repairs would indicate to him that the dynamic brakes should have been working on the day of the accident. According to the failure reports, unit 8317, the lead unit in the helper consist, had been reported as having inoperative dynamic brakes on May 8, 1989, 4 days before the accident. The chief mechanical officer testified that it was not uncommon for a unit to continue to be used in helper service "until it worked its way" to the Los Angeles repair facilities. Testimony by the head-end engineer and the helper engineer indicated that it was not uncommon to have a unit in a locomotive consist with inoperative dynamic brakes. The chief mechanical officer testified that the number of units reported to have inoperative dynamic brakes varied on a daily basis from 3 to 35.

Recovering Dynamic Brakes.--According to the chief mechanical officer, an engineer can recover the dynamic brakes (after an emergency application of the train brakes has been made) by going to "a handle off position and recover[ing] the PC after about 70 seconds."[25] He stated that he believed the head-end engineer had sufficient time to recover his dynamic brakes. He also stated, "I suspect there could have been some slight benefit going back into dynamic brakes but at those speeds the dynamic braking effort is very, very low."

[25] When an emergency air brake application is made, the PC switch, an electropneumatic device (sometimes referred to in the industry as the power cut-off switch or the pneumatic control switch), trips the electric current which causes the main generators to unload and the engines to return to idle. When the air brake handle is placed in the handle off position, the PC will automatically reset. After the pressure is restored ithin 20 to 30 seconds (which the engineer can observe in front of him), the engineer can then manually move the handle and go back into dynamic braking.

Federal Railroad Administration's (FRA) Position Regarding Functioning Dynamic Brakes.--The Safety Board received conflicting testimony from SP personnel regarding the company's interpretation of FRA requirements for functioning dynamic brakes. The general road foreman of engines stated that he believed, based on his interpretation of FRA regulations, that if a locomotive unit is equipped with dynamic brakes, they "must operate." The chief mechanical officer stated that he believed there were no FRA requirements regarding functioning dynamic brakes. The Safety Board requested the FRA to provide in writing its position on functioning dynamic brakes. In a letter to the Safety Board dated October 18, 1989 (see appendix G), the FRA stated:

> The Railroad Power Brake and Drawbars Regulations does [sic] not require the presence of a dynamic brake. However, dynamic brakes are referred to in the Locomotive Safety Standards, which states in part "If a dynamic brake or regenerative brake system is in use, that portion of the system in use shall respond to control from the cab of the controlling locomotive."
>
> This part makes clear that both the equipping and the use of dynamic brake is optional. The FRA will not take exception if a dynamic brake is found inoperative or operates at less than maximum designed capacity.

Southern Pacific's Method of Operation

Air Brake Rules and Timetable Instructions.--Trains operating on the double main track over the Mojave Subdivision are controlled by the train dispatcher using Direct Traffic Control between Mojave and East Mojave. Between Ansel and West Colton, trains are operated in accordance with signal indications of an automatic block and traffic control system.

Timetable No. 2, effective October 25, 1987, was current at the time of the accident. Maximum allowable speed on the line between East Mojave and West Colton was 65 mph for freight trains. Exceptions to the maximum allowable speed for eastward freight trains between East Mojave and West Colton were as follows:

between MP 463.8 and MP 487.4	30 mph
between MP 487.4 and MP 491	40 mph
between MP 491 and 491.9	30 mph
between MP 491.9 and 492.7	15 mph

The SP had adopted the General Code of Operating Rules, which became effective on October 28, 1985. The SP's Air Brake Rules and Train Handling Instructions, last revised on November 1, 1985, were also in effect. Pertinent excerpts from the Air Brake Rules and Train Handling Instructions follow:

Rule 2. Dynamic Brake.

Helper locomotives entrained may not use dynamic brake unless road engine has operative dynamic brake.

The number of axles of dynamic brakes of the helper engine(s) will be added to axles of dynamic braking of the road engine to determine the tonnage that may be handled in accordance with applicable Air Brake Rules.

Dynamic brake on head end of freight trains must not exceed 24 axles. Each helper entrained must not exceed 36 axles.

Rule 17. Retaining Valves.[26]

The Superintendent will prescribe the number and locations where retaining valves must be used.[27]

Instructions in Timetable No. 2 indicate that for the descending grade between Hiland and West Colton, retaining valves will be used under certain conditions. For trains being operated down the grade without operative dynamic brakes, one retaining valve will be used for each 80 tons in train. If gross tonnage exceeds 80 tons per operative brake, retaining valves must be used on all cars and speed must not exceed 15 mph. For trains being operated with operative dynamic brakes, use of retainers is not required if tons per axle of dynamic brake does not exceed 375 per standard range or 450 per extended range.

Rule 33. Tonnage Per Operative Brake.[28]

The maximum tonnage per operative brake that may be handled on descending grades of 1.8 percent or over will be prescribed by the Superintendent.

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[26] As defined in the Air Brake Association's Management of Train Operation and Train Handling, a retaining valve is "a control device through which brake cylinder air is exhausted completely or a predetermined brake cylinder pressure is retained." In short, the retainers provide the engineer with braking capability while the air brake system is being recharged.

[27] Typically, when a company rule (in this case an airbrake rule) indicates that the superintendent will prescribe certain operating parameters, the superintendent will accomplish this through instructions in the timetable or by special bulletins.

[28] Tonnage (or tons) per operative brake is computed by dividing the gross trailing tons by the number of cars in the train. The weight of the locomotives is not included in the gross trailing tons.

Freight trains handling cars with single capacity brakes (*), with tonnage exceeding 80 tons per operative brake, must not exceed 45 mph, except maximum speed must not exceed: (1) 25 mph; or (2) 20 mph in grade territories as designated by Superintendent by milepost locations under appropriate subdivision.

*Loaded cars with empty-load brakes are to be considered the equivalent of one and one-half (1 1/2) cars in determining tons per operative brake.[29]

Tonnage of operating locomotive(s) not in dynamic braking is not to be used in determining tons per operative brake.

The instructions in Timetable No. 2 indicate that the descending grade between Hiland and West Colton is covered by rule 33. The timetable also lists the maximum tons per operative brake for trains descending the grade and the exceptions for those trains using dynamic braking (appendix H). The instructions also state:

Insufficient dynamic brake capacity or failure of dynamic brake which results in exceeding these tonnages per axle, is to be considered as operating without dynamic brake.

Should dynamic brake failure occur on one or more locomotives resulting in insufficient dynamic brake capacity, train must stop and all retaining valves turned up. Train may then proceed not exceeding 15 mph if, in the judgement of the conductor and engineer, it is safe to do so.

The SP's general road foreman of engines provided the Safety Board with a speed decision flow chart for Rule 33 (see figure 15). According to his testimony, "A train consisting of 69 cars with a weight of 8,900 tons and that had 18 operative dynamic brake axles" would not have been allowed to descend the grade east of Hiland. Extra 7551 East on the day of the accident had 128 tons per operative brake (8,900 trailing tons divided by 69 (number of cars in train, not using the 1 1/2 braking equivalence)) and 494 tons per axle of dynamic braking (8,900 trailing tons divided by 18 (three locomotive units with six axles each)). Using the speed decision flow chart, the general foreman illustrated why the train was not permitted to operate (follow arrow #1 on figure 15). Using the chart, the general foreman also illustrated the decision process the engineer would have made on the day of the derailment with the information that he had 69 tons per operative brake[30] (follow arrow #2 on figure 15). According to the general road foreman, "If the train would have had 6,151 tons, with the information that [the head-end

[29] SP cancelled this rule by special instructions, effective May 22, 1989.

[30] 6,151 tons divided by 88 (38 SP cars equipped with E/L devices figured at 1 1/2 braking capability equals 57 (38 multiplied by 1 1/2) plus 31 DRGW cars not equipped with E/L devices) equals 69 tons per operative brake.

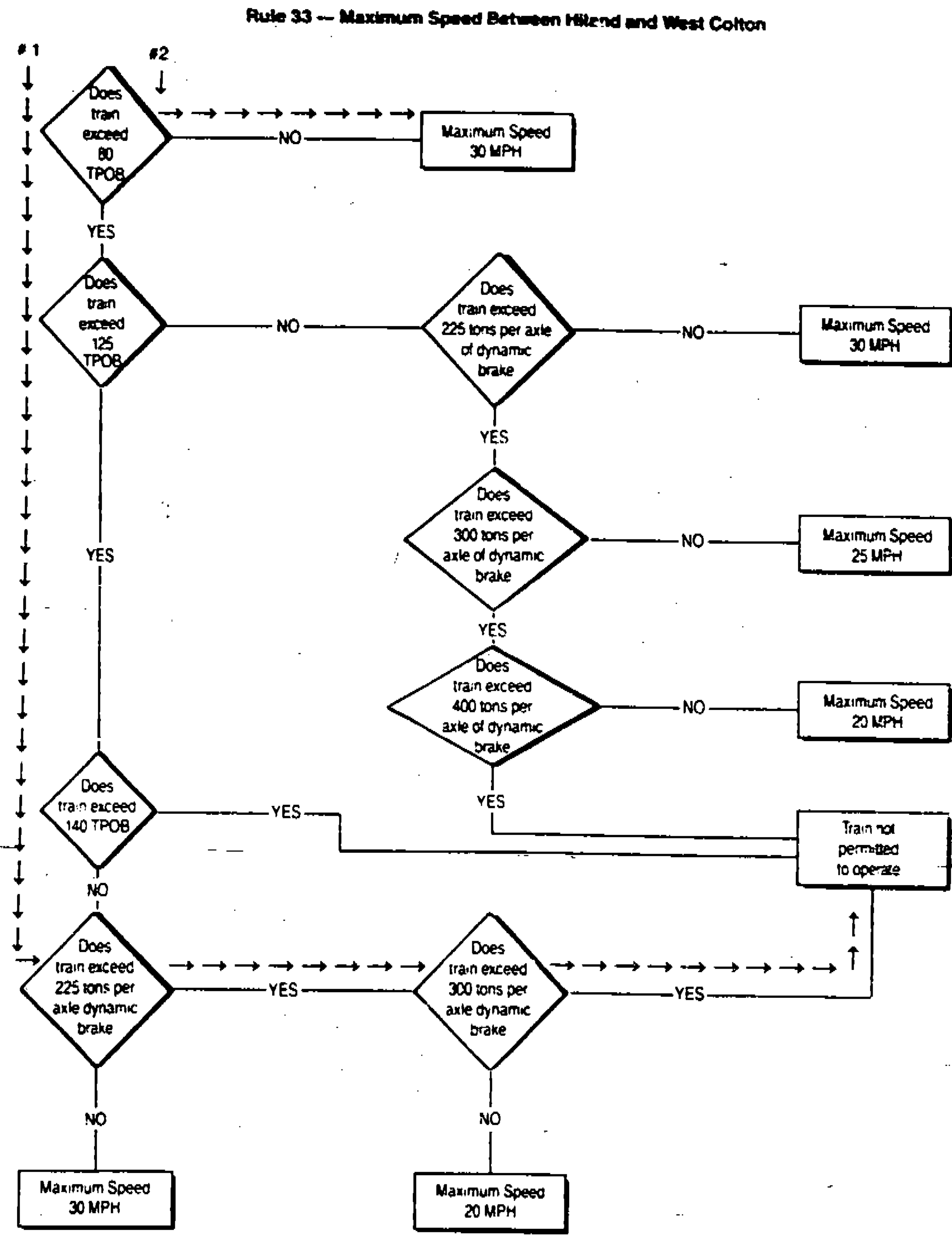

Figure 15.--Speed decision flow chart for Rule 33.

engineer] had and the dynamic brakes [he] thought he had working, he could easily have controlled the train down the hill." He further stated that the engineer, based on the information provided to him, could have taken the train down the hill without any dynamic brakes. According to the head-end engineer, based on the information he had, rule 33 did not apply to his train.

As outlined in the Air Brake Rules and Train Handling Instructions, the dynamic brake retarding force per brake axle diminishes as speed increases. For example, at a speed of 23 mph, the dynamic brake retarding force per axle is 10,000 lbs; at a speed of 40 mph, the dynamic brake retarding force per axle is 5,750 lbs.

> Rule 61.E. Balancing the Grade
>
> Operating freight trains on descending grades involves:
>
> 1. Balancing the grade, or holding speed steady at safe and practical values.
>
> The amount of brake (train) retarding force used to balance the grade normally should not exceed one half (50 percent) of the normal full service train brake available if dynamic brake and pressure maintaining are operative.
>
> In order to hold speed steady on a descending grade, the force of gravity must be balanced by the sum of train resistance and brake retarding force. The heavier the grade, the lower the effect of train resistance; and the more brake must be used. Train resistance will vary with the type of cars, train make-up, and train length and weather. On heavier grades the majority of the grade retarding force comes from the dynamic brake and the train air brake.

The locomotive engineer, the helper engineer, the road foreman of engines, and the general road foreman all testified that they considered rule 61.E.1 to be a recommended guideline or an option rather than a requirement. Testimony also indicates that engineers have routinely gone beyond the 50 percent reduction. On May 17, 1989, SP issued train order No. 1903, adding the following new rule to their operating rules:

> Rule 627.B.
>
> Within the territories where air brake rule 33 applies, except on Yuma subdivision-Los Angeles division, and with the use of dynamic brake the following brake pipe reductions must not be exceeded to control the train at the following speeds:

Maximum Speed	Maximum Air Brake Pipe Reduction
30 mph	13 pounds
25 mph	16 pounds
20 mph	18 pounds

In the event train speed cannot be controlled without exceeding the above brake pipe reductions, train must be stopped, secured and air brake system recharged. Train must not proceed unless authorized by the chief train dispatcher.

According to the general road foreman of engines, the SP decided to "put definite limits on what [speed] a train could go with a certain air brake reduction to reduce the wheel heat and keep it within the limits." He further stated that the Rio Grande had conducted tests and determined that an 18-pound reduction at 20 mph and a 13-pound reduction at 30 mph could be made without excessive wheel heat.

By special instructions, effective May 31, 1989, speed restrictions were placed on the area from Hiland to West Colton (the descending grade). According to the special instructions, trains with 25 or more loads of coal, grain and/or bulk minerals must not exceed 20 mph.

Rule 13 of the SP Air Brake and Train Handling Rules addresses the procedure for placing the locomotives in reverse. The rule states, "Should it become impossible to stop a train with the air brakes...place throttle in IDLE position, apply sand, place reverser lever in the opposite position and move the throttle to No. 1 position."

Communication Between Head-end and Helper Engineers.--On the day of the train derailment, there were no requirements that the head-end engineer and helper engineer communicate with each other regarding the condition of their respective locomotive units. Both the road foreman of engines and the general road foreman of engines testified that based on their review of the radio transcripts between the head-end engineer and the helper engineer on the day of the derailment, the amount of communication that took place was less than what they would have expected. The helper engineer testified that he communicates with the head-end engineer by observing the air gauge. According to his testimony, he can determine what actions the head-end engineer is taking by observing the air brake reductions.

Effective May 22, 1989, by special instructions, the following rule was added to the Western Region:

> The road and helper engineer(s) must communicate the condition of their units and train in order to determine maximum authorized speed and train handling requirements. Helper engineer will observe speed indicator while running and remind road engineer of speed requirements if necessary. If helper engineer is unable to communicate with road engineer and if train continues to operate in excess of maximum allowable speed, helper engineer will take necessary action to stop train.

Tonnage Information for Cars.--At the time of the train derailment and when yard clerks at various outlying areas released a car as loaded, SP's computer system required that certain information be entered into the system including: the new destination of the car, a lading code for the car, any special handling associated with the car, and a tonnage figure. This information was entered into the computer system's car file which contains, in addition to the above information, the physical characteristics of each car on the SP system. The yard clerks understood that the tonnage figure would be updated at a later time when the shipper's bill of lading was received in the billing office. SP's director of clerical operations testified that cars are often moved in service before the shipper's bill of lading information is received and entered into the computer system. He further testified that following the train derailment, "We have changed the system so that regardless of what estimate is put into the release, the computer will go to the car file and automatically update that tonnage to the capacity of the car." According to the director of clerical operations, the maximum tonnage figure will remain in the car file of the computer until the shipper's bill of lading is received and only when the bill of lading indicates a shipper-certified weight will the maximum tonnage figure be adjusted to reflect the shipper-certified weight. If an estimated weight is indicated on the shipper's bill of lading, the maximum tonnage figure will remain in the car file of the computer system until the car has been weighed. The nearest scale to the Mojave Yard was located at West Colton.

The director of clerical operations testified that the clerks in the various outlying areas are responsible for checking the accuracy and completeness of shipper-tendered bills of lading. According to his testimony, the first line supervisor for these clerks is located in Los Angeles. He further stated that during the last few years, shippers have been sending their bill of lading information directly to the central office in Los Angeles rather than dealing with clerks at the various outlying areas.

The Calnev Pipeline

Description.--The Calnev pipeline was constructed by Mid-Mountain Contractors, Inc., during 1969 and 1970. The approximately 248-mile-long pipeline, which transports petroleum products including gasolines, jet fuels, and No. 2 diesel fuel, originates at the Colton Pump Station at Colton, California, and terminates at Las Vegas, Nevada. From the Colton Pump Station (elevation 1,040 feet), the pipeline route is generally northward and crosses Cajon Pass at an elevation of 4,480 feet at MP 28 (figure 5). From Colton to about MP 236, the pipeline is 14 inches in diameter, and from MP 236 to the Las Vegas terminal, the pipeline is 8 inches in diameter. The first 107-mile section of the 14-inch-diameter pipeline was constructed of the same grade of pipe that was involved at the rupture site. The pipe at the rupture site was manufactured of steel by Kaiser Steel Corporation to American Petroleum Institute standard 5LX 52, using an electric resistance welding process. The pipe had a 0.312-inch wall thickness and weighed 45.61 pounds per foot. As a minimum, the pipe was required to have a specified yield strength of 52,000 psi and a specified tensile strength of 66,000 psi. Records of tests performed on the steel used to manufacture the pipe indicates that the steel exceeded these minimum requirements with some tests showing minimum specified yield strengths of 66,000 psi and minimum specified tensile strengths of 74,430 psi and greater. The pipe was coated with TGF3, a coal tar base coating. According to Calnev's cathodic protection records, the pipe had a minimum negative (cathodic) voltage of 0.85 volts (generally it had a considerably more negative voltage) as measured between the pipe and the soil. A cathodic protection rectifier was located at the Colton Pump Station, and Calnev's records indicate that there had never been a corrosion leak found on this 14-inch pipeline system. Calnev's manager of operations testified that if the coating damage existed prior to the derailment, Calnev would not have been able to see any change in the cathodic protection in this case because, "There is a casing that runs under Highland Avenue. At this particular location the casing and the pipe are operating at the same potential. That large casing would probably mask any damage to the coating that might be evident in that location. I don't think you would have seen a change to the cathodic level there."

The first 107 miles of the pipeline were hydrostatically tested between June 20, 1970, and July 3, 1970; the section through the rupture site (MP 0.0 through MP 25.2) was tested on June 29 and 30, 1970. The pressure test on this section was begun at 8:15 a.m. on June 29, 1970, at 2,085 psig and completed at 12:30 p.m. on June 30, 1970, at 2,083 psig. The minimum pressure during the test was 2,075 psig, and the minimum 4-hour internal sustained pressure was 2,077 psig.

Check Valves.--At the time the pipeline was constructed, Calnev installed check valves in its pipeline to prevent backflow of product from one section of the pipeline to another. These valves also serve to minimize the amount of product that can be released from the pipeline should the pipeline rupture. Generally, Calnev installed top-hinged check valves, and at some locations there are connections installed to bypass the check valves. However, on the 14-inch portion of the pipeline, Calnev installed seven Wheatley "All-Clear Check Valves." These check valves are side-hinged check valves which purportedly provided advantages over the top-hinged check valves by producing less pressure drop and offering less resistance to the passage of spheres and scrapers. Side-hinged check valves were installed at MP 0.0, 6.9, 14.9, 19.2, and 25.7. Calnev's manager of operations testified that he was not aware that Calnev had ever inspected any of the check valves installed in the pipeline between the Colton pump station and Cajon Pass to determine if the valves operated properly. He further testified that it was his understanding that check valves are not routinely inspected in the industry and that he was unaware of any Federal regulation or industry standard that required such inspection. He stated that following the rupture Calnev made plans to inspect the check valves in this area. In a letter to the Safety Board dated May 21, 1990, Calnev stated, "Calnev has installed four new check valves; three to replace existing check valves and one additional check valve at MP 10.0. Our intention is to replace one more check valve and install a supplemental block valve near another in the next 60 to 90 days."

The OPS representative who testified at the Safety Board's public hearing stated that the proper operation of check valves can be important to the safe operation of pipelines; he also advised that the OPS historically has considered that the regulations do not apply to the maintenance of check valves. The OPS has not issued an interpretation to this effect and it has not provided to its enforcement personnel any guidance indicating that check valves do not have to comply with the maintenance requirements; however, the OPS representative stated that this position reflected what OPS has been doing from an enforcement policy.

The Calnev manager of operations further testified that, based on the amount of product eventually required to refill the line, at the time of the rupture, the check valve at MP 6.9 did not close, the valve at MP 14.9 "must have come closed at some point," and that check valve at MP 19.2 "probably has at minimum leaking seats."

<u>Block Valves</u>.--Remotely operated block valves were installed on the Calnev pipeline at MP 35.4 and MP 46.7. A manually operated block valve was installed at MP 25.7. According to the testimony of the incident commander (the deputy fire chief) and Calnev's manager of operations, the deputy fire chief requested after the train derailment that a block valve be installed just north of where the derailment occurred. According to Calnev's manager of operations, "With a block valve you have the ability for positive shut-off. You can turn a crank and tighten it and possibly have a more certain measure that your pipeline is shut off at that point. I think the chief felt that given the difficulty we had in getting that check valve to seat during our drain-down, that that might be a good idea given the population in the area....We were basically in agreement with the chief that that would be a good idea." He further stated, "There is a fair amount of lead-time in ordering such an item and a fair amount of time to set up an installation such as that one." Subsequent to the pipeline rupture, a remotely operated block valve was installed at MP 6.9.

<u>Dispatch Center</u>.--The pipeline system is controlled by dispatchers from a dispatch center at the Colton Pump station. The system is equipped with a monitoring system that scans selected system parameters, such as pipe pressures and motor drive amperages, every 13 seconds, compares the data with programmed acceptance values, and through visual and audible alarms, alerts the dispatcher to changes to operating conditions in the system and abnormal or unacceptable occurrences. The audible alarm indicates that a change has occurred; however, this does not necessarily indicate that there is an emergency or that any action is required on the part of the dispatcher other than to acknowledge the alarm by pressing a key on his terminal keyboard. The visual alarms are presented in the form of numerical values flashing on a colored background. The background color varies depending on the measured value for the particular operating parameter. Background colors range from shades of white and blue, representative of the range of low pressure conditions, to yellow and red, representative of the range of high pressure conditions. Normal ranges are presented on a green background.

A computer printout of the monitoring system indicated that on the day of the accident, the dispatcher on duty received both a low suction and a low discharge pressure alarm on his computer terminal screen. The dispatcher did not detect the low discharge pressure alarm, and by one stroke on his terminal keyboard, he silenced the audible alarm, caused the flashing word "alarm" to disappear from his screen, and caused the flashing numerical information regarding the low suction pressure and the low discharge pressure to return to a steady presentation; the background color does not change until the operating condition changes. According to Calnev, subsequent to the rupture, Calnev modified its automated control system to include a high flow set point whereby if excessive flow is observed out of the Colton pump station (indicative of a potential leak or rupture), the system will automatically shut down the Colton pump, and indicate the alarm condition.

Emergency Response Manual.--On the day of the pipeline rupture, Calnev did not have any procedures in its abnormal operation response plans (a section of the company's emergency response manual) that would advise the dispatchers of the actions to take upon receiving both a low discharge pressure and a low suction pressure alarm. Calnev's manager of operations stated, "We felt that it was adequately covered in the explanation section for low suction pressure" which advises that the line pressure be checked in the event of a low suction pressure alarm. He stated further that following the pipeline rupture, Calnev revised its manual to include an explanation of what to do in the event a low discharge pressure alarm is received.

Calnev's emergency response manual was last revised in January 1989. The manual contains a list, by milepost, of telephone numbers for fire and police departments, and procedures for notifying Calnev personnel and other agencies in the event of a spill or leak. The manual also contains maps of the pipeline and directions to each mainline block valve, and procedures for responding to a natural disaster and external incidents.

The procedures for a suspected leak require the pipeline to be shut down, pressures to be stabilized, remotely operated valves to be closed, and pressures in specific sections of the pipeline system to be monitored. If a leak is confirmed, the procedures outline specific actions to be taken to locate the leak and to respond to the leak.

The procedures for a natural disaster and external incident refer to the potential adverse effects of train derailments. The procedures indicate that substantial portions of the pipeline system are built on the railroad right-of-way and that train derailments pose a serious threat to the pipeline primarily by equipment being used to clear the wreckage and replace the roadbed. The areas where the pipeline system is located near railroad tracks are listed by milepost; the area of the train derailment of May 12, 1989, is included in this section. In the event of a train derailment, the procedures indicate that Calnev personnel are to be immediately dispatched to the scene and assess the situation to determine if the pipeline could have been damaged. Railroad personnel are to be contacted and advised of the location of the pipeline. In the event of possible damage, the pipeline is to be shut down, and upstream and downstream valves are to be closed. The procedures also indicate that once the pipeline has been secured, the location of the pipeline through the derailment area should be accurately marked, heavy equipment should not be allowed to operate over the pipeline if it is considered hazardous to the pipeline, and Calnev personnel should be present on scene until all work is completed.

Personnel Information

<u>Operating Crew of Extra 7551 East</u>.--The head-end engineer had been off duty for about 20 hours before reporting for duty at Bakersfield at 9:00 p.m. on May 11. The engineer reported the following information: He spent his off-duty time sleeping, eating, watching television, and relaxing. He had been eating regular meals during the day preceding the accident, had been receiving his usual amount of rest of about 10 hours, and was fully rested when he reported for duty on the evening of May 11. There had been no recent changes in his lifestyle, he had not consumed any alcohol during the days preceding the accident, and he was not a user of illicit substances.

The engineer held an active State of California driver's permit. An inquiry to the State of California Department of Motor Vehicles (SCDMV) revealed that the engineer had no history of having received any summons or convictions. The National Driver Register (NDR) contained no information on revocations or suspensions regarding the engineer's driving privileges.

The head-end engineer had been employed by the SP for almost 15 years at the time of the accident. He had held the positions of fuel oil attendant, laborer, and fireman before being promoted to the position of engineer on November 28, 1986. (For additional information, see Engineer Training Program.)

The head-end engineer had been qualified on the physical characteristics of the territory by making one check ride from Tehachapi to Bakersfield (see figure 1) with a supervisor in September 1988. He stated that he was familiar with the descending grade in the accident area and had operated trains over this trackage several times. He stated further that he had previously operated trains with a trailing tonnage of 6,151 tons and with a trailing tonnage of about 8,900 tons. His testimony also indicated that he had never operated a train that he believed the tonnage of which was substantially more than the tonnage shown on his train documents. He did indicate, however, that this was the first unit (single commodity) freight train he had operated through the Cajon Pass; all of his prior experience through the Pass was operating mixed commodity freight trains. He added that he believed this was the first time he had transported trona. The head-end engineer stated that he had worked previously with the other head-end crewmembers, but had no knowledge of, nor had previously worked with, the helper engineer.

The conductor of Extra 7551 East had been off duty the 4 days preceding the accident. The conductor's wife reported the following information about the conductor: On Thursday, May 11, the conductor awoke around 8:30 a.m. and remained at home during the day. He received his call for duty, as expected, and reported to the Bakersfield yard at 9:00 p.m. that evening. He had been eating regular meals and had been receiving his usual amount of rest during the days preceding the accident. Her husband was "rested as usual" when he reported for duty the evening of May 11. She had noticed no changes in her husband's lifestyle. The conductor did not smoke cigarettes or drink alcohol.

The conductor held an active State of California driver's permit. According to the SCDMV, the conductor had no history of having received a summons or conviction. The NDR contained no information on revocations or suspensions regarding the conductor's driving privileges.

The conductor had been employed by the SP for 17 years at the time of the accident. He had held the position of brakeman until April 15, 1975, when he was promoted to the position of conductor.

The head-end brakeman of Extra 7551 East had been off duty during the 48 hours preceding the accident. The brakeman's wife reported the following information about the brakeman: He spent the time during the days conducting personal business and engaged in activities with his family. On Thursday, May 11, he awoke about 9:30 a.m. having received about 10 1/2 hours of sleep, and spent the day at home. He reported for duty at Bakersfield at 9:00 p.m. that evening. He had been eating regular meals, had been receiving his normal amount of rest, and "was not fatigued" when he departed home on the evening of May 11. He did not smoke cigarettes, drink alcohol, or use illicit substances, and she had not noticed any recent changes in her husband's lifestyle.

The head-end brakeman had been employed with the SP for more than 17 years at the time of the accident. He was promoted to the position of brakeman on November 27, 1971.

The helper engineer had been off duty since 11:00 p.m., May 9, having completed at that time an approximate 10-hour tour of duty. He stated that on May 10, he attended a union meeting in the morning and for the remainder of the day engaged in personal activities. According to his testimony, on Thursday, May 11, he awoke around 10:00 a.m., having received about 8 hours of sleep. He spent the day performing personal business and retired that evening about 11:30 p.m., at which time he received a call from the crew dispatcher for a 1:30 a.m. duty call. He reported to the West Colton yard and then rode in a company van for the 1/2-hour trip to the Dike siding where he was to relieve the on-duty helper engineer.

The helper engineer reported that there had been no recent changes in his lifestyle, that he does not use illicit substances, and that he had not consumed any alcohol during the days preceding the accident.

The helper engineer stated that he had eaten regular meals during the days preceding the accident and that he normally receives 6 to 8 hours of sleep daily. In his initial statements to Safety Board investigators, he stated that when he received the call for duty on the evening of May 11, he had not received his proper rest and "was tired." He elaborated by stating that he was not tired when he first reported for duty but that he was not "in tip top condition the whole trip." When questioned if he had fallen asleep during the trip, the helper engineer replied, "I don't think so." The engineer further stated that he had expected to receive a call for duty because he had called the crew dispatcher's office several times that day, but believed that he would receive the call for duty later in the night or early the following morning. During the Safety Board's public hearing, he testified that he was not tired when he reported for duty and had no difficulty remaining alert during the trip.

The helper engineer had been employed by the SP for more than 11 years at the time of the accident. He had held the positions of hostler and fireman before being promoted to the position of engineer on November 5, 1979.

The helper engineer stated that he normally operated trains between West Colton and Yuma. He was not qualified on the physical characteristics of the railroad for the territory in which the accident occurred and could not, therefore, operate as a road engineer in this area. He estimated that during the past year he had served as a helper engineer about four times on trains operating over the accident territory. Company records indicate that during the month preceding the accident, the helper engineer had not worked with any of the other crewmembers assigned to the accident train.

The helper brakeman received an emergency call for duty from the crew dispatcher on the evening of May 11, to report for duty at 1:30 a.m., May 12. He stated that he had expected to be called for duty about 10:00 a.m. later that morning. Prior to the emergency call, the brakeman had been off duty since 9:00 p.m. on May 10. The helper brakeman reported the following information about his activities. He had "a normal day" on May 11, had been eating regularly (which for him was one meal in the evening) during the day preceding the accident, had been receiving his usual amount of rest, about 8 hours daily, and he was not fatigued when he reported for duty on the day of the accident. He had consumed one beer at home on the evening of May 11. His lifestyle had been altered as a result of his wife's death 3 months earlier. He did not indicate that he was not adjusting properly to this loss.

The helper brakeman had been employed by the SP for more than 38 years at the time of the accident, holding the position of brakeman since the time he was hired. He estimated that he had been a crewmember on trains operating over the accident area on about 10 occasions in the past and that he had worked on many occasions with the helper engineer.

On-scene investigators attempted to locate the grips (personal bags) belonging to all five crewmembers. It was learned that the helper crew had taken their bags when they departed the accident site. The grip belonging to the conductor was removed from the wreckage by railroad officials, and investigators were unable to locate any documentation concerning the contents of this grip. The grips belonging to the head-end engineer and brakeman were located in the wreckage and recovered. A review of the contents of these grips revealed nothing noteworthy.

<u>Other Southern Pacific Personnel</u>.--The train dispatcher on duty at the time of the accident normally worked a 5-day week. Prior to the day of the accident, the dispatcher had not worked since May 6, due to illness. She stated that she was feeling fine when she reported for duty on the morning of

May 12. The dispatcher had been employed by the SP for almost 10 years and had held positions as yard clerk and interlocking operator before being promoted to the position of dispatcher on November 19, 1988.

The assistant chief train dispatcher, who arranged the locomotive units for the movement of Extra 7551 East, worked a regular shift of 10:30 p.m. to 6:30 a.m., 5 days a week. He had been off duty for 16 hours before reporting for duty on the evening of May 11. The assistant chief dispatcher was employed by the SP in July of 1970. He held various positions including freight clerk, yard clerk, and train order operator until being promoted to the position of train dispatcher in 1973. He was promoted to chief train dispatcher in August 1975, resigned voluntarily from that position in September 1977, and returned to the position of train dispatcher in Los Angeles until April 1983. At that time, he exercised his seniority options and returned to Bakersfield as a crew dispatcher and worked in that capacity until 1985, when he returned to the train dispatcher position. His last examination on the operating rules was conducted in 1985.

<u>Calnev Pipeline Dispatcher</u>.--The dispatcher on duty at the time of the pipeline rupture had been employed with the Calnev Pipe Line Company since October 3, 1988. He was hired as a pipeline operator, which includes serving as a relief dispatcher. He was performing the duties of relief dispatcher at the time of the accident.

According to the dispatcher, the day of the pipeline rupture was the third day of his work week; he had finished his last shift at 3:00 p.m. the preceding day. On the day of the rupture, he reported for work at 6:45 a.m. He reported the following information: He had been receiving his usual amount of rest and was properly rested when he reported for duty. He was not taking any medication on the day of the pipeline rupture, had not consumed alcohol the day before the rupture, and he does not "involve himself" with illicit drugs.

The dispatcher had been employed previously with the Paramount Petroleum Corporation for 10 years, during which time he served as a pumper-pipeline operator, a laboratory technician, and a crude oil unit operator.

(Additional personnel information is in Appendix B.)

Southern Pacific Training Programs

<u>Engineer Training Program</u>.--Trainees for the engineer training program were selected from employee applications with preferential treatment given to those applications submitted by United Transportation Union (UTU) members--brakemen, switchmen, and hostlers--because of existing labor agreements between the SP and the UTU. Those trainees selected initially entered a 4-week formal training program during which preliminary air brake, mechanical, locomotive, and operating rules are covered both in the classroom and in the field. The class size for the program normally consisted of 10 trainees. If the trainees successfully completed examinations midway and at the end of the 4-week period, they then progressed to the next stage, which consisted of making 60 road trips with a qualified engineer. A trainee was

not assigned to a specific engineer during this time (labor agreements did not provide for instructor engineers), and, thus, may have ridden with many different engineers in the process of completing 60 road trips. Following the completion of 60 road trips, the trainees were evaluated by the road foreman of engines on the respective district over which they had been working. If he determined that the trainees had reached a minimum level of proficiency, they were then scheduled for the final 3-week phase of training at the company's training facility in Cerritos, California: 1 week consisted of 40 hours of classroom instruction; the last 2 weeks consisted of 1/2 day of classroom instruction and 1/2 day of simulator training. If the trainees successfully passed all three written examinations (one each on air brakes, mechanical systems, and operating rules) and demonstrated train handling skills as observed in the train simulator, they were then promoted to the position of locomotive engineer and received a seniority date. An engineer was not qualified for a given territory until the road foreman of engines for the territory had ridden with the engineer for a period of time and had determined that the engineer was knowledgeable of the territory and could adequately handle trains over the territory. (According to the assistant manager of training and development, the number of times a road foreman of engines would ride with an engineer varied based on the level of skills of the engineer.)

The SP also had in place a 1-week and a 2-week continuing education program during which time engineers returned to the Cerritos facility for refresher training. The 1-week program consisted primarily of reviewing train handling skills (1/2 day in the classroom and 1/2 day in the simulator) and was geared for engineers who worked in heavy-grade territory or mountainous terrain. During the 2-week program, train handling skills were reviewed, and the mechanical systems on the locomotive and the operating rules book were also reviewed. The engineers were not confronted with a pass/fail situation upon completing the continuing education programs. The superintendent of an engineer's respective division received a report on the engineer's performance both on the simulator and on the written examinations. The superintendent could then use the information to determine if the road foreman of engines should spend additional time with a particular engineer.

The head-end engineer of Extra 7551 East entered the engineer's training program on October 20, 1986. After successfully completing the 2-week classroom or "presimulator" training course, he attended the 3-week training course held at the training center in Cerritos. After successfully completing 1 week of classroom instruction and 2 weeks of simulator training at the center, he was promoted to the position of engineer on November 28, 1986. The engineer returned to the training center in January 1988 for the 1-week continuing education program to receive additional instruction on heavy-grade operations. The engineer successfully completed both the classroom portion and the simulator training portion of the program.

The head-end engineer of Extra 7551 East testified that he had never been trained on procedures concerning the reversing of engines, had never received instruction concerning the effects of extended brake application on the deterioration of brake shoes, had never received instruction regarding train handling while receiving helper engine assistance, and had never been placed in an emergency situation during simulator training. He further stated that he was not taught during training how to recover dynamic brakes after an emergency application of the train brakes had been made.

The helper engineer entered the engineer's training program on August 13, 1979. He successfully completed the final phase, 1 week of classroom instruction and 2 weeks of simulator training, before being promoted to the position of engineer on November 5, 1979. He returned to the training center in Cerritos in July 1988 and successfully completed a 2-week continuing education program. The helper engineer testified that during his training, the company rule that addressed reversing the engines was discussed in situations involving "light engines or just a couple of cars, low speeds." He further testified that during this simulator training, they operated trains with helper units. He stated, "...you are trained to take and just go by what the road engineer requests. Normally, it is standard procedure just to go in full dynamics, unless he requests otherwise, and stay there in full dynamics."

According to SP's assistant manager for training of engineers, reversing the engines was not taught during any aspect of the training program "because with the train in emergency, we do not allow the engineer to attempt to reset the PC switch before the train comes to a halt." His testimony also indicated that emergency situations incorporated into the simulator training were predicated on the premise that once the brakes are applied in emergency, the train will stop. With respect to helper engine service, the assistant manager for training stated, "The extent of our instruction to people as far as being helper engineers is push as hard as you can up the hill and hold back as hard as you can going down the hill and if the road engineer asks you to do something, do it."

Dispatcher Training Program.--The SP was training its dispatchers at its training center in Cerritos. According to the training officer for dispatchers, the existing program had been in place for about 1 1/2 years. Candidates for the dispatcher position entered an 8-week training course that incorporated the use of the same computerized dispatching equipment that the individual would use once assigned to an office. After passing the final examination on the classroom portion of training, candidates were sent to a dispatching office where they began their on-the-job training. There was no set period of time that trainees were required to perform on-the-job training. The chief train dispatcher determined when an individual was qualified for a particular dispatcher's position.

The dispatcher, who had operational responsibility over the Mojave Subdivision and was on duty at the time of the derailment, successfully completed the 8-week dispatcher training program on August 19, 1988. She then received on-the-job instruction from an experienced dispatcher for 3 months before being qualified to operate independently as a dispatcher. The assistant chief dispatcher, who assigned the locomotive units for the movement of Extra 7551 East, had not been through the Cerritos dispatcher training program; his training for the position of dispatcher was all on-the-job training.

Clerk Training Program.--The yard clerks who estimated the weight of the cars at the time the cars were released and the yard clerk who estimated the weight of the trona on the shipper's bill of lading had received no formal instructions regarding their duties, according to their testimony. All training had been on-the-job training with other clerks. According to the director of system clerical operations, "It's not always feasible to give these people classroom training when, in fact, they may be trained in a classroom for 2 weeks and then have somebody exercise their seniority against them or they bid to another position...." He estimated that about 20 percent of the clerks were receiving classroom instruction and that SP hoped to raise that percentage to between 30 and 50 percent. According to his testimony, it was standard procedure that any time a clerk estimated a weight on the waybill, some notation on the waybill was needed to indicate that the weight was estimated. He further testified that more and more shippers were dealing directly with the billing office in Los Angeles rather than dealing with yard clerks in the various outlying areas.

Calnev Pipeline Dispatcher Training Program

The primary function of a Calnev pipeline dispatcher was to operate and monitor the pipeline through use of a computer-based operating system. This computer system monitored the condition of the pipeline and incorporated several safety mechanisms that would automatically shut down the system in the event of an emergency.

According to Calnev's manager of operations, there were no written criteria the company followed in selecting an individual for the position of dispatcher. The employee turnover rate was low, and individuals filling the positions of dispatcher normally came from within the company and were knowledgeable of Calnev's operations and procedures.

A trainee received an overview of the Calnev pipeline system and was then paired with the on-duty day shift dispatcher, who was responsible for the trainee's on-the-job training. The duration of on-the-job training varied with the individual. According to the manager of operations, an individual experienced in Calnev's operations might only require 2 months of on-the-job training before being allowed to dispatch while other individuals who were not as knowledgeable might require up to 6 months of on-the-job training.

The on-duty dispatcher provided updates on the trainee's performance to the terminal supervisor and the manager of operations. After a 6-month period, a trainee received a written performance appraisal. After a trainee had completed on-the-job training and had shown a competent working knowledge of the system, the dispatcher was monitored while operating the system alone. Performance was monitored continually by an event recording system, which recorded every keystroke entered on the computer by the dispatcher and all alarms received during the employee's shift. The event recorder printout was reviewed by company officers after an occurrence involving unusual circumstances.

To supplement on-the-job training, the trainee was exposed to several on-going training programs. These programs included monthly meetings concerning safety and operations, review and completion of the operator training manual, and special training seminars. The operator training manual was a self-paced, self-instructional two-volume document that covered a wide variety of pipeline operational procedures. Trainees reviewed these manuals while on duty, a chapter at a time. When the individuals believed they had adequately reviewed the chapter, they were examined on the material. A company officer administered the exam and reviewed all incorrect responses with the trainees. Trainees were to complete all chapters and associated tests during their first year of employment.

The dispatcher on duty at the time of the rupture received his 6-month performance appraisal on March 30, 1989, with the rating of "meets most performance requirements." His instructor had described the dispatcher's ability to learn material as "slow" at that time but attributed this to the dispatcher's refinery rather than pipeline background. The instructor added that as time passed, the dispatcher "quite easily" learned the proper operating and dispatching procedures.

Southern Pacific Management Oversight of Train Operations

The SP's road foreman of engines was responsible for the direct supervision of engineers operating over his particular territory. The road foreman of engines, whose territory was involved in the train derailment, testified that he was responsible for 35 to 55 engineers, depending on the number of helper units in service and the amount of train traffic. According to his testimony, in addition to the required rules examinations, rules compliance was measured through efficiency testing, train rides, review of event recorders, and general observation.

The road foreman of engines for the territory involved in the train derailment testified that efficiency tests were conducted 7 or 8 days a month and that 50 percent of that time would be devoted to checking speed violations through use of radar. The other 50 percent was devoted to efficiency testing of other operating rules. According to the road foreman, there was no set policy on the number of efficiency tests to be made on grade operations or through the use of radar. With respect to train rides, the road foreman testified that he would ride with each engineer at least once or twice a year or more if the engineer was experiencing problems. Again, there was no written policy regarding the number of check rides that had to be made. According to the road foreman, he reviewed 15 to 20 speed tapes a month, some of which were reviewed with the engineer if the road foreman had some concern about the engineer's performance.

The SP instituted a demerit system for rules violations as one method of disciplinary action. According to the road foreman, an employee could accumulate up to 90 demerits before suspension or disciplinary action was initiated. He stated further, however, that if an employee had accumulated

P-89-6

Establish inspection, maintenance, and test requirements to demonstrate and maintain the proper functioning of check valves installed in pipeline systems.

On November 13, 1989, RSPA responded to the Safety Board's recommendations stating:

> An Alert Bulletin has been issued that alerts all hazardous liquid pipeline operators to test in critical locations all check valves for proper closure and recommends the replacement of any check valve that fails to close properly. Also, the advisory recommends that valves located in noncritical areas be inspected for operation at the first opportunity the valves can be bypassed or otherwise taken out of operational service. (The full text of the alert bulletin is contained in appendix L.)
>
> We have initiated a study to determine the feasibility of establishing inspection, maintenance, and test requirements to demonstrate and maintain the proper functioning of check valves installed in pipeline systems. We plan to complete this study within 9 months. If the study supports a need for such a regulation, we will initiate rulemaking.

Based on RSPA's response to the Board's recommendations, Safety Recommendations P-89-5 and -6 have been classified as "Open--Acceptable Alternate Action" and "Open--Acceptable Action," respectively.

Meteorological Information

At 7:30 a.m. on May 12, 1989, at the Norton Air Force Base, located about 4 miles from the accident site, the sky was clear with a temperature of 57 degrees F. Visibility was reported as 15 miles. Similar weather conditions existed at the time of the pipeline rupture.

Medical and Pathological Information

Train Derailment.--Two children, ages 7 and 9, suffered fatal injuries when the train derailed and hopper cars struck their house at 2348 Duffy Street (see figure 11). Postmortem examinations indicated that both children died of suffocation and compressional asphyxia.

The head-end engineer of Extra 7551 East sustained a 4-inch laceration of the left upper arm, multiple rib fractures on the left side with pneumothorax, and multiple abrasions and contusions. He was admitted to the intensive care unit at St. Bernardine Hospital where he was treated and later released.

The two crewmembers located in the last helper engine reported receiving minor injuries. Immediate medical attention was not sought, and there are no records to indicate injuries or treatment.

As an agent for OPS, when CSFM detects a violation of 49 CFR 195, it advises OPS of the findings. Based on its review of the information provided by CSFM, OPS determines if enforcement action is warranted, the type of action warranted, and whether or not to pursue further action. According to a representative from the CSFM, in this arrangement, CSFM serves to detect noncompliance but has no regulatory authority in resolving any noncompliance detected. Testimony from the division chief for pipeline safety operations at CSFM indicated, however, that CSFM could request an operator to take corrective action without first consulting OPS if an immediate risk to public safety existed.

The San Bernardino deputy fire chief (incident commander) testifed that although he had been contacted by a representative from the CSFM on the day of the derailment, he was not made aware of the presence or activities of the CSFM during the days following the train derailment. Testimony from the division chief of pipeline safety operations indicated that representatives from the CSFM were on site through May 16, were in contact with Calnev personnel throughout this time concerning cleanup operations and inspection of the pipeline, and relayed information concerning activities at the derailment site to the OPS' regional office in Colorado. According to his testimony, OPS did not instruct CSFM to take any actions at the site, CSFM representatives on site were satisfied with Calnev's inspections, and based on Calnev's assessment of the integrity of the pipeline, CSFM did not request Calnev to take any further action. He stated also that CSFM was not aware of any request by the deputy fire chief to fully expose and inspect the pipeline in the derailment area. The division chief further testified that representatives from CSFM routinely worked with pipeline personnel rather than fire department personnel, but that CSFM had initiated a program subsequent to the pipeline rupture to contact the fire departments within the State of California to inform them of CSFM's role in and responsibilities for liquid pipelines.

Following the pipeline rupture, representatives from the CSFM and from OPS were dispatched to the scene of the accident. The deputy fire chief stated that he was made aware of their presence and was routinely updated on their activities during the days following the rupture. (The actions taken by the OPS following the pipeline rupture have been previously discussed.)

On August 9, 1989, as a result of its preliminary investigation of the pipeline rupture, the Safety Board issued the following two Safety Recommendations to the Research and Special Programs Administration:

P-89-5

Require pipeline operators that have "All-Clear Check Valves" manufactured by the Wheatley Company installed in their pipeline systems to test these valves for proper closure and require the replacement of any that fail to close properly.

60 demerits, an assessment of the employee's performance was made. For each month that no violations were incurred, two and one-half demerits were removed from the employee's record.

SP's records indicated that in the 12 months prior to the train derailment, the head-end engineer had successfully passed 68 of 70 efficiency tests conducted. His records indicated two instances of disciplinary action. On March 31, 1986, he was cited for exceeding maximum authorized speed (29 mph in a 25-mph zone) while serving as fireman during helper engine service. He waived a formal investigation and received 30 demerits. The second instance involved his failure to properly connect locomotives on February 13, 1988. Again, he waived a formal investigation and received 30 demerits.

SP's records indicated that in the 12 months prior to the train derailment, the helper engineer had successfully passed all 63 efficiency tests conducted. His records indicated no instances of disciplinary action.

None of the crewmembers involved in the train derailment on May 12, 1989, were cited for disciplinary action. According to the general manager for the Western Region, one reason for not taking any disciplinary action was because of the false information provided to the traincrew. He testified, "...it would not have seemed appropriate due to all the outside factors to cite this crew....It would have been very difficult to establish the complicity of the crew as far as the runaway train."

Industry Pipeline Standards and Federal Regulations

When the construction of the Calnev pipeline began in 1969, there were no Federal regulations in effect that addressed the operation, inspection, and maintenance of liquid pipelines. Industry-recommended standards, American Standards Association (ASA) Code B31.4 - "Liquid Petroleum Transportation Piping System" (as revised in 1966), addressed design, construction, inspection, testing, operation, and maintenance considerations, which liquid petroleum operators were encouraged to follow. Selected provisions of the code are contained in Appendix I.

Federal authority to regulate liquid pipeline carriers for safety purposes has existed since March 4, 1921, and was vested originally in the Interstate Commerce Commission (ICC). In 1967, this authority was transferred to the FRA of the U.S. Department of Transportation (DOT), and shortly thereafter, the first Federal safety regulations for liquid pipelines were issued requiring only the reporting of accidents (49 CFR 180.28).

In August 1968, the Natural Gas Pipeline Safety Act of 1968 was enacted, and the Office of Pipeline Safety (OPS) within the DOT was established to develop safety standards for natural gas pipelines and to provide technical advice to the FRA on matters relating to liquid pipelines. On September 29, 1969, the FRA issued regulations for liquid pipelines, 49 CFR Part 195. (The regulations did not apply to pipelines already constructed or under construction.) Many of the provisions of the regulations were based on the existing industry standards, including the 1966 edition of the ASA Code

B31.4. Pertinent provisions of Part 195 are contained in Appendix J. Only a few substantive changes have been made to these particular provisions since the regulations were issued in 1969.

ASA Code B31.8, "Gas Transmission and Distribution Piping Systems," is the industry standard for the natural gas industry. Code B31.8, unlike Code B31.4, had established design standards based on the surrounding population. In determining the population density, the number of buildings intended for human occupancy within a 1/4-mile exposure distance on each side of a gas pipeline route was to be considered. Initially, these standards applied only to the original installation of pipelines, and modifications were not required when the population adjacent to the pipeline increased. However, the 1968 edition of Code B31.8 recommended that gas pipeline operators continually survey their pipelines, and that for pipelines operating in excess of 40 percent of the specified yield strength of the pipe, operators confirm the adequacy of the design or reduce pressure in the pipeline when prescribed population densities were exceeded. Additionally, Code B31.8 (as revised in 1968) based the frequency of several tests required for acceptance of newly installed pipeline, and of several inspections required of pipelines in operation, on the population densities adjacent to a pipeline.

The first Federal regulations for natural gas pipelines, 49 CFR Part 192, were published on August 19, 1970, and were primarily based on the 1968 edition of Code B31.8. Pertinent provisions of Part 192, specifically the population-based spacing requirements for valves on natural gas transmission lines, are contained in Appendix K.

Oversight of Calnev's Pipeline Operations

The Calnev pipeline involved in the train derailment and the subsequent pipeline rupture is an interstate liquid pipeline. Federal regulations addressing interstate pipelines, as contained in 49 CFR Part 195, are currently administered by OPS within the Research and Special Programs Administration (RSPA), a part of the DOT.[31] The Office of the California State Fire Marshal (CSFM) has authority for the regulation, inspection, and enforcement of intrastate pipelines. On January 1, 1987, the CSFM signed an agreement with OPS that stipulates that the CSFM will act as an agent for OPS for inspecting and monitoring interstate pipelines within the State of California to determine compliance with certain provisions of 49 CFR Part 195. Because construction of the Calnev pipeline began in 1969, the provisions of 49 CFR 195 were not yet in effect; thus, the design, materials, installation (including the location of valves), and initial testing requirements do not apply to this pipeline. However, the provisions for reporting accident and safety-related conditions and for the operation and maintenance of the pipeline do apply.

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[31] On August 22, 1972, the U.S. Department of Transportation Act was amended to transfer the authority of the FRA to carry out the liquid pipeline safety functions to the Secretary of Transportation.

A resident at 2326 Duffy Street (see figure 11) sustained multiple injuries, including a right compound fracture of the femur, a large laceration of the right knee, and a compressed spinal fracture when several hopper cars struck his house. This resident was trapped for about 15 hours before being rescued and transported to a local hospital.

The conductor of Extra 7551 East, who was located in the lead engine unit, 8278, and the brakeman who was located in the third engine unit, 7549, suffered fatal injuries as a result of the derailment. Postmortem examinations indicated that both crewmembers died of multiple traumatic injuries.

__Pipeline Rupture__.--Two residents, one of whom was in her house at 2327 Duffy Street and the other in her backyard at 2315 Duffy Street (see figure 11), sustained fatal injuries as a result of the fire.

Three residents received serious injuries, second and third degree burns, while escaping from their burning homes. Sixteen other residents reported minor burns and shortness of breath from smoke inhalation. One firefighter reported burning his foot while fighting the fire.

One person, who was not a local resident, received multiple rib fractures in an automobile accident while attempting to make a U-turn to avoid the fire resulting from the pipeline rupture. Three other persons, who also were not local residents, reported minor injuries, including lacerations and contusions, while attempting to drive away from the fire.

Toxicological Information

In accordance with current FRA requirements, toxicological samples were obtained from all five crewmembers of Extra 7551 East. These samples (blood and urine specimens from the surviving crewmembers,[32] and blood, urine, and tissue specimens from the deceased crewmembers) were forwarded to and examined by the Center for Human Toxicology (CHT) in Salt Lake City, Utah. Additionally, in accordance with SP operating procedures, a second urine specimen was collected from each of the surviving crewmembers and forwarded to an alternate contract laboratory facility, Roche Biomedical Laboratories, Incorporated (RBL), for examination. The specimens examined by CHT and RBL were negative for alcohol and other drugs.

The train dispatcher on duty at the time of the train derailment was not requested to submit to toxicological testing. Calnev's pipeline dispatcher on duty at the time of the pipeline rupture was not requested to submit to toxicological testing. Calnev did not have a policy regarding postaccident toxicological testing of employees. Calnev employees, however, were required to submit to drug testing before being hired. Testimony by Calnev's manager

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[32] Samples from the head-end engineer, the helper engineer, and the helper brakeman were collected, respectively, at 12:15 p.m., 9:45 a.m., and 10:18 a.m., on the day of the accident.

of operations indicated that Calnev was aware that the company would be required by Federal regulation to implement a drug testing program in the near future.

Southern Pacific's Physical Examination Policy

SP's physical examination policy requires all employees to submit to a physical examination when they are hired. With the exception of engineers. there is no requirement that employees submit to further examinations after that date. Engineers must undergo a physical examination at the time they are promoted to the position of engineer. They are not required to submit to another examination until they reach the age of 40, at which time they must then undergo a physical examination every 5 years until the age of 60. At 60, an engineer must then receive an annual physical examination. At age 65, engineers are required to undergo semiannual examinations. (Physical examination dates of the SP employees are contained in Appendix B.)

Tests and Research

Event Recorders.--The multi-event recorders recovered from head-end locomotive units 7549, 7551, and 8278 were sent to the Safty Board's laboratory in Washington, D.C., for readout and evaluation.

The type of recorders installed on the SP locomotive units involved in the accident were designed to record speeds up to 90 miles per hour (mph). The three stripcharts generated from the event recorders indicated that the train speed exceeded 90 mph. Because the physical limit of these stripcharts was exceeded, the maximum speed of the train could not be determined based on the original recorded values. To determine the maximum speed attained, additional stripcharts were generated using a method that reduces the recorded speed values to half their original values (appendix M). Actual values at any point on the stripchart are then obtained by doubling the indicated speed.[33] The results indicate that the train probably reached a speed of 110 mph before derailing.

By reviewing the stripchart generated from the information recorded from unit 7549, Safety Board investigators attempted to determine if the dynamic braking on that unit was functioning. If the dynamic brakes on a locomotive unit are functioning, whenever an engineer uses dynamic braking, corresponding amperage activity should occur and be recorded on the stripchart. A review of the stripchart indicated that unit 7549 went into dynamic braking on 15 occasions during the previous 30 hours of operation; however, the expected corresponding amperage activity was recorded on only 2 occasions. Both instances of recorded amperage activity occurred before Extra 7551 East reached Hiland. The SP chief mechanical officer testified, "...I do not have [the] degree of confidence in the reconstructed tape that [the general road foreman] does because of the difficulty we've experienced with the tape cartridges. It's not uncommon to have them not record on a

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[33] Since the effect of the half-speed process on the other parameters is unknown, the stripcharts should be used to determine train speed only.

channel." The general road foreman testified that based on his review of the stripchart for unit 7549, "During the time that the train descended the hill from Highland, the dynamic brake did not work."

The event recorder printout indicated that service braking (air/mechanical brakes) occurred for more than 25 minutes as the train descended the hill from Hiland. According to information obtained from a brake shoe manufacturer, "Composition brake shoe binders start to decompose at temperatures between 700 degrees F and 800 degrees F, provided this elevated temperature is sustained. If composition brake shoe temperatures are sustained for an extended period of time (20 minutes or greater) above 700 degrees F and decomposition takes place, the shoe will continue to produce high frictional values with small losses as the result of heat fade."

<u>Train Dynamics Analyzer Runs</u>.--On August 15, 1989, six simulations of the movement of train Extra 7551 East down the 2.2 percent grade from Hiland were conducted on a Freightmaster Train Dynamics Analyzer in Fort Worth, Texas. Operating parameters, including air brake reductions and speeds, were based on the information contained on the stripchart made from the event recorder data pack removed from SP 7551 following the derailment. As stated by SP's general road foreman, who observed the simulations with Safety Board investigators, "Test one is the only test that we could run that would allow us to go down the hill in the same manner that this train went down the hill and make the air brake reductions as they were made on the strip chart." Test one was made with 12 axles of dynamic braking on the head-end locomotive units, 6 axles of dynamic braking on the helper units, and with a trailing tonnage of about 8,900 tons. The brake shoe efficiency was purposely degraded during the run with the level of degradation and the location of degradation estimated as follows:

Mile Post Location	Percent Brake Shoe Efficiency
469	75
473.7	60
474.7	55
475	50
480.7	40

The general road foreman of engines recounted the results of the simulation, "We maintained the 30 miles an hour with the reductions that was made on the strip chart and then as the speed started increasing on the strip chart, we started brake deterioration in the simulations and things deteriorated from that point on....the train obtained approximately 105 miles per hour."

Test four was conducted with 12 axles of dynamic braking on the head-end of the train, 12 axles of dynamic braking on the rear end, and a trailing tonnage of about 6,150 tons. These parameters represent the number of axles of dynamic braking and the tonnage that the head-end engineer believed existed for Extra 7551 East. The simulation revealed that the train was controlled and the speed maintained under 30 mph coming down the hill.

The other four tests were stopped when the train could not be controlled coming down the hill by using the parameters from the event recorders.

<u>Instrumented Brake Shoe Tests</u>.--On June 12, 13, and 14, 1989, SP conducted brake shoe tests on SP cars equipped with empty/load devices and on DRGW cars not equipped with the devices. The tests were conducted to determine braking forces on cars similar to the cars that were in the accident. By replacing the actual brake shoe with an instrumented brake shoe, accurate measurements of the forces applied to the wheel could be made. According to the SP's chief mechanical officer, the tests confirmed that the SP cars had "...a braking ratio of 1...."

<u>Train Vibration Study</u>.--At the request of the Safety Board, the Test and Engineering Center of Failure Analysis Associates, an engineering and scientific consulting service, conducted tests at the accident site to measure and record vibration and strain levels to determine if the passage of trains induced vibration or strain in the buried pipeline. As stated in the introduction to the report prepared by Failure Analysis Associates, "...an instrumentation system was assembled to provide a measure of the vertical and lateral acceleration at two locations and axial and hoop strains at two locations on the pipe." Data were acquired for a 24-hour period during which time nine trains passed through the area. In addition, consist and engine log data were acquired from the SP for several of these trains. After analyzing the data collected, Failure Analysis Associates concluded, "...it does not appear that the passage of trains, at the speeds observed, imparts a measurable strain or vibration in the pipeline."

<u>Soil Inspection Report</u>.--On May 25, the day of the pipeline rupture, Calnev contracted with Converse Consultants, a geo-technical and environmental consulting organization, to perform work in the area of the pipeline rupture. As stated in its August 30, 1989, report of findings (appendix N), Converse Consultants' investigation "...was performed to evaluate the subsurface conditions in the vicinity of the pipeline rupture in order to locate areas where the soils may have been disturbed by excavating equipment. It is our understanding that excavating equipment may have been utilized in the vicinity of the pipe rupture during Calnev post derailment pipe inspection and/or during clean-up of the derailment debris." A total of 14 tests were conducted; tests 1 through 4 (figure 16) were performed within the area of the rupture, and tests 5 through 14 were conducted in an area ("control area") where Converse Consultants believed there had been no excavation or disturbance of the soil. According to Converse Consultants' report, tests of samples taken at locations 1 through 4 indicated "...disturbed or poorly compacted earth materials...and contained significant quantities of the mineral trona." Tests of samples taken at locaions 5 through 14 indicated that the earth materials had not been recently disturbed. The tests indicated no presence of the material trona at these locations. A representative from Converse Consultants testified, "...my interpretation and conclusion is that the materials, backfill materials, which prior to the derailment would have been just clean, natural soils without the presence of trona, had become contaminated with trona by means of excavation and replacement, probably as backfill or certainly as materials that had been exposed to trona and mixed, by whatever means."

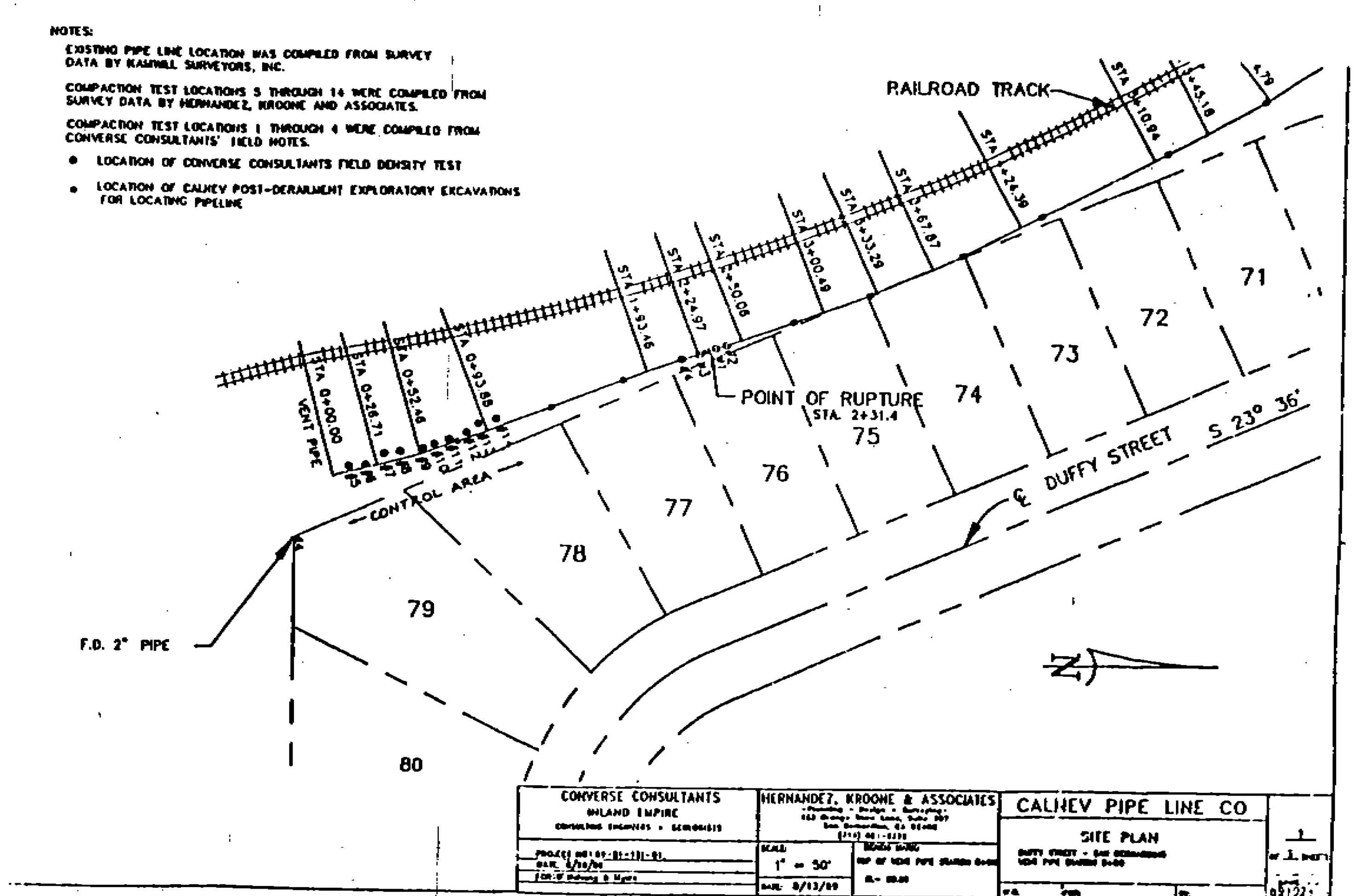

Figure 16.--Map from Converse Consultants' soil inspection report.

Metallurgical Testing.--Two 14-inch outside diameter (OD) pipe sections, one measuring 44 inches long and containing a rupture and one about 41 inches long, were taken to the Safety Board's materials laboratory in Washington, D.C., for examination. The two sections of pipe had been adjacent to each other before they were cut apart. As received in the Board's laboratory, the pipe contained directional arrows and a marking along the top of the section to indicate orientation of the pipe in the ground before removal. Arrows "N" and "S" denoted the north and south directions, respectively (figure 17). A longitudinal marking across the sections at the transverse cut signified the top of the pipe and the matching rotational positions of the two sections relative to each other. Yellow grid line markings had been made on the OD surface around the rupture area. Subsequent notes supplied by Failure Analysis Associates (the metallurgical consultants contracted by the SP to examine the pipe) indicated that these markings denoted positions where thickness measurements had been made on the pipe. Arrow "x" in figure 18 indicates a location where the wall thickness measured the thinnest at about 0.249 inch, which was confirmed by micrometer measurements in the Safety Board's laboratory. Wall thicknesses of 0.254 inch were also found in the origin area of the fracture. The wall thickness away from the fracture measured about 0.312 inches.

The northern section of pipe contained a gaping rupture on the east side of the pipe (bracket "o" in figure 18). As shown in figure 19, the fracture faces were gaped apart and the pipe was deformed outward.

Examination of the OD surface of the pipe sections disclosed what appeared to be mechanical damage in the form of depressions or scrapes which, for the most part, were linear. The most severe damage was on the northern section of pipe and in line with the origin of the rupture. Unmarked arrows in figure 18 outline the damage, which was readily visible. This damage produced a visible depression in the pipe OD surface with a matching bulge on the inside diameter (ID) surface. The maximum depth of the depression was estimated to be about 0.18 inch from the original OD shape. The width of the damage was about 2 inches at its maximum point.

Arrows in figure 20 outline mechanical damage to the OD surface on the southern section of pipe. This section contained two pronounced areas of elongated damage, the centers of which were 2 to 3 inches apart. Neither of these areas showed appreciable denting into the OD surface.

Visual examination of the fracture surface of the rupture disclosed no evidence of progressive cracking. All fracture features were typical of an overstress separation. A pie-shaped section containing the origin area of the rupture was excised from the pipe and further sectioned to a specimen size suitable for examination with the aid of a scanning electron microscope (SEM). SEM examination disclosed dimple rupture features throughout the fracture area that were typical of a ductile overstress separation. There was no evidence of crack arrest markings or oxidation areas that would indicate a progressive separation.

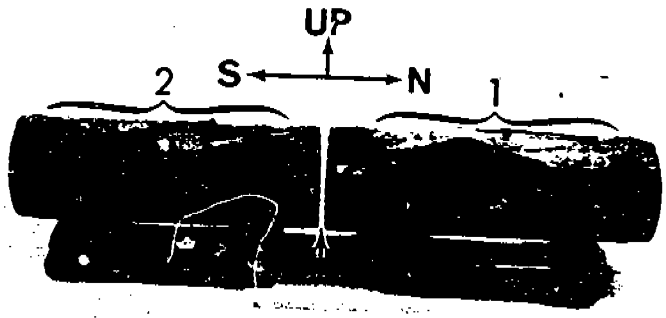

Figure 17.--Overall view of the pipe sectons as submitted for examination. Approximately 1/24 magnification.

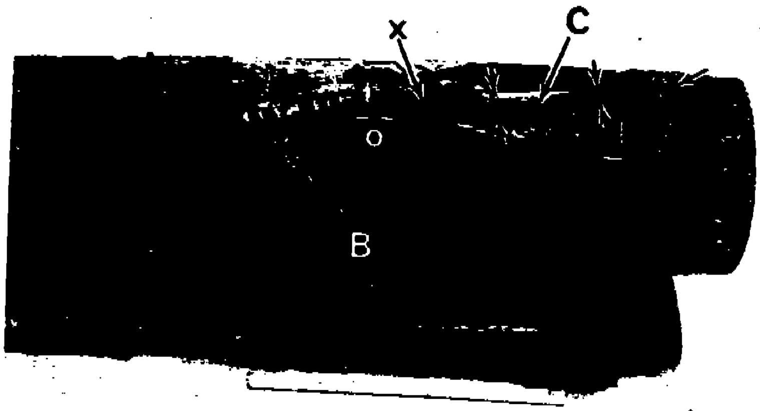

Figure 18.--Higher magnification view of northern pipe section containing the rupture (indicated by bracket 1, figure 17).

Figure 19.--Looking north on north section of pipe showing bulge in the pipe at the rupture. Bracket locates gap in rupture.

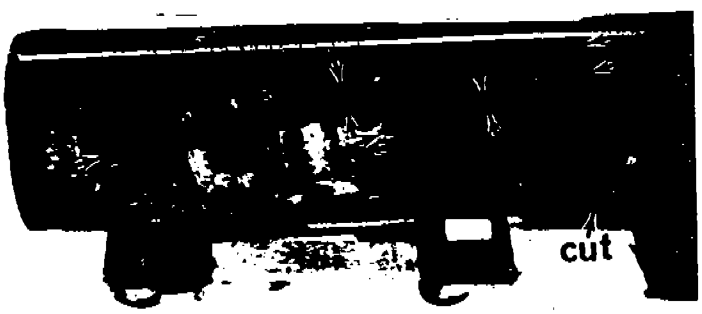

Figure 20.--Higher magnification view of the southern pipe section with mechanical damage outlined by arrowheads.

Many parallel microfissures were noted on the outside diameter in the origin area near the fracture plane. Most of these microfissures were extremely small and shallow and, for the most part, detectable only by higher magnification. However, some microfissures were readily visible with the unaided eye. SEM examination of the fractures within these larger microfissures disclosed features also representative of an overstress separation.

To better characterize the mechanical damage to the OD surface, several metallographic sections were prepared that were oriented both transversely and in line (along the length) with the linear depression. Arrows "B" and "C" in figure 18 indicate the general area where these sections were prepared. The sections were etched and examined along the OD surface for evidence of grain distortion. Except for sporadic highly isolated areas, there was no evidence of grain distortion that would signify a direction of deformation. A few very small areas were noted along the OD surface that were indicative of particles impacting the OD surface radially inward with a slight sliding movement. There was no evidence of grain distortion that would indicate a massive movement of the material in the depression.

A section of pipe located south of the rupture and which contained two areas of surface damage--one near the top centerline and one on the west side--was sent to the Southwest Research Institute for metallurgical examination. The principal objectives of the examination were to inspect for the presence of cracks and to identify the direction of surface deformation in the two damaged areas on the sample. A summary of the results follows:

1. No evidence of any surface cracking was observed on the outside surface of either sample.

2. No significant wall thinning had occurred in either of the scraped areas. The minimum wall thickness measured at the point of most severe damage was 0.313 inch, while the undamaged wall thickness was 0.317 inch.

3. The pipe had been locally dented inward approximately 0.1 inch at the damaged area near the top centerline (southernmost damage area).

4. SEM and EDS analyses of the surfaces did not detect any tool-to-pipe metal transfer.

5. Metallographic sectioning positively identified the direction of surface deformation in both areas of damage.

   a. Damage near top centerline

      The direction of surface deformation was established to be in a mainly southerly direction.

b. Damage near 270 degree position (west side)

The direction of damage was established to be in a downward and southerly direction. This direction is consistent with the nature of the coating damage.

Simulation of Excavating Equipment Operations.--On January 16, 1990, in accordance with a test plan agreed to by all parties, Calnev conducted a series of field tests to determine the amount of damage that three pieces of excavating equipment could inflict on a 14-inch pipeline. These three pieces of equipment that worked in the vicinity of the pipeline between May 12 and 19, 1989, following the removal of the train cars and locomotives, were a Case 580C rubber tire backhoe, a John Deere 690 track excavator, and a Caterpillar 988B front-end loader.

Two 80-foot lengths of pipeline that had been removed from the accident site were filled with water and pressurized to 800 psig and buried without anchors to about minimal burial conditions (one was buried to a 4-foot depth and the other to a 1 1/2-foot depth) that might have been encountered in the area of the train derailment during cleanup operations. The backhoe and the excavator were owned and operated by the Arizona Pipeline Company, and the front-end loader was owned and operated by Jimco Construction Equipment Company, working on behalf of SP. In addition to Safety Board personnel, representatives from Calnev, the Southern Pacific Transportation Company, the California State Fire Marshal's office, IT Corporation, and the Office of Pipeline Safety were present for these field tests.

The teeth on the 2-foot-wide bucket of the Case 580C backhoe penetrated the pipeline coating but could not substantially dent the pipe wall in any of the tests. Running the teeth of the bucket along the top of the pipeline resulted in shallow "chatter" type scratches in the pipe wall. The bucket of the backhoe, with teeth down, was pulled across the top of the pipeline at various angles; pulling the bucket across at an angle of 45 degrees resulted in the greatest penetration to the pipeline coating and the pipe wall with all five teeth of the bucket. Dropping the bucket from a 6-foot height and a 2-foot height and hitting the pipeline with the back of the bucket did not result in any dents to the pipe wall. Because the hydraulics of the equipment slowed the bucket speed when dropped from the 6-foot height, the damage to the coating was less than the damage that occurred when the bucket was dropped from the 2-foot height. The teeth of the bucket did not penetrate or dent the pipe wall when dropped onto the pipeline.

Running the teeth on the bucket of the John Deere 690B excavator along the top of the pipeline resulted in chatter type marks in the pipe wall similar to those made by the Case 580C backhoe. Scraping the side of the pipeline with the side of the bucket resulted in damage to the pipeline coating but no dents in the pipe. Two hits on the pipeline with the back of a loaded bucket created a dent about 1/16-inch deep in the top of the pipe.

During the first test on the second piece of buried pipeline using the Caterpillar 988B front-end loader, the operator dug into the soil covering the pipeline and then dragged the back of the bucket over the top of the pipeline. The operator stated that he did not feel the equipment hit the pipeline, and there was no noise at ground level of the equipment striking the pipeline. After the pipeline was uncovered by hand at this location, observers saw that two marks physically disturbed the metal, about 2 feet apart, on the top of the pipeline. Also, coating damage was observed. A second attempt to drag the back of the bucket over the top of the pipeline resulted in distinctive marks, 18 inches apart, to the coating and the pipe wall. During this second attempt, the operator felt the equipment hit the pipeline, and the noise of the equipment striking the pipeline was clearly heard at ground level. When the side of the bucket was forcefully scraped along the side of the pipeline in a forward motion, damage to the pipe coating was extensive. Where the coating damage ended, a tooth of the bucket struck the lower quadrant of the pipeline creating a deep dent. This action also caused the unanchored pipeline to move 4 inches in a longitudinal direction. When the side of the bucket was scraped along the side of the pipeline a second time over a 5-foot length of the pipeline, a 4-inch-wide area of coating was removed along the entire length. When the back of the bucket of the front-end loader was dragged over the top of the pipeline a third time, two marks, 5 inches apart, were observed along the top quadrant of the pipeline. There was no visible denting of the pipe at these locations.

Other Information

<u>Train Movements Following the Train Derailment and Preceding the Pipeline Rupture</u>.--Between the time the SP opened its rail line for traffic at 4:00 p.m. on May 16, 1989, and the time of the pipeline rupture on May 25, 1989, 34 trains and 1 light engine were operated eastbound, and 39 trains and 1 light engine were operated westbound.

<u>Agreement Between the Southern Pacific and City of San Bernardino Following the Train Derailment</u>.--An agreement between the Southern Pacific and the City of San Bernardino relative to the train derailment of May 12, 1989, was presented at the Safety Board's public hearing in August 1989 (appendix O). In addition to outlining the obligations of the railroad with respect to the property destroyed or damaged as a result of the train derailment, the agreement provided that Southern Pacific, rather than the City, would be responsible for any reimbursement claims by Calnev. The agreement further stated:

> It is further hereby acknowledged and agreed by the parties that a Cal-Neva[34] gas line runs adjacent to the location of the derailment; that the health, safety and welfare of the persons in the vicinity of the derailment requires that such line be fully exposed to allow visual and other examination to the satisfaction of the City Fire Department. As between City and Railroad, Railroad shall bear all costs incurred thereby and for replacement

[34] The Safety Board verified at the public hearing that the term "Cal-Neva" used in the agreement does refer to the Calnev Pipeline Company.

of the line. Railroad's obligation to Cal-Neva shall be determined by the contract between Cal-Neva and Railroad, if any.

This agreement may be amended only in writing by and between the parties hereto.

The agreement was signed on May 17, 1989, by the general manager of SP's Western Region and the City Attorney for San Bernardino.

The deputy fire chief (incident commander), who stated that he had expressed the desire to Calnev's manager of operations during the immediate days following the train derailment that the pipeline be fully exposed and inspected, testified that he was not made aware of the provision of the agreement until June 21, 1989. According to his testimony, it was his understanding that he did not have the authority to require Calnev to expose and inspect the pipeline and that only the State Fire Marshal's Office through the Office of Pipeline Safety had that authority. The deputy fire chief stated that he did not make his desire known to the State Fire Marshal's Office. The deputy fire chief terminated his command of the emergency response to the train derailment on May 15, 1989.

The general manager of SP's Western Region testified that when he signed the agreement, it was his belief that the inspection outlined in the agreement had been performed. Calnev's manager of operations testified that he was not aware of any agreement between the City and SP regarding the exposure and inspection of the pipeline and that there had been no contract between Calnev and SP. He testified also that, based on his understanding of the right-of-way agreement between SP and Calnev, SP could have requested Calnev to expose and inspect the pipeline. Testimony from the SP's general manager indicates that a request to fully expose and inspect the pipeline was never made to Calnev.

<u>Development of Land Adjacent to the SP Railroad and the Calnev Pipeline</u>.--The area affected by the May 12 derailment and the May 25 pipeline rupture was planned in 1955 for residential use, and the subdivision plat was recorded with San Bernardino County on November 10, 1955. On October 1, 1957, the subdivision was annexed by the City of San Bernardino and incorporated within the city limits. In 1967, the SP constructed the portion of its railroad where the train derailment occurred, and at that time, no houses were located on Duffy Street.

By October 1967, houses had been constructed within the eastern portion of the subdivision, but no houses were on either side of that portion of Duffy Street that paralleled the proposed railroad. In 1969 and 1970, when the Calnev pipeline was constructed along the eastern edge of the SP right-of-way, no houses had yet been erected on that portion of Duffy Street that paralleled the railroad; only a few houses had been built within the subdivision. According to recollections of long-term residents, intensive construction within the area occurred from 1970 to 1972.

The City of San Bernardino's General Plan for land use is a policy document that establishes goals, objectives, and policies for the future.

The specific standards for a development are to be guided by this Plan and included in the zoning ordinances or development codes. The subject of land use control because of its proximity to railroad mainline tracks or to high pressure liquid or other pipelines is not specifically addressed.

Before these accidents, the City had developed a proposed revision to its Plan, subsequently conducted public hearings on the proposal, and approved a revised plan. A statement within the proposal advised that, in part, this plan is a foundation policy document that defines the framework for decisions by the City on the use of its land for the protection of residents from natural and human-caused hazards. Neither the proposal nor the newly adopted plan specifically addressed the use of land near mainline railroads or high pressure pipelines.

Disaster Preparedness.--San Bernardino County, about 20,000 square miles in size, is located in the southeastern portion of California. Within the county are 20 incorporated cities with the heaviest concentration of population in the west-central portion. The county's population is more than 1 million.

The County of San Bernardino, the district fire agencies, and the municipal fire departments are signatories to the State of California's Master Mutual Aid Plan to combat emergency situations that may develop and that are beyond the control of any one agency. In addition, many of the agencies have developed local mutual aid and automatic aid agreements. To maximize the resources within the County and to assist in the coordination of such resources, a Mutual Aid System was developed that divides the County into 10 zones. The SP train derailment occurred in what is designated in the Mutual Aid Plan as Zone 2.

Zone 2, or the "East Valley" area is served by eight agencies in the east end of the San Bernardino Valley (figure 21). Resources of the agencies in Zone 2 include: 83 fire response vehicles, 28 specialty units and squads, and 6 pieces of specialized equipment. Within Zone 2 are 526 full-time firefighters and 25 reserve firefighters.

The San Bernardino County Communications Center located in Rialto serves as the Zone 2 Emergency Communications Center. The Communications Center is responsible for emergency dispatch functions for the San Bernardino County Fire Agency-Central Valley District and the Rialto and Loma Linda Fire Departments. Separate dispatch centers are maintained by the fire departments of the City of San Bernardino and Norton Air Force Base, and by the County Fire Warden.

Train Derailments over Pipelines.--The California State Fire Marshal's Office has maintained records on pipeline failures since it began regulating hazardous liquid pipelines in 1984. On March 9, 1989, a butane car derailed at the Tosco Refinery in Martinez, California, and struck and ruptured an above-ground pipeline. No injuries, fire, or explosion resulted from the accident. In another recorded incident at Montclair, California, on

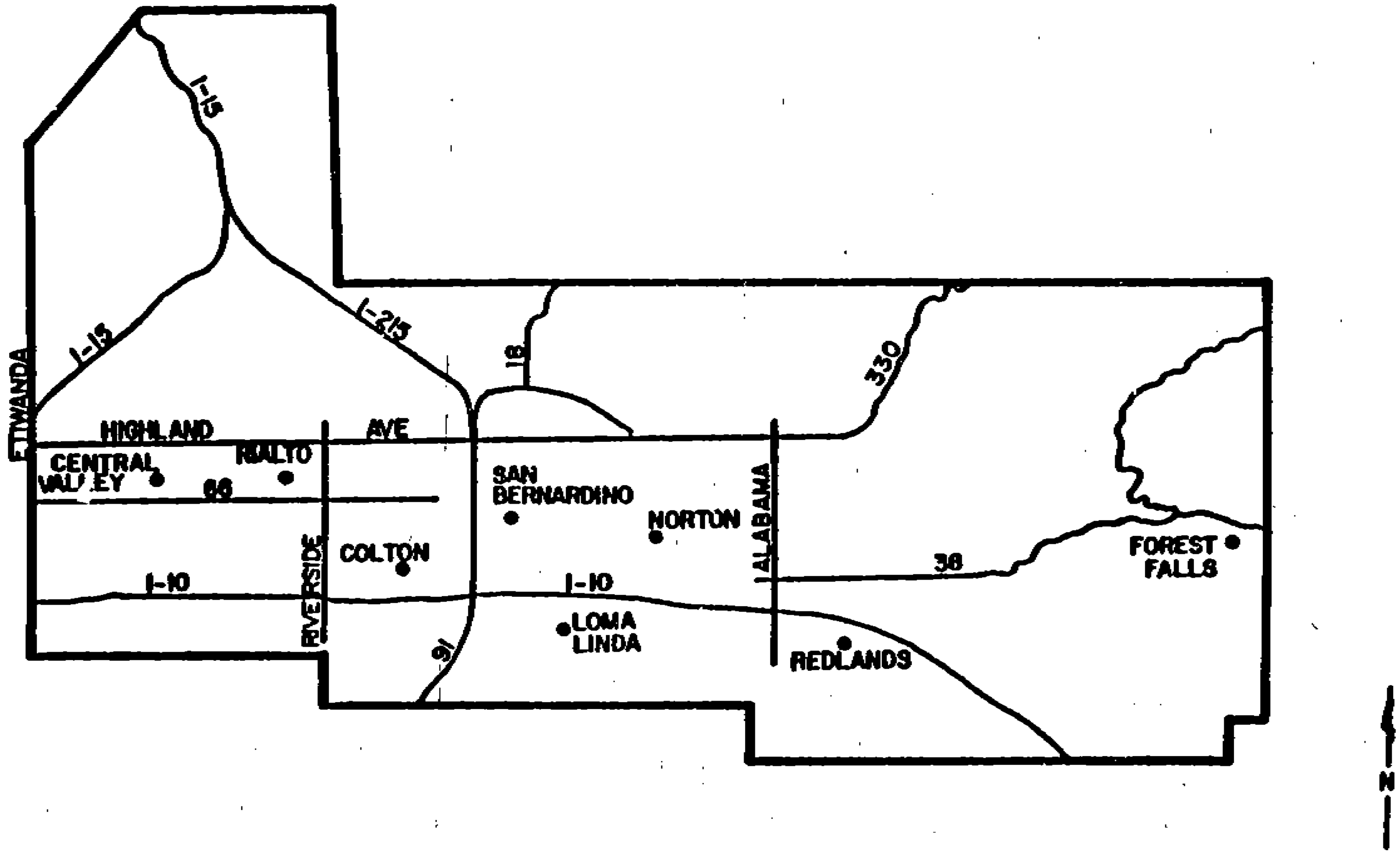

Figure 21.--County Zone 2 of mutual aid system, including San Bernardino.

December 19, 1988, an axle from a "rail car truck" had made a small hole in the 20-inch-diameter pipeline of the Southern Pacific Pipe Line Company; the pipeline ran parallel to the railroad tracks.

On June 27, 1989, a locomotive was being used to switch the order of rail cars at a Union Pacific Railroad yard at Las Vegas, Nevada. About 8:30 a.m., Pacific daylight time, 34 rail cars were being moved when the leading 9 cars and the trailing 12 cars derailed with several rail cars overturning on top of two Calnev petroleum products pipelines. The 6-inch pipeline located on one side of the rail line contained jet fuel, and the 8-inch pipeline on the opposite side of the rail line contained gasoline. Both pipelines were under about 600 psig pressure and both were buried 4 to 5 feet below the ground surface.

Pipeline inspection personnel from both the Nevada Public Service Commission and the Office of Pipeline Safety responded to the Las Vegas accident to monitor the removal of rail cars, to require inspection of both pipelines to determine if the pipelines had been damaged, and to determine if they were safe to return to service. The Office of Pipeline Safety required Calnev to fully uncover and visually inspect the pipelines for possible damage and then required Calnev to hydrostatically test the pipelines through the area of the derailment. The Office of Pipeline Safety advised the Safety Board that it had established as a policy that pipelines potentially damaged by a derailment would be both visually examined and subjected to a hydrostatic test before they could be returned to service, if OPS believes there is potential for harm to life or property.

The Safety Board requested that the Santa Fe Pacific Pipelines Company (formerly the Southern Pacific Pipelines Company)[35] provide records of any derailments over pipelines and their results. Santa Fe advised that 55 percent of its 3,300-mile pipeline system was installed along railroad rights-of-way and that between 1966 and 1989, 121 train derailments had occurred over its pipeline. The Santa Fe has never experienced any damage as a result of a train derailment where the pipe was buried 3 feet or more below ground. However, it did experience damage to its pipeline during the derailment clearing operations for the Montclair accident.

On June 20, 1989, the California Senate Committee on Toxics and Public Safety Management and the California Assembly Select Committee on Hazardous Materials and Pipeline Safety held a joint public hearing on the San Bernardino accidents. As a result of that hearing, Assembly Bill No. 385 was passed and signed into law. The bill calls for the California State Fire Marshal to conduct and prepare a risk assessment study addressing hazardous liquid pipelines within 500 feet of a railroad track. The study is to be completed by January 1, 1991.

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[35] As a result of mergers subsequent to the Montclair, California, accident, Southern Pacific Pipelines became the Santa Fe Pacific Pipelines.

ANALYSIS

General

When the Calnev 14-inch liquid petroleum pipeline ruptured on May 25, 1989, in the immediate area where a Southern Pacific freight train had derailed 13 days earlier, the Safety Board's investigation developed a bifold focus: (1) to determine the factors that led to the train derailment on May 12, 1989; and (2) to determine the factors that led to the pipeline rupture, including the effect, if any, that the train derailment and the postderailment wreckage clearance and pipeline inspection activities had in causing the pipeline to rupture. To facilitate a discussion of the accident investigation, this report will address first those issues that relate exclusively to the train derailment; second, those issues pertinent to the time period between the train derailment and the pipeline rupture; third, those issues that relate exclusively to the pipeline rupture; and fourth, those issues germane to both the train derailment and the pipeline rupture, such as emergency response.

No anomalies or deficiencies in the track structure, track geometry, or signals were noted that would have contributed to the train derailment. The crewmembers of Extra 7551 East were qualified by the Southern Pacific for their respective positions. The Calnev pipeline dispatcher on duty at the time of the pipeline rupture had successfully completed the training program established by the company. Weather was not considered a factor in either the train derailment or the pipeline rupture.

The Train Derailment

The investigation of the train derailment on May 12, 1989, revealed that when Extra 7551 East crested the hill at Hiland to descend the 2.2-percent grade, the head-end engineer believed he had a trailing tonnage of 6,150 tons and 69 tons per operative brake, based on the tonnage profile that had been given to him at the Mojave yard office, and 24 axles (four 6-axle units) of dynamic brakes, based on his assumption that two of the head-end locomotive units and the two helper locomotive units had functioning dynamic brakes. Based on this information, the operating rules required that the engineer crest the hill at 5 mph under the maximum speed allowed, 30 mph, and not exceed the maximum speed during the descent. The general road foreman testified, and the results of the train dynamics analyzer tests corroborated, that the engineer should have been able to easily control the train and maintain a speed of 30 mph down the grade with 24 axles of dynamic brakes and a trailing tonnage of 6,150 tons. The Safety Board's investigation, therefore, examined (1) the accuracy of the information--particularly the number of axles of functioning dynamic brakes and the trailing tonnage--on which the engineer based his operation of the train, and (2) whether or not the engineer's acceptance of this information as being accurate was reasonable. The investigation then attempted to determine what action, if any, the engineer could have taken to control the train down the 2.2-percent grade or to prevent the train from derailing given the information that was provided to him.

Axles of Dynamic Brakes.--The Safety Board examined the available evidence to determine the actual condition of the dynamic brakes on all six units. The head-end engineer and the helper engineer were riding in the first unit of the head-end consist, SP 8278, and the last unit of the helper consist, SP 7443, respectively. Their testimony indicates that the dynamic brakes on these two units were functioning. Also, a readout of the event recorder data from unit SP 8278 verifies that the dynamic brakes on that unit were functioning. Although unit SP 7443 was not equipped with an event recorder, the Safety Board believes that the testimony of the helper engineer is sufficient to conclude that the dynamic brakes on that unit were also functioning. The second unit in the head-end consist, SP 7551, was dead-in-consist, and the first unit in the helper consist, SP 8317, while operating in power, had its dynamic brakes cut out and tagged. Based on the physical evidence and the testimony of the two engineers, the Safety Board concludes that the dynamic brakes on units SP 8278 and SP 7443 were functioning whereas the dynamic brakes on units SP 7551 and SP 8317 were not functioning when the train began descending the 2.2-percent grade.

The Safety Board received conflicting information regarding the condition of the dynamic brakes on the remaining two units, SP 7549 and SP 9340. The head-end brakeman was riding in the third unit, SP 7549 of the head-end consist. According to the head-end engineer, he asked the head-end brakeman about the condition of the dynamic brakes on that unit, and the head-end brakeman replied, "its revving." According to the SP's chief mechanical officer, even though a unit "revs" in dynamic, one cannot be certain that the dynamic brakes on the unit are actually functioning without checking the ammeter reading in the cab of the locomotive in question. The inquiry by the head-end engineer should have prompted a conscientious brakeman to report any malfunction of the dynamic brakes. The lack of any further comment by the head-end brakeman suggests that either he was not attentive or that the dynamic brakes were functioning. Although there is no evidence to suggest that the head-end brakeman was inattentive, the Safety Board could not rule out that possibility. An engineer's failure report of May 4, 1989, 8 days before the derailment, indicated a dynamic brake failure on SP 7549 because of a stuck motor-braking switch. Although this defect was corrected, the chief mechanical officer testified that this type of defect could easily recur. Therefore, the possibility exists that the motor-braking switch became stuck after the head-end brakeman observed that the brakes were "revving." Data from the event recorder of SP 7549 indicated no amperage in dynamic braking as the train descended the hill. The general road foreman testified that, based on this information, he believed that the dynamic brakes on unit SP 7549 were not functioning when the train descended the hill. The chief mechanical officer testified, however, that because of past experience with the cartridges from the event recorders not recording accurately, the lack of a recording was not sufficient evidence to conclude that the dynamic brakes were not functioning.

According to the head-end engineer, the dynamic brakes on unit SP 9340 were "intermittent" when he operated the unit from Fleta to Mojave before the locomotives were repositioned for the eastbound trip through the Cajon Pass; that is "it would load and then the dynamics would drop out." Based on a review of worksheets provided by SP, extensive dynamic brake work had been performed on unit SP 9340 between April 27 and April 29, 1989. During this time, several dynamic braking grids and a grid blower were replaced to correct a previously reported dynamic brake defect. According to the chief mechanical officer, based on this extensive work, the unit should have had functioning dynamic brakes during the descent from Hiland.

The results of the train dynamics analyzer tests indicated that in order to replicate the accident sequence, including brake pipe reductions and speed, a train with a trailing tonnage of 8,900 tons would have required the equivalent of three locomotive units with functioning dynamic brakes. Although the Safety Board concludes that when Extra 7551 East began its descent from Hiland, only three of the six locomotive units had functioning dynamic brakes, the Board could not determine, based on the available evidence, whether this total of three units involved the full dynamics of either SP 7549 or SP 9340, or a combination of the two.

After the operating crew of Extra 7551 East picked up their three-unit locomotive consist at the Mojave yard, they determined that one of the locomotive units was not operating. During the movement of the four-unit locomotive consist to pick up the 69 loaded cars of trona, the head-end engineer became aware that the dynamic brakes on one of the locomotive units were functioning only intermittently. When the two-unit locomotive helper consist coupled onto the rear of Extra 7551 East at Oban, the dynamic brakes on only one unit (SP 7443) were functioning. The helper engineer testified that he did not inform either the dispatcher or the head-end engineer because the dynamic brakes on the other unit (SP 8317) were not functioning when he took control of the consist and thus he believed the information had been relayed to the dispatcher by the engineer whom he relieved.

When Extra 7551 East departed Oban, the head-end engineer asked the helper engineer if he had "...all of your dynamics." When the helper engineer responded, "Yeah, I'm in full," the head-end engineer believed that both helper locomotive units had functioning dynamic brakes. Therefore, the head-end engineer believed that he had at least four units with fully functional dynamic brakes. Although the Safety Board is concerned about the lack of communication among the assistant chief dispatcher, the helper engineer, and the head-end engineer regarding the condition of the dynamic brakes on the six locomotive units, the head-end engineer's belief that he had four units with functioning dynamic brakes was reasonable, under the circumstances.

Trailing Tonnage.--The Lake Minerals Corporation had shipped an average of only 88 tons per rail car when it had intended to ship 100 tons per car on the one previous occasion that it had shipped trona by rail. To avoid a repeat of that situation and also to avoid having excess material at the destination, Lake Minerals requested that the loading contractor at Rosamond install a sensing device on the front-end loader to measure the amount of material that was being loaded into the hopper cars. According to the superintendent of Lake Minerals, the accuracy of the sensing device had been tested and he was confident that each of the 69 hopper cars contained approximately 100 tons of trona. Therefore, the Safety Board concludes that the 69 hopper cars loaded at Rosamond each contained approximately 100 tons of trona for a total lading weight of about 6,900 tons. Given the total light weight of the 69 cars was 2,130 tons, the Safety Board concludes that the total trailing tonnage of the train was about 9,000 tons.

At the time the cars were loaded and moved to the siding at Fleta, SP procedures required that yard clerks release Lake Minerals Corporation from the per diem charge for empty cars by accessing SP's computer system and entering information into the car file of the computer system, including the estimated tonnage of the car lading. The yard clerks estimated what they thought to have been the weight of the material in the car, believing that the estimated weight they entered would be overridden by the proper weight when the shipper's bill of lading was later received at the billing office in Los Angeles, and the computer system's car file updated with that information. The yard clerks had routinely estimated the weights of cars that were being released and had no reason to believe in this instance that the estimated weights would not be replaced with the actual weight as provided by the shipper. The yard clerks' actions, while ultimately a factor in the information provided to the traincrew concerning the weight of their train, were consistent with accepted SP practices for releasing cars. Although one yard clerk testified that it was necessary to estimate as closely as possible the actual weight of the material, he could not provide a reason why. Because all cars were loaded with about the same amount of material, the estimated weights of 50 tons each for 32 cars, 75 tons each for 15 cars, and 60 tons each for 22 cars suggest, however, that there was no consistent method for estimating the actual weight of material at the time cars were being released. The Safety Board concludes that the established practice of estimating weights at the time the cars were released, coupled with the belief that these weights would be changed at a later time, created a potentially hazardous situation in which yard clerks were merely satisfying a requirement of the SP computer system in order to obtain a release of the affected cars.

The bill of lading submitted by the superintendent of Lakes Minerals Corporation to a shipping clerk at SP's yard office at Mojave did not indicate the weights of the cars. The document was reviewed and signed by both the shipping clerk and the superintendent, but testimony indicates there was no discussion regarding the lack of weight information. According to the shipping clerk, he realized, after the superintendent had left the office, that the billing office in Los Angeles would require a weight to be listed on the document. After an unsuccessful attempt to contact Lake Minerals Corporation about the weights of the cars, he estimated the weight of each car to be 60 tons and wrote the figure of 120,000 pounds per car on the bill of lading. Contrary to company procedures, however, he did not indicate on the bill of lading that the weight listed was an estimated weight. The clerk's actions, particularly because he had never before received a bill of lading without the weights provided, again indicate an unsafe practice in preparing train documents.

The investigation revealed that the tonnage profile document generated by SP's computer system and given to traincrews was based, in part, on information contained in the car file of the system. Because of the design of the computer system, when the billing clerk received the shipper's bill of lading without an indication that the weights listed were estimated weights, the billing clerk had the option of entering the bill of lading information into the computer system by listing either the total shipment weight in the waybill file of the system or by listing the individual weight of each car in the car file of the system. Because the billing clerk chose to list the total shipment weight into the waybill file, the weights estimated and previously entered into the car file of the computer system by the yard clerks when the hopper cars were released were not overridden; these weights remained in the car file. The Safety Board, therefore, concludes that the tonnage profile document later generated and given to the operating crew of Extra 7551 East at the yard office in Mojave contained the incorrect trailing tonnage of 6,150 tons based on the weights estimated by the yard clerks at the time the cars were released, rather than the correct trailing tonnage of 9,000 tons (the weight of the trona and the light weight of the cars).

Had the billing clerk elected the other method to enter the bill of lading information into the computer system, the shipping clerk's estimated weights of each car would have overridden the weights previously estimated by the yard clerks and entered into the car file. Consequently, the tonnage profile given to the operating crew would still have indicated that the trailing tonnage was less than it actually was by about 2,760 tons (40 tons multiplied by 69 cars). Had the shipping clerk indicated that the weights listed on the bill of lading were estimated weights, the billing clerk would have had to verify the true weight of the lading before entering the information into the computer. Therefore, the shipping clerk's failure to indicate that the weights listed on the bill of lading were estimated weights contributed to the accident. The billing clerk's decision to enter the total shipment weight rather than the individual weight of each car was influenced by the manner in which the weight information was provided and, therefore, not considered a factor in this accident. Nevertheless, the Safety Board is concerned about the procedures for entering bill of lading information and addresses this issue in more detail later in the report.

The investigation determined that the 38 SP cars in the train consist were equipped with empty-load devices. According to timetable instructions in effect at the time of the accident, loaded cars with these devices were to be considered the equivalent of 1 1/2 cars in determining tons per operative brake (i.e., 50 percent additional braking capability per car). At the time of the train derailment, this information was programmed into the computer system, which automatically calculated the tons per operative brake. This information was listed on the tonnage profile given to the crew of Extra 7551 East--69 tons per operative brake, based on a trailing tonnage of 6,150 tons.

The results of the brake tests performed on SP cars equipped with empty-load devices in June 1989 indicated that the tested cars had a normal braking capability of 1, rather than the 1 1/2 capability. The Safety Board concludes, therefore, that the tonnage profile given to the head-end crew of Extra 7551 East contained inaccurate information regarding the tons per operative brake. Based on the listed trailing tonnage of 6,150 tons, the tons per operative brake should have been listed as 88. Further, had the tonnage profile correctly listed the trailing tonnage as 9,000 tons, the tons per operative brake would have been listed as 130. However, even if a braking capability of 1, rather than the 1 1/2, had been used to calculate the tons per operative brake, with a trailing tonnage of 6,150 tons and 24 axles of dynamic brakes (which is what the engineer believed he had), the operating rules would still have permitted Extra 7551 East to be operated down the grade.

The head-end engineer testified that he had never on any previous occasion questioned the paperwork given to him, including the tonnage profile. He had no reason to believe on this occasion that the tonnage profile contained inaccurate information. Although he had never operated a unit train of this material before, he had operated many trains down the grade and had operated trains with trailing tonnages of about 6,000 tons and about 9,000 tons. The Safety Board concludes that the head-end engineer's acceptance of the information contained on the tonnage profile as being accurate when he received the document was reasonable.

Extra 7551 East had an actual trailing tonnage of about 9,000 tons, 69 cars calculated with a braking equivalence of 1, and 18 axles (three locomotive units) of dynamic braking. Consequently, the train would have had 130 tons per operative brake (TPOB) and 500 tons per axle of dynamic brake. Based on Rule 33 of the company's operating rules, Extra 7551 East would not have been permitted to be operated down the 2.2-percent grade. (See figure 15, arrow 1.)

In summary, the Safety Board concludes that deficiencies in SP's operating procedures in estimating the weights of cars at the time they were released combined with the method for entering bill of lading information into the computer resulted in inaccurate information being provided to the head-end engineer of Extra 7551 East concerning the trailing tonnage of his train. These procedures were directly causal to the engineer's decision to operate the train down the 2.2-percent grade and, consequently, causal to the train derailment.

Operation of Extra 7551 East Down the 2.2 Percent Grade.--Based on the tonnage profile document provided to the engineer and the number of axles of dynamic brakes that the engineer believed he had, timetable instructions indicated that Extra 7551 East could descend the 2.2-percent grade at a speed not exceeding 30 mph. According to the event recorder data, Extra 7551 East crested the hill at 27 mph. As the speed of the train increased, the head-end engineer gradually increased the brake pipe reduction and eventually exceeded one half (13 lbs) the normal full service train brake available (26 lbs) at MP 467 to hold the speed at 30 mph. The operating rule in effect at the time stated that "the amount of brake (train) retarding force used to balance the grade normally should not exceed one half (50 percent) of the normal full service train brake available...." The results of the train dynamics analyzer tests indicate that the train would have stopped had the engineer attempted to stop it at the point he exceeded the 13-lb reduction, which occurred while the train was still negotiating curves at the top of the hill. The engineer also testified he believed he could have stopped the train at that point. The engineer, however, had been able to hold the speed of the train at 30 mph by increasing the brake pipe reduction and, therefore, probably had no reason to believe he would not be able to control the train.

beyond that point. (Not until he increased the brake pipe reduction to 20 lbs did he begin to become concerned about controlling the train.) Furthermore, testimony by the head-end engineer, the helper engineer, the general road foreman, and the road foreman of engines indicated that the operating rule was considered a recommended guideline or option and not mandatory. Testimony also indicates that engineers apparently had routinely exceeded the 13-lb reduction and were able to control trains down the grade. The Safety Board notes that after the train derailment SP revised the operating rule to provide more explicit direction to operating crews. The Safety Board agrees that more explicit direction was needed and concludes that the operating rule in effect at the time of the train derailment provided inadequate guidance to the head-end engineer on the allowable speed and brake pipe reduction down the 2.2-percent grade and this was, therefore, a contributing factor to the derailment.

The head-end engineer testified that after the helper engineer placed the train brakes in emergency, which in essence nullified all dynamic braking capability, he believed there were no further options available to him to stop or control the train. The Safety Board investigated what options, if any, were available to the head-end engineer at that point.

One possible option, according to the rules, was for the head-end engineer to reverse the engines. The Safety Board's investigation, however, revealed that although the SP air brake and train handling rules addressed the procedure to reverse the engines, the head-end engineer had never received any training on the procedure. Furthermore, the assistant manager for training of engineers testified that this procedure was not taught because engineers are not allowed to reset the PC switch [an action that would be required before the engines could be reversed] before the train comes to a halt. He also testified that emergency situations incorporated into the simulator training ~~program are~~ predicated on the premise that once the brakes are applied in emergency, the train will stop. The Safety Board notes and is concerned with this apparent conflict between what is addressed in the rules and what is addressed in the training program. However, the Board believes that certain questions need to be answered before any railroad advocates, through train handling rules or in training programs, that engines be reversed in the event of an emergency situation (particularly at high speeds). For example, the results of reversing the engines at high speeds in terms of the destruction to the locomotive operating compartment and when hazardous materials are entrained are factors that should be considered. In view of the foregoing concerns, the Safety Board could not determine if reversing the engines would have been an option for the head-end engineer of Extra 7551 East when he realized that the train was not slowing sufficiently in response to brake pipe reductions.

Another possible option for the head-end engineer would have been to recover dynamic braking capability after the emergency application of the train brakes. Given that the procedure takes about 1 1/2 minutes, the head-end engineer would have had sufficient time to accomplish this procedure during the more than 5 minutes that elapsed from the time the brakes were placed in emergency until the train derailed. The Safety Board's investigation revealed again, however, that the head-end engineer had never received any training on the procedure to recover dynamic braking. The Safety Board recognizes that the effectiveness of dynamic brakes above 40 mph is substantially degraded. Furthermore, using the formula to determine the amount of retardation of dynamic brakes at various speeds, the Safety Board calculated, based on the weight of the train/force of gravity and the rate of acceleration, that the retarding force from the dynamic brakes would have been minimal and would have had little, if any, effect on the speed of the train as it entered the accident curve. Therefore, the Safety Board concludes that while the engineer had sufficient time to recover the dynamic brakes, had he done so, the accident would still have occurred.

The Safety Board considered the possibility that the head-end engineer could have used retaining valves to operate Extra 7551 East down the 2.2-percent grade. The timetable instructions indicate, however, that for trains being operated with operative dynamic brakes down the grade between Hiland and West Colton, use of retainers is not required if tons per axle of dynamic brake do not exceed 375 per standard range or 450 per extended range. Based on the information contained on the tonnage profile document given to the head-end engineer and based on the number of axles of dynamic brakes that the head-end engineer thought he had, the tons per axle of dynamic brake would have been about 256 (6,150 tons divided by 24 axles)--far less than as outlined in the timetable instructions. The Safety Board concludes, therefore, that the head-end engineer would have had no reason to consider using retainers before he began descending the grade.

In summary, the Safety Board believes that the head-end engineer would have been able to stop the train only if he had gone to a full service brake application at the time he exceeded the 13-lb brake pipe reduction while the train was negotiating curves at the top of the grade. At that time, however, the head-end engineer probably had no indication that he would not be able to control the speed of the train. The Safety Board further believes that after the engineer reached MP 469 and had used 21 lbs of his air brake pressure, there was no possibility of stopping the train.

<u>Derailment Speed</u>.--The initial three stripcharts generated from the event recorders installed on three of the lead locomotive units indicated that the train speed exceeded 90 mph--the physical limit of the stripcharts. Additional stripcharts were generated; they indicated the maximum speed was at least 100 mph. These results are consistent with the testimony of the head-end engineer who believed that the train reached 100 mph. The Safety Board, therefore, concludes that Extra 7551 East was traveling at least 100 mph when it derailed.

Communication

The Safety Board's investigation revealed serious shortcomings in the exchange of pertinent information among the head-end engineer, the helper engineer, and the assistant chief dispatcher. In reviewing the communication that took place, the Safety Board attempted to determine what information, or lack thereof, was critical to the operation of Extra 7551 East down the 2.2-percent grade.

When the helper units coupled onto the rear of Extra 7551 East at Oban, the helper engineer knew that one of the helper units did not have functioning dynamic brakes and did not know the condition of the dynamic brakes on the lead locomotive units. The helper engineer stated that he did not inform the dispatcher about the lack of functioning dynamic brakes because the brakes on that unit were not functioning when he took control of the helper units; he believed that the engineer whom he had relieved would have informed the dispatcher who, in turn, would have informed the head-end engineer. The head-end engineer testified that had he been informed that only one of the helper units had functioning dynamic brakes, he probably would not have operated Extra 7551 East any differently because he still believed that he could control a train with a trailing tonnage of 6,150 tons with three locomotive units having functioning dynamic brakes.

The assistant chief dispatcher arranged the number of locomotive units for the movement of Extra 7551 East based on his calculation that the trailing tonnage was about 8,900 tons. Futhermore, when he was informed that one of the locomotive units in the yard was dead-in-consist, he altered the plan to have the crew pick up an additional locomotive at Palmdale by ordering the 2-unit helper locomotive to move to Oban and couple onto the rear of Extra 7551 East--an action that suggests that the dispatcher was concerned with the number of locomotive units that had been arranged for the movement of Extra 7551 East. However, in spite of this concern and even though the dispatcher had never in the past recalculated the tonnage to determine the number of locomotive units needed, he was not prompted to query the crew or access the computer system, which was available at his desk, to determine the tonnage figure that had been provided. Had he done so, he might have realized that a discrepancy existed. Nevertheless, even if the dispatcher had expressed some concern to the head-end engineer that the trailing tonnage of the train might have been about 8,900 tons, the head-end engineer, in applying rule 33 and believing that he had 24 axles of dynamic brakes, would still have concluded that he could operate the train down the grade. However, with a trailing tonnage of 8,900 tons and 24 axles of dynamic braking, the engineer would have been required to crest the hill at 15 mph and not exceed 20 mph descending the grade. The Safety Board believes that at those speeds, the brake shoes would probably have not been destroyed or burned away and that, consequently, the train could have been brought safely down the grade. Therefore, the failure of the assistant chief dispatcher to follow up on a possible discrepancy regarding the tonnage of the train contributed to the train derailment.

The investigation also revealed that the assistant chief dispatcher was primarily concerned with assigning sufficient locomotive units to provide power for moving trains up a grade. The dispatcher testified that he did not request information from engineers nor did he query the computer system; engineers were responsible for informing him if dynamic brakes were not functioning. While the Safety Board agrees that engineers have this responsibility, the Board also believes that the dispatcher, who is responsible for the safe movement of trains, should be equally concerned about providing sufficient locomotive units with functioning dynamic brakes to bring a train safely down a mountain grade as he is with providing sufficient power to move a train up a mountain grade. Had the assistant chief dispatcher queried the operating crew of Extra 7551 East concerning the status of dynamic brakes, he might have been prompted to assign an additional unit to the consist.

Consequently, the Safety Board concludes that the head-end engineer would possibly have altered his decision to operate Extra 7551 East down the grade, only if he had received accurate information concerning the trailing tonnage figure and information regarding the inoperative dynamic brakes on one of the helper units. Neither piece of information alone would have been significant enough to alert the engineer that operating down the grade might be unsafe. Therefore, the lack of communication among the assistant chief dispatcher, the helper engineer, and the head-end engineer concerning the trailing tonnage of the train and the number of locomotive units with inoperative dynamic brakes before the train began descending the grade is considered a factor to the cause of the train derailment.

There was no communication between the head-end engineer and the helper engineer after the train departed Oban and during the descent down the grade. The helper engineer testified that there was no need for communication because he could observe the brake pipe gauge and determine what action the head-end engineer was taking. When the train speed reached about 40 mph, the helper engineer initiated an emergency brake application without communicating with the head-end engineer. Although the head-end engineer testified that he was about to initiate an emergency brake application, the Safety Board is concerned that no communication was initiated by either crewmember when it was obvious that an emergency situation was developing.

The Safety Board notes that the SP now requires the road and helper engineer(s) to communicate the condition of their units and train to determine maximum authorized speed and train handling requirements. The Safety Board recognizes that this rule should ensure that the engineers are aware of the condition of the dynamic brakes on the locomotives in their train; the Board remains concerned, however, that vital information, as was evident in this accident, may not be relayed to and from the dispatcher. Apparently engineers are required to inform dispatchers of any defective locomotive condition, but the helper engineer in this accident did not make sure that the dispatcher had been informed. Further, although the assistant chief dispatcher in this accident had some concern regarding the accurate tonnage of the train, he did not relay this concern to the operating crew of Extra 7551 East. Therefore, the Safety Board believes that the SP should develop explicit procedures that require the dispatcher and the operating crew to communicate vital information concerning the condition of the train.

Testing Dynamic Brakes

Despite the railroad industry's emphasis on the use of dynamic brakes to control a train, as reflected in the operating rules, timetable instructions, and engineer training programs, neither the carrier involved in this train derailment, the SP, nor the FRA required that the dynamic brake system on a locomotive be tested or be functional. The Safety Board is concerned that certain rules and special instructions regarding the operation of trains, particularly in mountain territory, require a train to have a certain number of axles of dynamic brakes, yet there is no rule to require that the dynamic braking system on a locomotive be functional or even tested.

Testimony by the head-end engineer revealed, however, that SP personnel are familiar with the procedure for testing the dynamic brakes. The only positive method is for someone to read the ammeter in each unit of the locomotive consist while moving above 15 mph to ensure sufficient current while in the dynamic braking mode. This test method, however, was not followed before Extra 7551 East began descending the 2.2-percent grade, even though sufficient dynamic braking was critical to the safe operation of the train down the grade. The Safety Board believes that the status of a system as critical to the safe movement of the train as the dynamic brake system should be tested before departure and that testing should be required by both the FRA and the railroads. The Safety Board does, however, have concern about the safety involved with having an employee climb from one locomotive to another while the train is moving. With today's technology, the Safety Board believes that a positive method could be developed to indicate to the operating engineer in the cab of the controlling locomotive unit the status of the dynamic brakes on all units in the train. Furthermore, the Safety Board believes that the Federal Railroad Administration and the Association of American Railroads are the appropriate agencies to research this issue and develop an appropriate method for transmitting dynamic brake information to the cab of the controlling locomotive unit.

Because of conflicting testimony from SP personnel regarding the company's interpretation of FRA requirements for functioning dynamic brakes, the Safety Board requested that the FRA provide in writing its position on this issue. The FRA responded, "If a dynamic brake or regenerative brake system is in use, that portion of the system in use shall respond to control from the cab of the controlling locomotive." The Safety Board does not agree with FRA's further statement that this "makes clear that both the equipping and the use of dynamic brake is optional." Moreover, the Safety Board is disappointed with FRA's position that it will not take exception if a dynamic brake is found inoperative or not operating properly. Given the emphasis on dynamic brakes in operating rules, in timetable instructions, and in training programs for engineers, and given the lack of a requirement for testing dynamic brakes, the Safety Board firmly believes that if a locomotive is equipped with dynamic brakes, the dynamic brakes should be functional. Consequently, the Safety Board believes that the FRA should revise its regulations accordingly.

Event Recorders

According to SP's general road foreman, all new locomotives being purchased are equipped with event recorders, and event recorders are being installed on existing locomotives during major overhaul. The investigation of the derailment of Extra 7551 East demonstrates the need for all locomotives to be equipped with event recorders. While the Safety Board obtained pertinent information from the readout of the stripcharts generated from the event recorders installed on three of the lead locomotive units, other pertinent data were not available because the two helper locomotive units and the fourth lead unit were not equipped with event recorders. For example, had the helper units been equipped with event recorders, more accurate information would have been available concerning the time when the helper engineer placed the train brakes into emergency. Also, had the fourth lead unit, unit 9340, been equipped with an event recorder, amperage activity from dynamic braking should have been recorded; this information would have aided in determining whether or not the dynamic brakes on that unit were functioning. The Safety Board continues to believe that event recorders are not only an invaluable investigative tool in determining the cause of accidents and preventing future accidents, but also a management tool that can be used to monitor compliance with operating rules, particularly speed restrictions. The Safety Board notes that the SP has established a program to equip existing locomotives with event recorders.

The Safety Board's position regarding the mandatory use of event recorders in the railroad industry has been well documented in previous accident investigations, through the issuance of safety recommendations to the industry and the FRA, and in comments on Federal rulemaking proposals. The Safety Board addressed the issue of a Federal regulation requiring event recorders in its investigation of a head-on collision between two Iowa Interstate Railroad freight trains near Altoona, Iowa, on July 30, 1983.[36] The Board stated:

> The Safety Board believes that the Rail Safety Improvement Act of 1988 mandates rules requiring event recorders and that it does not give the FRA freedom to decide whether Federal regulatory intervention on this subject is necessary. The Board is concerned, based on the FRA's past considerations of this issue, that the FRA will arbitrarily decide that Federal regulations are not justified or warranted. The Board believes that the intent of Congress is explicit and that the FRA should take immediate action and issue the rulemaking requiring event recorders in the railroad industry.

As a result of the Altoona accident, the Safety Board issued the following safety recommendation to the FRA:

> R-89-50
>
> Expedite the rulemaking requiring the use of event recorders in the railroad industry.

The FRA has not responded formally to the Board's recommendation. However, in a recent meeting between FRA and Safety Board staffs, agreement was reached on the general principle that some type of recording device should be required to be installed on trains. The FRA and Safety Board staffs will meet further to discuss the parameters of this issue. In spite of the agreement reached through this cooperative effort, the Safety Board remains concerned that rulemaking activity has not been expedited. Consequently,

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[36] Railroad Accident Report--"Head-on Collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with Release of Hazardous Materials, near Altoona, Iowa, July 30, 1988" (NTSB/RAR-89/04).

Safety Recommendation R-89-50 remains in an "Open--Unacceptable Action" status, and the Safety Board reiterates the recommendation as a result of the Board's investigation of the San Bernardino accident.

Computer-Generated Tonnage Profile Information

At the time of the train derailment, the estimation and placement of weights of loaded cars into the car file of the computer system was an accepted practice on the SP. After the train derailment, SP revised the computer system so that regardless of the weights estimated and placed into the file, the computer will automatically update the tonnage to the maximum capacity of the car. According to the director of clerical operations, the maximum tonnage figure will remain in the car file of the computer until the shipper's bill of lading is received and only when the bill of lading indicates a shipper-certified weight will the maximum tonnage figure be adjusted to reflect the shipper-certified weight. If an estimated weight is indicated on the shipper's bill of lading, the maximum tonnage figure will remain in the car file of the computer system until the car has been weighed. Although the Safety Board notes that the SP has taken steps to improve the system in place at the time of the derailment, the Board remains concerned that inaccurate information concerning the trailing tonnage of a train can still be generated and given to the operating crew. The current system does not provide an adequate method of generating accurate trailing tonnage information.

Opportunity for error still exists after the computer has automatically updated the tonnage figure to the maximum capacity of the car. If a yard clerk (1) receives a shipper's bill of lading without weights listed, and (2) estimates the weights without indicating the weights are estimated, when that document is transmitted to the billing office in Los Angeles, the billing clerk could assume, as occurred in this accident, that the weights listed are shipper-certified weights. If the billing clerk then elects to list the individual weights, as shown on the document from the yard clerk, the estimated weights would override the maximum tonnage figure that was automatically generated at the time the cars were released. Consequently, even with the changes made by SP after the train derailment, a traincrew's tonnage profile document, which is generated based on information in the car file of the computer sytem, could still reflect inaccurate information concerning the trailing tonnage of the train. The Safety Board recognizes that this most likely would occur when a unit train is involved; yet the opportunity for error still exists with the system currently in place. Therefore, the Safety Board believes that the SP should take immediate steps to improve the method of providing accurate trailing tonnage information to traincrews.

The use of the maximum tonnage figure until a car has been weighed, in the event the shipper's bill of lading reflects estimated weights, raises additional concerns regarding the efficiency and safety of train operations. If the maximum tonnage figure remains in the car file of the computer system, this information will dictate, in essence, the number of axles of dynamic brakes needed to operate a train down a grade. It is conceivable, therefore, that the actual weight of a train could be substantially less than what is indicated on the tonnage profile document, based on the maximum tonnage figures. As a result, more locomotive units to provide power and dynamic braking could be assigned to a train than are needed. While the margin of safety would appear to be increased by this procedure, the Safety Board questions whether or not the SP has studied the ramifications of this procedure in terms of traincrews becoming overly reliant on the increase in power and dynamic braking capability and in terms of operating a railroad efficiently. On the other hand, operating personnel may become increasingly wary of a tonnage profile document knowing that the document may not contain accurate information concerning tons per operative brake. One additional point to consider is the overloading of cars. If, for example, each car in a unit train is loaded to a weight that is higher than the maximum figure contained in the computer, the actual trailing tonnage of the train could be considerably higher than the weight listed on the tonnage profile generated by the computer. Accordingly, the Safety Board urges the SP to examine the ramifications of any method proposed to provide accurate trailing tonnage information to traincrews.

Dynamic Brake/Emergency Interlock

The purpose of the interlock that nullified the dynamic brakes after an emergency application of the air brakes was to prevent the wheels from sliding. This had some validity when dynamic braking was new and before engineer training became formalized. However, engineers in the industry are now trained to automatically release locomotive brakes in a trainline emergency. Other railroads, such as the Union Pacific and the Burlington Northern, recognize the importance of retaining dynamic brakes to ensure that some retardation is still available if brake shoes burn away. Consequently, the Safety Board believes that the SP should eliminate the dynamic brake/emergency interlock on all locomotive units to ensure the availability of at least one braking system at all times.

Reporting Defective Conditions on Locomotives

The investigation revealed that updating the computer system with information regarding defective locomotive conditions did not appear to receive priority attention. Furthermore, conflicting testimony by SP personnel suggests that the responsibility for updating the computer had not been well delineated. According to the assistant chief dispatcher involved in this accident, it is not his responsibility to place that information into the computer. He stated he does so on occasion or gives the information to a clerk in the office who will update the computer when convenient to do so. According to the chief mechanical officer, however, the dispatcher is responsible for updating the computer when he receives information from engineers concerning locomotive defects. The Safety Board believes that the computer system should accurately reflect the condition of locomotive units and that SP should develop a procedure to ensure such information is entered into the computer system in a timely manner and to clearly designate the responsibility for doing so.

Training Program for Engineers

The Safety Board's review of the training program for engineers revealed that, overall, the program was well conceived and offered a balance of classroom instruction and simulator training. Refresher training programs were also offered with the 1-week program geared for engineers who worked predominantly in mountainous terrain. The Board's investigation of this accident, however, revealed shortcomings in the program.

Of concern to the Safety Board was the head-end engineer's testimony that he had never been placed in an emergency situation during simulator training. The assistant manager for training testified that emergency situations incorporated into the simulator training are predicated on the premise that once the brakes are applied in emergency, the train will stop; consequently, engineers are not taught to recover their dynamic brakes after an emergency application of the train brakes have been made. If the assistant manager's statement accurately reflects SP's position regarding simulator training, the Safety Board believes that SP is not attaining maximum benefit from its simulator training program. During simulator training, crewmembers should be confronted with several operating parameters, including emergency situations that require the crewmembers to make appropriate decisions and to take appropriate actions. Contrary to what occurred in this accident, crewmembers should be trained and instructed to work as a team and communicate to arrive at the most suitable solution to the emergency at hand. The Safety Board believes that the head-end engineer of Extra 7551 East should have been provided adequate training and instructions regarding options during emergency situations, including the recovery of dynamic brakes. The SP, therefore, should review its training program for engineers and incorporate emergency situations into the simulator portion of the program that will require crewmembers to respond appropriately to various operating parameters.

Southern Pacific Training Program for Yard Clerks

The investigation revealed that yard clerks had been provided no formal guidance regarding the weights of various commodities that were being transported by the SP or how the practice of estimating weights could possibly affect the safety of train operations. The discrepancy between the actual weights of the cars and the weights estimated by the yard clerks indicate that even on-the-job training was not accomplishing a degree of consistency. The Safety Board notes that the change in the computer system and the tendency of shippers to deal directly with the billing office in Los Angeles rather than with the clerks in outlying areas should minimize the type of errors with the bill of lading information that occurred in this accident. The Safety Board believes, however, that because clerks in outlying areas may continue to receive bill of lading information from shippers, SP should emphasize to its employees the importance of (1) obtaining the actual weights from shippers, and (2) the importance of indicating on the bill of lading if the weights listed are shipper-certified or estimated weights. Furthermore, shippers should be alerted to the importance of providing accurate weight information on the bill of lading they submit.

Southern Pacific Management Oversight of Train Operations

SP's oversight of train operations is primarily accomplished through efficiency testing, train rides, and a review of event recorders. However, the investigation also revealed that there is no consistent method or written policy regarding the number and types of efficiency tests that are to be made (particularly on grade operations), no policy regarding the number of check rides that should be made with engineers, and no policy regarding the review of event recorders.

The Safety Board is concerned that without specific guidance or a written policy regarding efficiency tests, check rides, and a review of event recorders, SP management may not detect certain operating practices that are not in compliance with operating rules. For example, Rule 61.E, in effect at the time of the train derailment, stated, "The amount of brake retarding force used to balance the grade normally should not exceed one half (50 percent) of the normal full service train brake available if dynamic brake and pressure maintaining are operative." Testimony by the head-end engineer indicated, however, that he had in the past exceeded 50 percent of the full service train brake available, and that engineers routinely exceeded the 50 percent. Although testimony also indicated that this rule was not to be interpreted as mandatory, the Safety Board believes that had a specific policy regarding oversight of train operations been in place--through efficiency checks, check rides, or a review of event recorder tapes--the practice of exceeding 50 percent of the full service train brake available may have been detected by supervisors and corrective action may have been taken. The Safety Board believes that riding with an engineer only once a year or reviewing an event recorder tape only when an apparent violation occurs is not adequate supervisory oversight. Consequently, the Safety Board believes that the SP should review its supervisory oversight of train operations and provide specific guidance regarding efficiency tests, check rides, and the review of event recorder tapes.

The Safety Board has previously addressed the issue of supervisory oversight of train operations with the SP. On November 18, 1986, as a result of its investigation of the derailment on June 9, 1985, of a St. Louis Southwestern Railway Company freight train near Pine Bluff, Arkansas, the Safety Board issued the following Safety Recommendation to the SP:

<u>R-86-42</u>

> Provide intensive full-time supervisory oversight of its mainline train operations with particular emphasis placed on the enforcement of speed restrictions and operating rules.

In its response of September 8, 1987, the SP advised the Safety Board, in part, of the following:

> A comprehensive program to control speed as well as overall rules compliance has been initiated. This program...includes efficiency testing by all of our officers, both individually and as teams, to

> insure rules compliance both day and night. Our officers are required to make a preponderant number of their tests during hours of darkness.
>
> Team testing is done by assigning our officers in groups of four with one officer designated as captain....They test all areas of the division, on a random basis to ensure no patterns are established that would nullify the surprise element....
>
> Our road foremen of engines are required to ride 12-15 trains each month, concentrating on those engineers with lesser skills in train handling techniques, air brakes and rules knowledge. This program is designed to upgrade all of our enginemen to a high level of performance....
>
> A large percentage of our locomotives are now equipped with event recorders. The tapes are captured at strategic locations and all of them are read and evaluated by our road foremen of engines for speed violation and train handling techniques....

The safety recommendation was being held in an "Open--Acceptable Action" status pending completion of the Board's investigation of an accident at Yuma, Arizona, in which supervisory oversight was again raised as an issue. The SP informed the Board that as a result of the Yuma accident, the company was placing an officer on duty 24 hours a day at the Yuma yard office. The results of the investigation of the San Bernardino accident again suggest that the SP needs to examine supervisory oversight of train operations. In view of the new safety recommendation being issued in this report, Safety Recommendation R-86-42 has been classified as "Closed--Unacceptable Action/Superseded."

The head-end engineer had been qualified over the territory by making one trip with a supervisor from Bakersfield to Tehachapi; this trip did not include the area in which the accident occurred. The Safety Board believes that supervisors cannot assess adequately the ability of engineers to operate trains properly over an entire territory by making one short ride with an engineer. In territory with mountainous terrain, supervisors, at a minimum, should ride with an engineer in both directions on the mountain grade before qualifying an engineer for the entire territory. Further, the ride should be performed on a train that is comparable in size and trailing tonnage to those typically most difficult to operate on that territory. Consequently, the Safety Board believes that the SP should revise its procedures accordingly for qualifying engineers. The Board also believes that the FRA should promulgate regulations along the same line.

The Pipeline Rupture

To determine the cause of the pipeline rupture on May 25, 1989, the Safety Board examined the physical damage to the pipeline, reviewed the results of reports of the metallurgical examinations of the pipeline, inspection of soil, recordings of train vibrations; conducted field simulations of excavating equipment operations; and reviewed the testimony of equipment operators and Calnev and SP personnel who were at the accident site between the time of the derailment and the time of the pipeline rupture. Although the occurrence of the pipeline rupture in the same area where the train had derailed 13 days earlier immediately raised concern about the relationship of the two events, the Safety Board considered the possibility that the damage to the pipeline had occurred before the train derailed. The results of the metallurgical examination performed at the Safety Board's laboratory indicate that the rupture was not associated with the longitudinal weld. There was no evidence that any heavy equipment had been operating in the area before the train derailment, yet the mechanical damage to the pipe in the form of linear scrapes and depressions and the damage to the coating were typical of equipment-related damage. In view of the physical damage to the pipe and the lack of any evidence that heavy equipment was operating in the area before the train derailment, the Safety Board ruled out the possibility that the damage to the pipe occurred before the train derailed.

The Safety Board then examined the possibility that railroad parts from derailing equipment or sections of track may have penetrated the native soil sufficiently to strike and damage the pipeline. Testimony and the available evidence indicates that during the postderailment inspections of the pipeline, and during the inspection of the area following the pipeline rupture, railroad equipment parts were found in the immediate area and that although some parts were embedded in the native soil, no part was of sufficient mass and shape to be suspected of having caused the damage to the pipeline. The immediate concern following the derailment was that if the inverted locomotive had remained intact, it may have penetrated the ground as much as 3 or 4 feet. When the locomotive was removed, however, it was determined that the top of the locomotive had been sheared off and that the locomotive remained at ground level. Also, the location of this locomotive was south of the rupture area. Further, the Safety Board believes that it is unlikely that any railroad debris coming in contact with the pipeline could have produced the relatively parallel marks that were noted on the pipeline in the area of the rupture. Based on the lack of any railroad parts in direct contact with the pipeline and based on the physical damage to the pipeline, indicating excavation equipment-related damage, the Safety Board ruled out the possibility that railroad parts penetrated the soil sufficiently during the derailment sequence to contact and damage the pipeline. The soil consultant's report strongly indicates that the area where the rupture occurred had most likely been excavated because of the loose compaction of the soil and the amount of trona material that was observed in the soil. This information combined with the information regarding the train parts found near the rupture further supports a finding that the pipe was damaged after the train derailment. However, this information does not help to identify precisely the timing of the damage to the pipeline after the train derailment.

In view of the foregoing, the Safety Board examined the activities during the time between the train derailment and the pipeline rupture to determine if the pipeline was damaged (1) during removal of the train wreckage, (2) during the removal of the trona from over the pipeline, (3) during the excavation and inspection of the pipeline, or (4) during removal of the trona from the derailment area.

Removal of the Train Wreckage.--SP cut a breach through the levee and brought in several pieces of heavy equipment--including cranes, bulldozers, and front-end loaders--to remove the train wreckage. Although no calculations were made to determine the stress imposed on the pipeline by the heavy equipment operating over it, both Calnev and SP personnel testified they believed there was sufficient cover, with the existing native soil and the spilled trona above the pipeline to prevent any damage to the pipeline. According to the testimony of on-site personnel, the removal of the train wreckage was accomplished as planned; no cars or locomotives were dropped or dragged over the pipeline--all equipment was lifted and carried out to the other side of the track. The Safety Board, however, considered the possibility that a piece of equipment, such as a front-end loader with teeth on the bucket, may have inadvertently dug deep into the ground unnoticed. Equipment operators stated that excavation equipment, including two large bulldozers, were working diligently in the area lifting cars and moving trona. During that time, the terrain was uneven because of the spilled trona and, consequenty, the exact depth to native soil was probably not known to the operators of the equipment. Furthermore, because of the many pieces of equipment operating in the area, the high noise level generated by the heavy equipment, and the visibility throughout the area restricted by stacked rail cars, supervisory personnel unlikely would have been able to observe every movement of the equipment operators, particularly on May 13 when operations continued after dark. Although the 4 to 6 feet of natural cover that existed over the pipeline at this time should have provided ample protection against damage from the wreckage clearing operations, some equipment being operated was capable of penetrating the available cover. Because of the limited surveillance during the wreck clearing operations, opportunity existed for equipment to damage the pipeline unobserved.

Removal of Trona From Over the Pipeline.--After the train wreckage was removed, Calnev cut an 8-foot-wide path through the trona to excavate and inspect the pipeline at those locations where railroad parts may have penetrated the native soil. To accomplish this, Calnev had to work through the night of May 15.

The equipment used to remove the trona from over the pipeline included a John Deere 690B excavator and a front-end loader. Although testimony by Calnev personnel on site indicated that they were never concerned during the removal of the trona that the integrity of the pipeline may have been compromised, the Safety Board considered the possibility that the teeth on the bucket of the 690B excavator could have been the source of the linear and relatively parallel marks observed on the pipeline following the rupture. (Because the bucket on the front-end loader had a smooth edge, it is highly unlikely that the bucket could have produced the relatively parallel marks observed on the pipeline.) Testimony indicates that the 690B excavator may have dug as deep as 16 inches into the native soil at one location. However, the depth of the pipeline in this area was later determined to have been at a minimum of 3 1/2 feet, and close to 4 feet. Further, the metallurgical examination of a section of pipe just south of the ruptured area of the pipe by the Southwest Research Institute indicated that the damage was established in a southerly direction. The testimony also indicated that the excavator was working primarily in a south to north direction which means that any damage inflicted would have been in a northerly direction. Finally, the damage produced by the excavator during the field simulations did not approximate the damage found on the pipeline following the rupture. Therefore, the Safety Board concludes, based on the available evidence, that the damage to the pipeline did not occur when Calnev made the 8-foot-wide path and removed the trona from over the pipeline before the excavation and inspection of the pipeline.

<u>Excavation and Inspection of the Pipeline</u>.--The only piece of equipment noted to have been close to the pipeline during its excavation and inspection was the Case 580C backhoe used to excavate the pipeline at the locations where railroad debris had penetrated the native soil. At those locations, the pipeline was excavated and inspected from the 6 o'clock position clockwise to the 2 o'clock position looking north, and no damage to the coating or pipeline was observed. Calnev's manager of operations testified that the area of rupture on the pipe most likely was located in an area where Calnev had excavated. The metallurgical examination indicates that the point of rupture was at the 1:30 o'clock position, although photographs of the pipeline suggest that it may have been closer to the 3 o'clock position. The Safety Board believes that during its inspections had Calnev uncovered the area of the pipeline that later ruptured, they would have observed the damage, recognized the danger it posed to continued operations, and removed the damaged portion. Consequently, either Calnev's inspections did not uncover this area sufficiently to expose the damage, or if it did, the damage did not exist at that time. Even if the exact point where the pipeline eventually ruptured was not completely uncovered during the excavation and inspection, the Safety Board believes that if the damage was inflicted during the excavation of the pipeline, coating damage on top of the pipeline, at a minimum, would have been observed when the pipeline was visually inspected.

The Safety Board, therefore, considered the possibility that the damage occurred when the backhoe backfilled the excavation hole after the pipeline was inspected. Testimony indicates that much of the backfilling was accomplished by hand. However, time was a factor and to expedite the backfilling process, the backhoe may have been used to reach in and pull the soil that was above and to the side of the pipeline; during this process, the teeth of the bucket may have contacted and damaged the pipeline. Furthermore, testimony of the equipment operators and Calnev's manager of operations indicate that the 580C backhoe was working from north to south. Consequently, any damage to the pipeline from the teeth of this backhoe would have resulted in the infliction of damage in a southerly direction during both the excavation and the backfilling of the hole. This direction of damage is consistent with the results of the metallurgical examination by the Southwest Research Institute.

However, further testimony by equipment operators and the results of the simulation of the excavating equipment operations suggest that the 580C backhoe could not inflict the type of damage that occurred to the pipeline. The "chatter" type marks inflicted during the simulation were not consistent with the physical damage observed on the pipe. Therefore, the Safety Board concludes that the damage to the pipeline did not occur when the excavation hole near the middle of lot 76 was backfilled with the 580C backhoe after the pipeline had been inspected.

Removal of Trona From the Derailment Area.--The Safety Board considered the possibility that the pipeline may have been damaged when the trona was removed by SP from the derailment area following the excavation and inspection of the pipeline. Calnev personnel testified that the soil cover they observed over the pipeline following the rupture may have been 1 1/2 feet less than what they noted when they left the site following the derailment. Because the trona had already been removed above the pipeline through the area where the rupture eventually occurred, there was no need for equipment to have been digging into the native soil during the process of removing the trona from the derailment area. However, equipment operators who were in the area where the trona was being removed later testified that equipment may have been operating near the pipeline and even over the pipeline during the removal process. The track excavator used to remove the trona from the railroad embankment was observed to have been dragging the trona down the side of the embankment and across the pipeline. Although a piece of metal had been welded to the teeth of this equipment to facilitate a smooth grade, testimony indicates that this piece of metal occassionally broke off, but that the excavator continued to operate. Other testimony indicated that after the trona was dragged down the embankment, it was stockpiled west of the pipeline at which point a front-end loader would move in (with its tires east of the pipeline), scoop up the trona, and then back up to a point where the trona could be loaded into trucks. To remove trona that had been stockpiled east of the pipeline, a front-end loader raised its bucket over the top of the pile, and then lowered the bucket dragging the trona back to a point where it could then be loaded into trucks.

The soil consultant's report indicated that in the excavated areas the soil had been loosely compacted following the backfilling of the hole. It is possible, therefore, that the track backhoe without the piece of metal welded to the teeth of the bucket or a front-end loader could have penetrated the loosely compacted soil to a greater depth than anticipated by the operator and could have contacted the pipeline. The simulation of the excavating equipment operations indicated that a front-end loader could strike the pipeline without the noise being heard in the immediate area or the contact being felt by the operator of the equipment. In view of the foregoing, the Safety Board believes that it is possible that the damage to the pipeline occurred during the removal of the trona following the excavation and inspection of the pipeline.

Adequacy of Calnev's Inspection of the Pipeline Following the Train Derailment

The exact timing of the damage and the precise manner in which the damage was inflicted is not, in the Safety Board's view, the major safety issue; rather that Calnev recognized that damage to its pipeline could occur as a result of the derailment, the wreckage clearing operations, and the trona removal, but failed to perform adequate inspections or tests of the pipeline to determine that it had not been damaged before resuming normal operations. Although Calnev had the greater responsibility to protect its pipeline, SP was aware of the potential for damage during the wreckage removal and cleanup, and it had a responsibility to prevent damage to the pipeline.

Calnev prudently decided to use its employees and its contract personnel to remove the trona over the pipeline and to excavate and inspect the pipeline in areas where train wreckage penetrated the ground. In so doing, Calnev minimized the opportunity for excavation equipment not under its control to damage its pipeline and afforded the company the opportunity to determine if any of the train wreckage had penetrated the ground to a depth that may have compromised the integrity of the pipeline. However, Calnev apparently did not adequately consider the potential for damage that could have been caused earlier by excavation equipment during the wreckage removal or later during the removal of the trona from the accident site. Action to properly and fully assess the condition of the pipeline could have been achieved by following one of three procedures: by excavating and visually inspecting the entire pipeline through the derailment area after all equipment had been removed from the site, by performing a hydrostatic test at a level capable of confirming the integrity of the strength of the pipe, or by using internal inspection instruments capable of detecting pipe wall reductions and pipe diameter abnormalities.

To have performed a hydrostatic strength test, Calnev would have had to remove the petroleum product from the pipeline and to have tested that section of pipeline between Colton and Cajon Pass, or would had to have taken additional action such as separating the pipeline on either side of the derailment area and hydrostatically testing the pipeline section through the derailment area. This would have involved removal of the water from the tested section and then reconnecting the tested section to the pipeline. To have used the internal inspection instrument, Calnev would have had to install at some point downstream of the derailment area a means for receiving and removing the internal inspection instrument, and would have had to place the pipeline in operation at a pressure sufficient to move the internal inspection instrument through the pipeline to the receiving point. Although each of the three inspection or test procedures could have been performed, visual inspection of the pipeline within the derailment area was the most practical procedure given the existing configuration of the pipeline because this method would have only required the pipeline to be kept out of operation until the inspection had been performed; no special arrangements or changes to the pipeline would have been required.

However, had the pipeline configuration permitted the use of an internal inspection instrument without having to increase substantially the pressure then in the pipeline, such an inspection would have readily revealed the damages in the pipe wall and their locations without having to excavate the entire pipeline or without having to take the pipeline out of service. The Safety Board discussed in its 1987 report of gas pipeline ruptures and fires at Beaumont, Kentucky,[37] the capabilities and limitations of internal inspection equipment, the special provisions that must be made in the configuration of pipelines to use this equipment, the fact that many pipelines are not configured to accept and use this equipment, and the fact that the Federal pipeline safety standards do not require pipeline operators to use this equipment. Because the Safety Board believed that many potentially hazardous conditions, such as the damage to the Calnev pipeline, could be identified through the use of internal inspection equipment before an accident occurred, the Board, on March 24, 1987, issued the following safety recommendations to the Research and Special Programs Administration:

P-87-6

> Require existing natural gas transmission and liquid petroleum pipeline operators when repairing or modifying their systems, to install facilities to incorporate the use of in-line [internal] inspection equipment.

P-87-7

> Require that all new gas and liquid transmission pipelines be constructed to facilitate the use of in-line [internal] instrument inspection equipment.

On April 29, 1987, RSPA advised the Safety Board that the topics addressed by the recommendations were related to a proposal included in an advance notice of proposed rulemaking (ANPRM) (Docket PS-93) issued earlier in 1987, and that it was reviewing the subsequent comments to assist in developing a further position on the need for new inspection or testing requirements. On June 8, 1990, RSPA issued a notice (55 FR 23514) advising that, in accordance with section 304 of the Pipeline Safety Reauthorization Act of 1988 (Public Law 100-561), it had begun a study on the feasibility of requiring operators to use internal inspection instruments to test their pipelines at periodic intervals. Intervals would be determined by applying operational factors such as location; size, age, manufacturer, and type of pipe; nature and volume of materials transported; frequency of leaks; present and projected population adjacent to pipelines; and climatic, geologic, and environmental conditions of the areas in which pipelines are located. RSPA advised that the completed study would be submitted to the Congress in 1990; if the results are positive, new rulemaking will be initiated. RSPA further advised that, as required by sections 108(b) and 207(b) of the Reauthorization Act, it will establish requirements for new and replaced gas transmission lines and hazardous liquid pipelines to be designed to accommodate the passage of internal inspection instruments. RSPA also advised that an NPRM has been scheduled but did not provide the scheduled date. Although the Safety Board notes that RSPA has pledged to consider the merits of Safety Recommendations P-87-6 and -7 and to require operators to

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[37] Pipeline Accident Report--"Texas Eastern Gas Pipeline Company Ruptures and Fires at Beaumont, Kentucky, on April 27, 1985, and Lancaster, Kentucky, on February 21, 1986," (NTSB/PAR-87/01).

design new and rebuilt pipelines to accommodate the use of internal inspection instruments, the safety recommendations have been classified as "Open--Unacceptable Action," because of RSPA's apparent reluctance to consider them until required by the Congress to do so and because of the time that elapsed before RSPA initiated action.

On October 31, 1988, the Pipeline Safety Reauthorization Act of 1988 (Public Law 100-561) was enacted. Sections 108 and 207 of that Act requires the Secretary of Transportation to establish by regulation that the design and construction of new and replaced natural gas transmission and liquid pipeline facilities "... be carried out, to the extent practicable, in a manner so as to accommodate the passage through such ... facilities of instrumented internal inspection devices (commonly referred to as 'smart pigs')."

In summary, the Safety Board believes that given the extensive wreckage clearance operations that took place following the train derailment and the many pieces of excavation equipment operating in the area through May 19, Calnev should have taken additional precautionary measures before normal pipeline operations were resumed to determine positively that the integrity of the pipeline had not been compromised. Consequently, the Safety Board believes that Calnev's failure to determine positively that the pipeline had not been compromised after all equipment had been removed from the area was causal to the pipeline rupture.

The Timing of the Pipeline Rupture

The pipeline failed catastrophically 13 days after the train derailment at a location where the pipe had been dented and gouged by earth-moving equipment. Metallurgical examination of the rupture and damage to the pipeline revealed no evidence typical of a fatigue failure, and the fracture features were typical of an overload failure. However, several microfissures were also found in the pipe wall metal in and adjacent to the fracture face. If the yield strength of an undamaged section of this pipe was 52,000 pounds per square inch (psi) (the minimum yield strength specified by the manufacturer), the pipe would be expected to contain without failure internal pressures up to 2,580 psi. However, with the wall thickness reduced to 0.249 inches, it could contain without failure about 1,850 psi. The microfissures likely existed before the pipe was damaged, and at the ratio of operating stress to pipe metal yield strength, these microfissures likely posed no immediate safety problem. However, when the pipeline as damaged was again operated, the microfissures apparently grew in size as the normal operation of the pipeline subjected the metal in the damaged area to cyclic loading at a substantially larger operating stress-to-yield-strength ratio. It appears that the rupture occurred when the size of one or more of the microfissures became critical for the pressure in the pipeline at the time of the rupture.

Calnev Pipeline Monitoring System

The investigation revealed that on the morning of the pipeline rupture, the pipeline dispatcher on duty received both a low suction and a low discharge pressure alarm on his terminal screen. However, the dispatcher apparently did not observe the low discharge pressure alarm. Furthermore, by one stroke on his terminal keyboard, he silenced the audible alarm and deactivated the flashing alarm. However, the dispatcher's failure to notice the low discharge pressure alarm and his attempts to restart the pumps had no substantial effect on the amount of product discharged because the computer monitoring system promptly recognized the low discharge pressure and shut down the pumps. After the pipeline rupture, Calnev installed a high flow set point whereby if excessive flow is experienced on the pipeline, the system will automatically shut down. Calnev also revised the emergency response manual to advise the dispatchers of the actions to take when receiving both a low discharge and a low suction pressure alarm. While the Safety Board notes the actions taken by Calnev following the rupture, the Board believes that Calnev should enhance the computerized operating system by requiring the dispatcher to acknowledge individually each alarm received or by adding a second dissimilar sounding alarm denoting multiple alarm conditions.

Shutdown of Failed Pipeline

<u>Check Valves</u>.--Because more than 9,400 barrels of gasoline were required to refill the pipeline, with 1 mile of pipeline holding 917.69 barrels of product, it was evident that the check valve at MP 6.9 failed to close when the pipeline ruptured and the check valve at MP 14.9 did not close completely. The 4.3- to 8.0-mile spacing of the four check valves along this segment of pipeline would probably have lessened the severity of this accident had the valves worked properly. The check valves installed in the pipeline should have closed when the gasoline at higher elevations began to flow to the rupture site and less than 100 barrels (about 4,000 gallons) of gasoline should have been released. However, the investigation revealed that the check valves had not been inspected and closed to determine if they functioned properly in the 19 years since they were installed, nor were they required by Federal safety regulations to have been installed, tested, or inspected.

Following the train derailment, Calnev's plan of action to lower the pressure in the pipeline was prudent and appropriate to ensure that an immediately dangerous condition did not materialize. However, the problems that Calnev experienced in attempting to lower the pressure in the pipeline should have raised some concern about the proper functioning of the check valves in the pipeline between Colton and Cajon Pass. Had Calnev considered that its inability to lower the pressure in the pipeline may have resulted from other than an inadequate rate of product withdrawal, the company then may have recognized that malfunctioning check valves could produce the conditions it was experiencing. Such recognition would not have altered Calnev's capability to further lower the pressure in the pipeline during the wreckage clearing operations; however, it would have alerted Calnev to determine the status of its check valves before again restarting pumping operations.

The All-Clear check valve does not incorporate in its design a means to determine the position of the valve clapper as do many conventional check valves. Calnev, however, could have excavated one of these valves that was equipped with bypass connections, installed pressure gauges to monitor the pressure on each side of the valve, and then withdrawn product from the upstream connection and monitored the pressures to assess the functioning of the clapper. Alternatively, Calnev could have excavated the check valve at MP 6.9, installed a product withdrawal tap upstream of the check valve and pressure monitoring taps on each side of the check valve, and then withdrawn product from the pipeline and monitored the pressure on each side of the check valve to assess the functioning of the clapper.

As a result of the apparent failure of two or more of the side-hinged check valves, Calnev and RSPA entered into an agreement calling for Calnev to inspect these check valves and to subject at least two to examination to determine why they did not function properly. Since the accident, Calnev has inspected three check valves--at pipeline MP 6.9, MP 19.2, and MP 25.7. All check valves thus far inspected were found stuck in the open position. Calnev has removed the check valves at MP 19.2 and 25.7 and planned to remove the check valve at the Colton Terminal. These valves were subjected to OPS-approved operational tests. Calnev has installed top-hinged check valves equipped with a clapper position indicator to replace the check valves removed and plans to install similar check valves adjacent to all of the side-hinged check valves remaining in the pipeline. The Safety Board notes Calnev's efforts following the pipeline rupture; the Safety Board concludes, however, that the company's failure to ever inspect and test the check valves to determine they functioned properly, particularly following the train derailment, contributed to the severity of the damage that resulted from the pipeline rupture.

The top-hinged valves incorporate the clapper as an integral part of the hinge, which places the hinging mechanism further out of the product stream. The placement makes the hinge less susceptible to fouling by product impurities and uses the full weight of the clapper to achieve positive closure (figure 22). The Board understands the desire to take advantage of the advertised benefits of the side-hinged valves: less pressure drop through the valve and improved ability to pass cleaning instruments. However, the Safety Board was unable to locate any documentation regarding reliability tests on which pipeline designers based their selection of the side-hinged check valves in 1969. Because of its concern that other malfunctioning check valves may be installed in other pipeline systems, the Safety Board issued Safety Recommendation P-89-5 to RSPA. In response to the recommendation, RSPA issued an alert bulletin to operators of all liquid pipeline operators advising them to test for proper closure all check valves in critical locations and to replace any valves that fail to close properly.

<u>Remotely Operated Valves</u>.--The first mainline block valve from the Colton Pump station was located at MP 25.7. It took 55 minutes for a Calnev employee to drive from the Colton station and manually close the block valve. Since the pipeline rupture, Calnev has installed a remotely operable block valve at MP 6.9. In the event of an emergency situation, this valve can be remotely closed by the pipeline dispatcher at the Colton Pump Station within a minute after being notified of an emergency. However, the installation of the remotely operated valve at MP 6.9 does not reduce the hazard posed to the residential communities that now exist or that will be constructed adjacent

Pipeline Accident Rep...
Rupture and Fire, Mounds View, Minnesota, July 8, 1986," (NTSB/PAR-87/02).

this accident to ensure that it functioned properly, the consequences of the May 25 rupture would have been substantially less destructive.

The Federal pipeline safety regulations, 49 CFR Parts 192 and 195, do not define "valve," "mainline valve," or "block valve." The regulations do include specific requirements on the location, accessibility, and maintenance of valves, and they specifically require an operator to maintain in good working order at all times each valve that is necessary for the safe operation of its pipeline. The Safety Board notes from the OPS representative's testimony at the Board's public hearing on this accident that the circumstances of the Calnev accident have prompted the OPS to review its policy on the treatment of check valves. In response to Safety Recommendation P-89-6, RSPA has initiated a study, to be completed in August 1990, to determine the feasibility of establishing inspection, maintenance, and test requirements to demonstrate and maintain the proper functioning of check valves installed in pipeline systems. The Safety Board believes that the RSPA study should also address the lack of definitions for the various terms used for valves in the pipeline safety regulations.

The circumstances of this accident attest to the need for improvements in the Federal regulations for prompt detection and shutdown of failed liquid pipelines--a safety improvement long sought by the Safety Board. Both the liquid and the natural gas pipeline Federal regulations were based on industry codes ASA B31.8 for 49 CFR Part 192 (the natural gas pipeline regulations) and ASA B31.4 for 49 CFR Part 195 (the liquid pipeline regulations). The Safety Board has previously noted that the industry code for gas pipelines took into account population densities for construction, valve spacing, testing, and many other safety requirements whereas the industry code for liquid pipelines did not. To construct a pipeline in San Bernardino adjacent to Calnev's pipeline, the design for a natural gas pipeline would have to comply with several population-based safety factors such as the allowable operating stress level, mainline valve spacing, and the hydrostatic testing level; no population-based safety factors would apply to the design of a liquid pipeline constructed in the same location. Additionally, a natural gas pipeline installed in the area of the Calnev pipeline would be subject to several population-based operating and maintenance requirements including the requirement to reduce the operating stress in the pipe by lowering the internal pressure should the population density increase to specified levels; a liquid pipeline would not be subject to the requirements. Recognizing the above related differences between the two sets of pipeline safety regulations, the Safety Board, as a result of its investigation of a petroleum gas pipeline rupture in West Odessa, Texas, on March 15, 1983,[39] recommended that RSPA:

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39 Pipeline Accident Report--"Mid America Pipeline System Liquefied Petroleum Gas Pipeline Rupture, West Odessa, Texas, March 15, 1983" (NTSB/PAR-84/1).

P-84-26

Amend Federal regulations governing pipelines that transport highly volatile liquids to require a level of safety for the public comparable to that now required for natural gas pipelines.

RSPA responded on April 7, 1986, that the maximum allowable operating pressure for gas pipelines was based on the maximum hoop stress levels in the line as a function of population densities adjacent to the lines. The letter further stated that "In contrast, stress level does not appear to be a significant factor in HVL [high volatile liquid] pipeline accidents. In fact, we are not aware of any HVL pipeline accident that has involved a long-running fracture...."

In a letter to RSPA on August 20, 1986, the Safety Board stated:

> ...the Research and Special Programs Administration (RSPA) may have missed the thrust of this recommendation. The Safety Board is recommending that the safety standards for liquid pipelines be equivalent to natural gas pipeline standards....Based on our knowledge of the history of the ANSI B31.8 Code, the industry rationale for development of the population based class location criteria was not solely in response to its concern about fracture propagation; it was also in response to industry's over all concern about the increasing populations residing adjacent to its pipelines which initially were located in noninhabited areas....Furthermore, the Board did not make its assessment solely on the basis that the gas standards contained requirements tied to class locations rather its assessment was that the overall standards were not as stringent in many respects as those for gas pipelines.

The Safety Board classified Safety Recommendation P-84-26 as "Open--Unacceptable Action." Subsequently, on February 11, 1987, RSPA issued an ANPRM (Docket PS-93) addressing amendments to the safety standards for gas and hazardous liquid pipelines. The Safety Board provided comments to the docket on this ANPRM and reclassified the recommendation as "Open--Acceptable Action." At the time RSPA informed the Safety Board of the ANPRM, it also informed the Board that it was planning a research study in fiscal year 1988 to determine if there is a difference in the levels of safety provided for liquid pipelines and for gas pipelines. RSPA has advised the Safety Board that the report on this study has been drafted; however, completion and issuance of the report has been delayed because OPS has an insufficient number of staff members to accomplish this work and the work mandated by Congress in RSPA's Reauthorization Act. As a result of its investigation of the liquid pipeline rupture and fire in Mounds View, Minnesota, on July 8, 1986, the Safety Board reiterated Safety Recommendation P-84-26 to RSPA and reconfirmed its position that there is a difference in the level of safety and that RSPA should take action to eliminate this difference. The Safety Board's investigation of the train derailment and pipeline rupture at San Bernardino, California, heightens the Board's concern that the difference in the level of safety provided for liquid pipelines and for gas pipelines has not been eliminated. In its June 8, 1990, notice on Docket PS-93, RSPA addresses some issues related to Safety Recommendation P-84-26. On the issue of improved populated-based leak detection and isolation requirements through remotely controlled valves and remotely monitored gauges and meters, RSPA stated "that pipeline-simulation technology for more rapid leak detection and shutdown is not sufficiently developed for general use. Operators now are required to monitor their pipelines for leaks and other indications of abnormal operations and to take appropriate corrective actions if necessary." RSPA also stated that it is continuing to study the capabilities of advanced supervisory control and data acquisition systems and the benefits of using remotely controlled or automatic valves to isolate line sections where leaks are located. RSPA plans to initiate further rulemaking with respect to these subjects if its studies demonstrate that net benefits can be achieved in particular situations.

On the issue of establishing population-based class location criteria for liquid pipelines and establishing more stringent safety standards as the population-at-risk increases, RSPA states that Part 195 now contains many safety standards that vary in stringency according to population characteristics, although a class location scheme is not employed. RSPA stated that a study is near completion on the need to amend these regulations to establish more stringent safety standards for hazardous liquid pipelines in populated areas, and the results of this study will determine if further rulemaking on this subject is required. Because RSPA contends that Part 195 contains population-based safety standards, Safety Board staff again reviewed these regulations. A few requirements, primarily related to construction and testing when a pipe is initially constructed, contain general statements such as "avoid as far as practicable" populated areas or establish distances that newly constructed pipelines must be offset from existing buildings. The review of Part 195 found no safety requirement that required additional action of a liquid pipeline operator as a result of increased population adjacent to a pipeline. For a pipeline initially constructed through uninhabited land, no change in the pipeline or in its manner of operation and maintenance would be required under Part 195, even when a metropolitan area had been constructed adjacent to the pipeline. The Safety Board urges RSPA to objectively assess the increased operating, maintenance, and emergency response requirements essential to provide reasonable public safety when a greater number of people are exposed to risks of unintended releases of hazardous liquids from pipelines. Safety Recommendation P-84-26 has been reclassified as "Open-Unacceptable Action" because RSPA has taken no action to implement the recommendation and because RSPA's comments on subjects related to this recommendation are more directed at supporting existing regulations rather than objectively assessing the need to improve the existing regulations.

Enhancing Public Safety Near Railroads and Pipelines

Although the City of San Bernardino had developed a general plan for land use, which was the framework for decisions by the City on the use of its land for the protection of residents from natural and man-caused hazards, the use of land in proximity to mainline railroads or high pressure pipelines was not addressed in the general plan or in subsequent revisions to the plan. The Safety Board believes that city and county officials should take into account the location of railroads and high pressure pipelines when developing a general plan for land use. Furthermore, the Safety Board believes that the National Association of Counties and the National League of Cities are the appropriate organizations to inform their members of the circumstances of the train derailment and subsequent pipeline rupture and to urge their members to account for the location of mainline railroads and high pressure pipelines during the development of plans, or during revisions to existing plans, that address policies and objectives for land use.

The Safety Board has previously expressed concern about the development of residential lots near pipelines. As a result of its investigation of the liquefied petroleum gas pipeline rupture in West Odessa, Texas, the Safety Board issued Safety Recommendation P-84-27 asking that the National Association of County Administrators and the National Council of County Association Executives "...urge [their members] to develop measures to preclude the development of residential lots over pipelines transporting hazardous liquids or gases or of lots on which construction will necessarily encroach on easements for the pipelines." The Safety Board has not received a substantive response to the recommendation despite efforts to solicit a response. Consequently, Safety Recommendation P-84-27 has been classified "Closed--Unacceptable Action."

As a result of its investigation of the accident in West Odessa, Texas, the Safety Board also issued Safety Recommendation P-84-28 to the American Land Development Association asking that they:

> Advise its members of the circumstances of the accident near West Odessa, Texas, on March 15, 1983, and urge them to cooperate with local government land planning and zoning agencies in the development and implementation of restrictions against the development of residential lots over pipelines transporting hazardous liquids or ~~gases or of~~ lots on which construction will necessarily encroach on easements for the pipelines.

The Safety Board also issued Safety Recommendation P-84-30 to the National Academy of Sciences asking that it:

> Assess the adequacy of existing public policy for surface and subsurface use of land adjacent to pipelines that transport hazardous commodities to provide reasonable public safety. Based on the findings of the assessment, develop a recommended policy to correct identified deficiencies in current policy.

Despite followup efforts by the Safety Board to ascertain what actions were taken, neither the American Land Development Association nor the Urban Land Institute responded to Safety Recommendation P-84-28 (the recommendation was classified as "Closed--Unacceptable Action" in May 1989). In response to P-84-30, however, the Transportation Research Board of the National Research Council completed a report "Pipelines and Public Safety" (Special Report 219) that examines ways in which pipeline accidents caused by land development too near pipelines could be averted by more effective land-use policies. The report also provides a synthesis of policies and practices for enhancing public safety near pipelines through damage prevention programs and emergency preparedness programs, as well as land-use measures. The recommended actions in this report are specifically directed to public safety and land-use issues for pipelines, but the Safety Board believes, in principle, the discussion on land use would also apply to railroads. Moreover, many of the considerations on land-use limitations for property adjacent to pipelines but not yet developed, also should be applied to land adjacent to railroads that has not yet been developed. Consequently, the Safety Board believes that the report could prove useful to local officials and it encourages the National Association of Counties and the National League of Cities to inform their respective members of the guidance available in the report and to encourage them to develop and implement policies on the use of lands adjacent to railroads and pipelines that are designed to protect public safety.

Survival Aspects

As a result of the train derailment, two crewmembers received fatal injuries: the conductor, riding in the lead unit with the head-end engineer; and the head-end brakeman, located in the third lead locomotive unit. Both of these locomotive units came to rest on their left sides (with respect to their direction of travel). There is no evidence that either locomotive unit rolled over during the derailment. Examination of the wreckage indicated that the left side of both units received substantial damage, which most likely compromised the occupiable space for these two crewmembers. Postmorten examinations indicated that both crewmembers died of multiple traumatic injuries. The head-end engineer, according to witnesses, climbed out of the top of the wreckage (right side of locomotive). The right side of the locomotive had substantially less damage than the left side. As a result, the right side of the operating compartment was not substantially compromised and, consequently, the head-end engineer survived the derailment.

Two residents received fatal burn injuries as a result of the pipeline rupture and subsequent fire. One resident was located in a burned out home at 2327 Duffy Street; the other resident was found in the backyard of a residence at 2315 Duffy Street. Because of the explosion and extensive fire immediately following the rupture, the accident was not survivable for either resident.

Emergency Response

The initial response to both the train derailment and the pipeline rupture was timely; mutual aid agreements were appropriately implemented and the necessary resources were available to an incident command system that was well organized. Evacuation of residents following both accidents was well coordinated and was conducted in a timely manner. Residential utility lines were appropriately shut down following both accidents. A staging area for incoming equipment was set up which was effective in the management of firefighting efforts following the pipeline rupture. The medical triage group coordinated transportation and treatment of injured with ambulance agencies and the Red Cross following both accidents.

When the incident commander arrived at the scene of the train derailment, he appropriately requested that a hazardous materials unit respond to the scene because of the unknown product being carried by the train, the leaking diesel fuel from the overturned locomotive units, and the possibility of pipeline involvement. Considerable effort was given to locating missing persons during the search and rescue operation before any attempt was made to remove the train wreckage.

The investigation revealed that personnel from the California State Fire Marshal's Office, as representatives for the Office of Pipeline Safety, did not make the incident commander sufficiently aware of their role in responding to the train derailment. The incident commander testified that he made several requests of Calnev following the train derailment but failed to exercise his authority as incident commander, which empowered him to shut down all operations until acceptable safety precautions had been taken, to follow up on his requests to ensure that the integrity of the pipeline had been maintained. Had the incident commander contacted the State Fire Marshal's Office and expressed his concerns, some of the requests he made to Calnev may have been more adequately addressed. Testimony from representatives of the State Fire Marshal's Office suggests that they had routinely dealt directly with pipeline companies and may have been remiss in not dealing more directly with the incident commander. During the response to the pipeline rupture, the presence and role of the State Fire Marshal's Office was made known to the incident commander. Nevertheless, the Safety Board believes that the role of the incident commander should be clearly defined to outline the individual's authority as the person in charge of the incident. The incident commander should not, as the deputy fire chief did following the train derailment, relinquish control of the incident until all concerns regarding the public's safety have been thoroughly satisfied.

The agreement between the City of San Bernardino and the SP that was brought to the Safety Board's attention at the public hearing raises concerns regarding adequate communication among the interested parties responding to the accident. Although one provision of the agreement signed by the City of San Bernardino and the SP indicated that the pipeline throughout the derailment area would be completely exposed and inspected, neither the incident commander, who testified that on scene he had expressed the desire to have the pipeline exposed and inspected, nor Calnev, who ultimately decided that complete exposure of the pipeline was not necessary, were informed of the provision at the time the agreement was signed. Further, the agreement was signed after the incident commander terminated his command of the emergency response to the train derailment and after Calnev resumed pipeline operations. According to testimony, neither Calnev nor the San Bernardino fire department were made aware of the provision until weeks after the pipeline rupture. Although it appears that the agreement was signed primarily for the SP to compensate the City of San Bernardino, the Safety Board is concerned that this information was not shared promptly with all pertinent parties.

Medical and Toxicological Factors

<u>Southern Pacific's Physical Examination Policy</u>.--Although the medical condition of the train crewmembers was not considered a factor in the train derailment, the Safety Board's investigation raised some concern regarding the current SP physical examination policy. Both the head-end and helper engineers had received physical examinations about 3 years before the accident. Since their respective physical examinations 17 years, 18 years, and 29 years before the accident, the conductor, the head-end brakeman, and the helper brakeman had not been required by the company to undergo any further physical examinations. Also, there is no record that the assistant chief dispatcher had ever received a company physical examination. The Safety Board is concerned that without the requirement that employees receive comprehensive periodic physical examinations, medical conditions may arise, go undetected, and conceivably affect an employee's ability to perform duties. The Safety Board has previously addressed this issue. In its investigation of the head-end collision of two Consolidated Rail Corporation freight trains near Thompsontown, Pennsylvania, on January 14, 1988, the Safety Board stated:

> The motivation for requiring periodic company physical examinations has always been the fact that the safe operation of railroads demands a proper level of employee fitness. Unless employees are seriously ill or injured, they cannot be expected to seek regular physical examinations. More than ever, railroad employees should be subject to more stringent physical standards and regular, more comprehensive physical examinations by practitioners who understand what the employees do and under what circumstances they have to do it.

The Safety Board believes, therefore, that the SP should require its operating crews and employees in safety-sensitive positions to receive periodic comprehensive physical examinations.

In accordance with FRA requirements, toxicological samples were obtained from all five crewmembers of Extra 7551 East: blood and urine specimens from the surviving crewmembers and blood, urine, and tissue specimens from the deceased crewmembers. Also, in accordance with SP requirements, a second urine specimen was collected from each of the surviving crewmembers. Because all specimens were negative for alcohol and other drugs and because the available testimony indicates that none of the crewmembers was impaired, the Safety Board concludes that alcohol and drugs were not a factor in the operation of Extra 7551 East on May 12, 1989.

The train dispatcher on duty at the time of the derailment, the assistant chief dispatcher who arranged the movement of Extra 7551 East, and the clerks who estimated the weights of the hopper cars and who prepared the shipper's bill of lading were not requested to submit to toxicological testing nor were they required to be tested. The Safety Board's concern about the potential involvement of alcohol and other drugs in all railroad operations has been well documented. The Safety Board believes that employees in safety-sensitive positions that can affect the movement of trains--including supervisors and managers, train dispatchers, maintenance-of-way employees, clerks who handle hazardous materials shipments or who are responsible for recording vital information concerning the makeup of trains--should be required to submit to toxicological testing. Recommendations have been addressed to the FRA that it include in its alcohol and drug abuse regulations all persons in safety-sensitive positions, as a result of a Safety Board study on alcohol/drug use and its impact on railroad safety.[40] Although the Safety Board concludes that alcohol and drugs were not a factor in the train derailment on May 12, 1989, the Safety Board believes that the SP should revise its rules to require postaccident toxicological testing of all employees in safety-sensitive positions.

CONCLUSIONS

Findings

1. When Extra 7551 East began its descent from Hiland, only three of the six locomotive units had functioning dynamic brakes; whether this total of three involved the full dynamics of SP 7549 or SP 9340, or a combination of the two could not be determined.

2. The head-end engineer's belief that he had four locomotive units with functioning dynamic brakes was reasonable in view of the information provided to him by the helper engineer.

3. Each of the 69 hopper cars of Extra 7551 East contained about 100 tons of trona.

4. The accepted practice of estimating weights at the time cars were released, coupled with the belief that these weights would be changed at a later time, created a potentially hazardous situation in which yard clerks were merely satisfying a requirement of the Southern Pacific computer system.

5. The Southern Pacific shipping clerk did not indicate on the shipper's bill of lading that the weights he had listed were estimated weights; the failure to do so affected the method by which the billing clerk chose to enter the bill of lading information into the computer system and ultimately the trailing tonnage information given to the operating crew of Extra 7551 East.

6. The tonnage profile generated by the Southern Pacific computer system and given to the operating crew of Extra 7551 East contained the incorrect trailing tonnage of 6,150 tons based on the weights estimated by the yard clerks at the time the cars were released, rather than the correct trailing tonnage of about 9,000 tons.

[40] For more information, read Safety Study--"Alcohol/Drug Use and Its Impact on Railroad Safety" (NTSB/SS-88/04).

7. Had the billing clerk elected to enter the individual weight of each car into the car file of the computer system, the tonnage profile given to the operating crew of Extra 7551 East would still have listed an incorrect trailing tonnage.

8. The tonnage profile given to the crew of Extra 7551 East contained inaccurate information regarding the tons per operative brake because of the incorrect trailing tonnage and because the Southern Pacific cars equipped with empty-load devices had a normal braking capability of 1, rather than the 1 1/2 as outlined in the special instructions.

9. The head-end engineer's acceptance of the information contained on the tonnage profile as being accurate when he received the document was reasonable.

10. Based on actual tonnage, available dynamic brakes, and Southern Pacific operating rules, Extra 7551 East should not have been permitted to operate down the 2.2 percent grade.

11. The head-end engineer would have been able to stop the train at the point he exceeded the 13-lb brake pipe reduction.

12. Southern Pacific operating rule 61.E provided inadequate guidance to the head-end engineer on the allowable speed and brake pipe reduction down the 2.2-percent grade.

13. The head-end engineer had sufficient time to recover his dynamic brakes, although he had not been trained to do so; however, recovering the dynamic brakes would have had little, if any, effect on the speed of the train as it entered the 4-degree curve, and the accident would still have occurred.

14. The head-end engineer would have had no reason to consider using retainers before he began descending the grade.

15. The helper engineer did not convey accurate information to the head-end engineer regarding the status of dynamic brakes on the helper units.

16. Crewmembers were not trained and instructed to work as a team and communicate to arrive at the most suitable solution to the emergency at hand.

17. The head-end engineer may have been able to bring the train safely down the hill had he crested the hill at 15 mph, which he would have been required to do if the dispatcher had informed him of the correct trailing tonnage.

18. The head-end engineer may have decided not to operate Extra 7551 East down the grade had he received accurate information about the trailing tonnage and the number of locomotive units with inoperative dynamic brakes.

19. The Federal Railroad Administration's position that both the equipping and use of dynamic brakes are optional is not consistent with the level of emphasis placed on the use of dynamic brakes in railroad operating rules, timetable instructions, and training.

20. Inaccurate information concerning the trailing tonnage of a train can still be generated by the Southern Pacific computer system and given to the crew, even with the revisions made by Southern Pacific following the train derailment.

21. The rationale to have the interlock nullify the dynamic brakes when the train brakes are placed into emergency is no longer consistent with the current training and operation of trains.

22. Updating the computer system with information regarding defective locomotive conditions did not receive priority attention in the dispatchers' office, and the responsibility for doing so was not clearly delegated by Southern Pacific management.

23. The Southern Pacific engineer training program did not adequately prepare engineers for handling a train in the event of an emergency situation.

24. The Southern Pacific management oversight of train operations, particularly on mountain grades, was inadequate.

25. The damage to the pipeline did not occur before the train derailment on May 12, 1989.

26. Calnev's pipeline met the industry-recommended safety requirements in effect when it was constructed; no State or Federal regulations were in effect at that time.

27. The 4 to 6 feet of earth cover over Calnev's pipeline protected it from damage when the Southern Pacific train derailed over the pipeline.

28. Calnev and Southern Pacific's surveillance of excavating equipment operations was insufficient to prevent damage to Calnev's pipeline.

29. Calnev's pipeline was mechanically dented and gouged at several locations by earth-moving equipment.

30. The Calnev pipeline was most likely damaged during the train wreckage removal operations or during the removal of the trona from the derailment site.

31. Calnev returned the pipeline to service without adequately inspecting or testing the pipeline for damage and without recognizing that its earlier inability to lower the pressure below 800 psig could have been the result of malfunctioning check valves.

32. Calnev's pipeline experienced an overstress on May 25, 1989, when a preexisting microfissure grew in size as the normal operation of the pipeline subjected the metal in the damaged area to cyclic loading at a substantially larger operating stress-to-yield-strength ratio.

33. The previously untested All-Clear check valves at MP 6.9, 14.9, 19.2, and 25.7 failed to properly close and allowed thousands of barrels of gasoline at higher locations to be released from the failed pipeline.

34. The Calnev dispatcher's attempts to restart the pipeline had no effect on the consequences of the pipeline accident because the computer control and monitoring system promptly detected the abnormal pressures in the pipeline and shut down the pumps.

35. Federal pipeline safety requirements for liquid pipelines do not properly protect public safety because they do not contain adequate requirements for the rapid detection and shutdown of failed pipelines and there are no provisions for safety enhancements when the population at risk increases.

36. The City of San Bernardino's plan for land use did not address the hazards posed by the proximity of mainline railroads and of high pressure pipelines.

37. The head-end engineer probably survived the accident because the side of the operating compartment in which he was riding was not substantially compromised.

38. The initial notification and emergency response to both the train derailment and the pipeline rupture was timely and effective.

39. After the train derailment, the deputy fire chief, although assured by Calnev that the pipeline was safe to resume normal operations, did not fully exercise his authority as incident commander to have his concerns regarding the integrity of the pipeline addressed.

40. The California State Fire Marshal's office, as an agent for the Office of Pipeline Safety, did not adequately explain its role and responsibility to the incident commander during the emergency response to the train derailment.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the train derailment on May 12, 1989, was the failure to determine and communicate the accurate trailing weight of the train, failure to communicate the status of the train's dynamic brakes, and the Southern Pacific operating rule that provided inadequate direction to the head-end engineer on the allowable speed and brake pipe reduction down the 2.2-percent grade.

The National Transportation Safety Board determined that the probable cause of the pipeline rupture on May 25, 1989, was the inadequate testing and inspection of the pipeline following the derailment that failed to detect damage to the pipe by earth-moving equipment. Contributing to the cause of the pipeline rupture was the severity of the train derailment that resulted in extensive wreckage and commodity removal operations. Contributing to the severity of the damage resulting from substantial product release was Calnev's failure to inspect and test check valves to determine that they functioned properly, particularly after the train derailment.

RECOMMENDATIONS

As a result of its investigation, the National Transportation Safety Board made the following safety recommendations:

--to the Southern Pacific Transportation Company:

> Develop explicit procedures that require the dispatcher and the operating crew to communicate vital information concerning the condition of the train that may impact on the crew's decisionmaking and train handling including, but not limited to, the number of locomotive units with functioning dynamic brakes and the trailing tonnage of the train. (Class II, Priority Action) (R-90-12)
>
> Improve the method of developing accurate trailing tonnage information to be provided to traincrews. (Class II, Priority Action) (R-90-13)
>
> Eliminate the dynamic brake/emergency interlock on all locomotive units. (Class II, Priority Action) (R-90-14)
>
> Develop a procedure that will ensure that information concerning defective locomotive conditions is entered into the computer system in a timely manner and that the responsibility for doing so is clearly delegated. (Class II, Priority Action) (R-90-15)
>
> Review the training program for engineers and incorporate emergency situations into the simulator portion of the program that will require engineers to respond appropriately to various operating parameters, including the recovery of dynamic braking. (Class II, Priority Action) (R-90-16)
>
> Review the supervisory oversight of train operations and provide specific guidance regarding the number and types of efficiency tests, check rides, and the review of event recorder tapes. (Class II, Priority Action) (R-90-17)

Require postaccident toxicological testing of all employees in safety-sensitive positions, including dispatchers and clerks who are responsible for preparing accurate train documents. (Class II, Priority Action) (R-90-18)

Revise the procedures for qualifying engineers to require that supervisors ride with an engineer in both directions on mountain grade territory before qualifying the engineer over the entire territory and that the ride be performed on a train that is comparable in size and trailing tonnage to those typically most difficult to operate on that territory. (Class II, Priority Action) (R-90-19)

Require operating crews and employees in safety-sensitive positions to receive periodic comprehensive physical examinations. (Class II, Priority Action) (R-90-20)

Require the appropriate employees to obtain the actual weight of cars and product from shippers and to indicate on the bill of lading if the weights listed are shipper-certified or estimated weights. (Class II, Priority Action) (R-90-21)

--to the Federal Railroad Administration:

Promulgate regulations regarding the qualification of engineers to require that supervisors ride with an engineer in both directions on mountain grade territory before qualifying the engineer over the entire territory and that the ride be performed on a train that is comparable in size and trailing tonnage to those typically most difficult to operate on that territory. (Class II, Priority Action) (R-90-22)

Study, in conjunction with the Association of American Railroads, the feasibility of developing a positive method to indicate to the operating engineer in the cab of the controlling locomotive unit the condition of the dynamic brakes on all units in the train. (Class III, Longer Term Action) (R-90-23)

Revise regulations to require that if a locomotive unit is equipped with dynamic brakes that the dynamic brakes function. (Class II, Priority Action) (R-90-24)

Require, in conjunction with the Research and Special Programs Administration, railroad operators to coordinate with operators of pipelines located on or adjacent to their railroad rights-of-way the development of plans for handling transportation emergencies that may impact both the rail and pipeline systems and then to discuss the plan with affected State and local emergency response agencies. (Class II, Priority Action) (R-90-25)

--to the Association of American Railroads:

Study, in conjunction with the Federal Railroad Administration, the feasibility of developing a positive method to indicate to the operating engineer in the cab of the controlling locomotive unit the condition of the dynamic brakes on all units in the train. (Class III, Longer Term Action) (R-90-26)

Inform your members of the circumstances of the train derailment at San Bernardino, California, on May 12, 1989, and notify them of the braking capability of cars equipped with empty/load devices, advising that timetable instructions and operating rules should be revised accordingly. (Class II, Priority Action) (R-90-27)

--to Calnev Pipe Line Company:

Enchance the computerized operating system by requiring the dispatcher on duty to acknowledge individually each alarm received or by adding a second dissimilar sounding alarm denoting multiple alarm conditions. (Class II, Priority Action) (P-90-22)

Provide a means for testing all mainline check valves to determine that they function properly and test these valves annually. (Class II, Priority Action) (P-90-23)

--to the City of San Bernardino:

Revise the existing plan for land use to account for the location of railroads and high pressure pipelines. (Class II, Priority Action) (I-90-18)

Define clearly the authority of the incident commander as the person-in-charge of an emergency response and emphasize the need to not relinquish control of an incident until all concerns regarding the public safety have been thoroughly satisfied. (Class II, Priority Action) (I-90-19)

--to the Research and Special Programs Administration:

Address, in the ongoing study to determine the feasibility of establishing inspection, maintenance, and test requirements for check valves, the lack of definitions for the various terms used for valves in the pipeline safety regulations. (Class II, Priority Action) (P-90-24)

Require, in conjunction with the Federal Railroad Administration, operators of pipelines located on or adjacent to railroad rights-of-way to coordinate with the railroad operators the development of plans for handling transportation emergencies that may impact both the rail and pipeline systems and then to discuss the plan with affected State and local emergency response agencies. (Class II, Priority Action) (P-90-25)

--to the National Association of Counties and the National League of Cities:

Inform your members of the land-use guidance for enhancing public safety contained in the National Research Council's Special Report 219, "Pipeline and Public Safety," and encourage them to develop and implement policies to protect public safety for lands adjacent to pipelines and railroads. (Class II, Priority Action) (I-90-20)

As a result of its investigation, the Safety Board also reiterated the following safety recommendations:

--to the Research and Special Programs Administration:

P-84-26

Amend Federal regulations governing pipelines that transport highly volatile liquids to require a level of safety for the public comparable to that now required for natural gas pipelines.

P-87-6

Require existing natural gas transmission and liquid petroleum pipeline operators when repairing or modifying their systems, to install facilities to incorporate the use of in-line [internal] inspection equipment.

P-87-7

Require that all new gas and liquid transmission pipelines be constructed to facilitate the use of in-line [internal] instrument inspection equipment.

P-87-22

Require the installation of remote-operated valves on pipelines that transport hazardous liquids, and base the spacing of remote-operated valves on the population at risk.

--to the Federal Railroad Administration:

R-89-50

Expedite the rulemaking requiring the use of event recorders in the railroad industry.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Chairman

/s/ Susan M. Coughlin
Vice Chairman

/s/ John K. Lauber
Member

/s/ Jim Burnett
Member

Adopted: June 19, 1990

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

Investigation

The National Transportation Safety Board was notified on May 12, 1989, of a derailment of a Southern Pacific Transportation Company freight train near San Bernardino, California. The investigator-in-charge and other members of the investigative team were dispatched from the Washington, D.C. office and the Fort Worth, Texas, and Atlanta, Georgia, field offices. Investigative groups were established for engineering, mechanical, operations, human performance, and survival factors.

On May 25, 1989, the Safety Board was notified of a pipeline rupture at the site of the earlier train derailment. The investigator-in-charge and members of the investigative team were again dispatched to the scene of the accident. Investigative groups were established for mechanical, pipeline operations, human performance, and survival factors.

Hearing

A 5-day public hearing was convened in San Bernardino, California, beginning on August 28, 1989. Designated parties at the hearing were the Southern Pacific Transportation Company, the Calnev Pipe Line Company, the Federal Railroad Administration, the Research and Special Programs Administration, the State of California (the Public Utilities Commission for the train derailment and the State Fire Marshal's Office for the pipeline rupture), the City of San Bernardino, the Brotherhood of Locomotive Engineers, and the United Transportation Union. Thirty four witnesses testified during the 5-day hearing.

APPENDIX B

PERSONNEL INFORMATION

Southern Pacific Transportation Company Personnel

Engineer, Extra 7551 East.--Engineer Frank W. Holland, age 33, received his last SP medical examination on December 11, 1986. The medical record disclosed no adverse medical condition and reported that his hearing and corrected vision were within normal limits.

Conductor, Extra 7551 East.--Conductor Everett Crown, age 35, underwent a company physical examination on April 18, 1972. The record of that examination disclosed no medical problems and reported vision and hearing to be within normal limits. No other documentation could be located by SP officials concerning his medical condition. Postaccident statements by Conductor Crown's wife indicated that his sensory acuity at the time of the accident was normal.

Brakeman, Extra 4771 East.--Brakeman Allan Reiss, age 43, received his last company physical examination, according to SP medical records, in November 1971. The record revealed no medical problems and reported his hearing and uncorrected vision to be normal. According to Brakeman Reiss' wife, her husband had recently received a routine physical examination from their family physician, who reported no medical problems.

Helper Engineer, Extra 7551 East.--Engineer Lawrence Hill, age 42, underwent a company physical examination on December 19, 1986. The record indicated no restrictive medical conditions and reported his hearing and corrected vision to be within normal limits.

Helper Brakeman, Extra 7551 East.--Brakeman Robert Waterbury, age 57, received his last company physical examination in April 1960. The SP records at that time indicated no adverse medical conditions and reported his hearing and corrected vision to be within normal limits. Brakeman Waterbury indicated that since his last company physical examination, he had been seeing a local physician for a high blood pressure condition. The physician last examined Brakeman Waterbury in March 1989, and refilled a prescription for an antihypertensive drug. At the time of the examination, the physician reported no complications and noted Brakeman Waterbury's blood pressure to be within the normal range.

Calnev Personnel

Pipeline Dispatcher.--Dispatcher Arturo Aguilar, age 34, received his last company physical examination on September 2, 1988. The record disclosed no adverse medical condition and reported his hearing and uncorrected vision to be normal.

APPENDIX C

BILL OF LADING
(provided by shipper)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM

Shipper No. ______

Carrier No. ______

Memorandum Copy

SOUTHERN PACIFIC TRANSPORTATION CORP. ICC-SP-C-6855 Date 05/06/89

(Name of Carrier)

TO:	FROM:
Consignee KAISER INTERNATIONAL CORP.	Shipper LAKE MINERALS CORPORATION
Street BERTH 49/50 WHITE LOADING FACILITY	Street P.O. Box 37
Destination PORT OF LOS ANGELES Zip Code	Origin Lone Pine, CA Zip Code 93545
Route: SP	Vehicle No.

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (Subject to Correction)	RATE	CHARGES
37	CARS TRONA (BULK) CAR No's			
	DRGW 16734 - DRGW 16090 - DRGW 11167			
	SP 451001 - SP 481077 - SP 451061			
	SP 481076 - SP 481138 - SP 451126			
	SP 451100 - DRGW 12275 - DRGW 16378			
	SP 481021 - SP 481143 - SP 451061			
	SP 451026 - SP 451053 - SP 481145			
	SP 451137 - SP 481077 - SP 481055			
	DRGW 11750 - SP 481119 - SP 481028			
	DRGW 11635 - DRGW 16811 - DRGW 16568			
	DRGW 11623 - DRGW 11684 - DRGW 16235			
	(PAGE 1 of 3)			

REMIT C.O.D. TO ADDRESS | COD Amt: $ | C.O.D. FEE: PREPAID ☐ COLLECT ☐ $ | TOTAL CHARGES: $

FREIGHT CHARGES

Check Appropriate Box:

☐ Freight prepaid ☐ Collect

SHIPPER Lake Minerals Corp. | CARRIER

PER W.M. Chan 5/6/89 | PER | DATE 5/6/89

3

APPENDIX C

BILL OF LADING
(provided by shipper)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM

Shipper No.

Carrier No.

SOUTHERN PACIFIC TRANSPORTATION CORP. ICC-SP-C-6855

Date 05/01/89

TO: KAISER INTERNATIONAL CORPORATION

Street Berth 49/50 Bulk Loading Facility

Destination Port of Los Angeles Zip Code

FROM: Shipper LAKE MINERALS CORPORATION

Street P.O. Box 37

Origin Lone Pine, CA Zip Code 93545

Route: SP

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight	RATE	CHARGES
	DRGW 16838 - SP 481147 - DRGW 12342			
	DRGW 16016 - DRGW 19694 - DRGW 12066			
	SP 481076 - SP 481127 - SP 481093			
	SP 481078 - DRGW 19141 - DRGW 16277			
	SP 481086 - DRGW 19815 - DRGW 19902			
	DRGW 19044 - DRGW 19165 - SP 481071			
	SP 481144 - SP 481120 - SP 481036			
	SP 481069 - DRGW 19104 - SP 481052			
	SP 481090 - DRGW 16286 - DRGW 19874			
	DRGW 16552 - DRGW 16341 - DRGW 19701			
	~~[illegible]~~ SP 481115 - SP 481027			
	(Page 2 of 3)			

REMIT C.O.D. TO ADDRESS

COD Amt: $

C.O.D. FEE PREPAID ☐ COLLECT ☐ $

TOTAL CHARGES $

FREIGHT CHARGES

Check Appropriate Box:

☐ Freight prepaid ☐ Collect

SHIPPER Lake Minerals Corp.

PER [signature] 5/6/89

CARRIER S.P.

PER [signature] DATE 5/6/89

3

APPENDIX C

BILL OF LADING
(provided by shipper)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM

Shipper No.
Carrier No.
Date 05/06/89

Memorandum Copy
SOUTHERN PACIFIC TRANSPORTATION CORP. ICC-SP-C-6855
(Name of Carrier)

TO: Consignee KAISER INTERNATIONAL CORP.
Street Berth 49/50 Bulk Loading Facility
Destination Port of Los Angeles Zip Code
Route SP

FROM: Shipper LAKE MINERALS CORPORATION
Street P.O. Box 37
Origin Long Pine, CA Zip Code 93545
Vehicle No.

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (Subject to Correction)	RATE	CHARGES
	SP 481043 – SP 481624 – SP 481074			
	SP 481623 – SP 481141 – DRGW 14843			
	DRGW 16607			
	(page 3 of 3)			

REMIT C.O.D. TO ADDRESS
COD Amt $
C.O.D. FEE: PREPAID ☐ $ COLLECT ☐
TOTAL CHARGES $

FREIGHT CHARGES
Check Appropriate Box:
☐ Freight prepaid ☐ Collect

(Signature of Consignor)

SHIPPER Lake Minerals Corp.
PER 5/6/89

CARRIER
PER
DATE 5/6/89

3

APPENDIX C

BILL OF LADING
(filled out by yard clerk)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM APPENDIX Item (15) Shipper No.

Carrier No.

Shipping Order Copy

SOUTHERN PACIFIC TRANSPORTATION CORP. ICC-SP-C-6353 Date [illegible]

(Name of Carrier)

TO.	FROM:
Consignee KAISER INTERNATIONAL CORP.	Shipper [illegible]
Street BERTH 49/53 BULK LOADING FACILITY	Street P.O. BOX 1
Destination PORT OF LOS ANGELES Zip Code	Origin [illegible] Zip Code

Route SP | Vehicle No.

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (Subject to Correction)	RATE	CHARGES
87	[illegible] (BULK) CAR No.s			
[illegible]	[illegible]	120000 lbs		
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			
	[illegible]			

REMIT C.O.D. TO ADDRESS | COD Amt: $ | C.O.D. FEE PREPAID ☐ COLLECT ☐ $ | TOTAL CHARGES $

FREIGHT CHARGES

Check Appropriate Box:

☐ Freight prepaid ☐ Collect

(Signature of Consignor)

SHIPPER [illegible] Corp | CARRIER [illegible]

PER [illegible] 5/6/[illegible] | PER [illegible] DATE

2

APPENDIX C

BILL OF LADING
(filled out by yard clerk)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM

Shipper No. ______

Carrier No. ______

Date [illegible]

Shipping Order Copy

SOUTHERN PACIFIC TRANSPORTATION CORP. ICC-SP-C-635[illegible]

(Name of Carrier)

TO:		FROM:	
Consignee	KAISER INTERNATIONAL CORPORATION	Shipper	LAKE MINERALS CORPORATION
Street	[illegible] Bulk Loading Facility	Street	P.O. Box [illegible]
Destination	Port of Los Angeles Zip Code	Origin	[illegible] Zip Code [illegible]
Route	SP		Vehicle No.

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (Subject to Correction)	RATE	CHARGES
[illegible]	[illegible]	120000 LBS		

C.O.D. TO ADDRESS	COD Amt $	C.O.D. FEE PREPAID COLLECT $
TOTAL CHARGES $		

FREIGHT CHARGES

Check Appropriate Box

☐ Freight prepaid ☐ Collect

Signature of Consignor

[illegible]

SHIPPER [illegible] PER [illegible]

CARRIER [illegible] PER [illegible] DATE [illegible]

2

APPENDIX C

BILL OF LADING
(filled out by yard clerk)

ALTERNATE STRAIGHT BILL OF LADING—SHORT FORM

Shipping Order Copy

Shipper No.

Carrier No.

Date 05/06/89

(Name of Carrier)

TO Consignee		FROM: Shipper	CORPORATION
Street		Street	
Destination	Zip Code	Origin	Zip Code
Route		Vehicle No.	

No. Shipping Units	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (Subject to Correction)	RATE	CHARGES
[illegible]	[illegible]	12,000 LBS		

REMIT C.O.D. TO: ADDRESS	COD Amt: $	C.O.D. FEE PREPAID COLLECT $	TOTAL CHARGES $

(Signature of Consignor)

FREIGHT CHARGES

Check Appropriate Box

☐ Freight prepaid ☐ Collect

SHIPPER

PER

CARRIER

PER

DATE 5/6/89

APPENDIX D

TONNAGE PROFILE OF EXTRA 7551 EAST

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1000 C 6 1225 05/12/89 U586      KZ N606 SF  NF25000
 INPUT DEVICE  NF25000    SEQUENCE NUMBER  441

 CAR TONNAGE PROFILE FOR 1MJLBP1 11                    MJV-LGB-LD

**.   JM 'GA' INPUT DETAILS AT WCOLTON  CA      1224   5/12/89 ****

S: 069/000/06151/03474

S    (TONS PER OPERATIVE BRAKE    69.9)
                                 NNNNNNNNN NNNNNNN
      N NNNNNNNNN NNNNN NNNN NNNNNNNNNN NNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN   NNNNNNNNN NNNNNNNNNN
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      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
      NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
   TT NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN
N       455  912  1367 1821  2315 2834  3354 3805  4208 4613  5019 5424
H       240  505   750 1007  1250 1506  1763 2014  2262 2519  2776 3027
H EE
  TT
PH READS FROM FIRST DETAIL ENTERED TO LAST

   NNNN NNN
  NNNNNNNNN
    NNNNNN
     NNNNN
  N...NNNNNN
  NNNNNNNNN
  NNNNNNNNN
  NNNNNNNNN
  NNNNNNNNN
N  5826
H  3275

ARDOUS COMMODITIES: NONE
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APPENDIX D

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PIPLAAA 0 2 0836 05/18/89 UPEP      AN NSAT SP  NAPAEA E
TRAIN INQUIRY RESPONSE
INQUIRY 11                         MJV-LBE-LD      406      2652
DEPT MOJAVE       12 0330
CONDUCTOR CROWN          ES 120710 1920  ENGINEER HOLLAND        FU 120720 1920
  TOUT 22000
   .     75510605050080500     550AR110615         N  F
  SF     75490805280052800     5052FDN0608         N  F
  SF     93400807290072900     529  CC0614         N  B
  SF     82780808060080600     707T20N0621         N  B
 SETOUT 22000
 SFEP 90184 EZTD     22000 A7        SFEZTD  X
 SPHP  9188 EZTD     22000 A7        SPHZTD  X
      0 LDS     0 MTYS       0 TONS        0 FT  BLK SUMMARY
 SETOUT 22000
 SF  481018 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481051 LH03090 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481099 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481061 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW 19167 LH03092 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW 16050 LH03092 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW 16784 LH03092 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW 16007 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW 19843 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481141 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481028 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481074 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481074 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481045 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
     481027 LH03091 21980 XSDCOMP 21980   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 SF  481115 LH03090 21960 XSDCOMP 21960   B                    KAISERINTERN 450
      BERTH 49/50 BULK LOADING FACILITY
        FF
 DRGW [illegible] LH03091 21980 XSDCOMP 21980   B              KAISERINTERN 450
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5

APPENDIX D

FF								
DLCU	[illegible]	LH08091	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	16552	LH08091	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
[illegible]U	19874	LH08091	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	16286	LH08091	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481090	LH08091	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19141	LH08105	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481078	LH08103	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481052	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19104	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481060	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481006	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481120	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481144	LH08103	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481071	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19168	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19046	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19902	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19815	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481066	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
[illegible]GU	16277	LH08104	21980	XSDCOMP	21980	B	KAISERINTERN	450
	BERTH 49/50 BULK LOADING FACILITY							
FF								
DRGU	19655	LH08081	21980	XSDCOMP	21980	B	KAISERINTERN	450 6
	BERTH 49/50 BULK LOADING FACILITY							
FF								
SF	481070	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	

APPENDIX D

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      FF
SF    481119 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 19730 LHO8080 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
      481083 LHO8080 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481077 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481098 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481127 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481076 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 12006 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 19694 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 16010 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 12842 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481147 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 16588 LHO8082 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 16265 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 19084 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 19625 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 16866 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
DRGU 16811 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481148 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      F
      481107 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481026 LHO8081 21980 XSDCOMP 21980   B          KAISERINTERN 450
       BERTH 49/50 BULK LOADING FACILITY
      FF
SF    481088 LHO8080 21980 XSDCOMP 21980   B          KAISERINTERN 450
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APPENDIX D

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     FF
SP  481145 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
SP  481137 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
    481021 LHOSO81 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
DRGU 16378 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
DRGU 12278 LHOSO80 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
SP  481100 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
SP  481125 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
SP  481138 LHOSOS1 21980 XSDCOMP 21980     B                KAISERINTERN 450
     BERTH 49/50 BULK LOADING FACILITY
       FF
     69 LDS     0 MTYS    6151 TONS    3474 FT   BLK SUMMARY
     69 LDS     0 MTYS    6151 TONS    3474 FT   TRAIN TOTAL
        UNITS  13800 OK HORSEPOWER    HPT    2.24  00274 FT
 3748 FT-TOTAL TRAIN LENGTH
        FOREIGN PER DIEM VALUE                     SYSTEM PER DIEM VALUE
   LOADS   $  303      MTYS  $    0      LOADS  $  418     MTYS  $
                   TOTAL PER DIEM VALUE   $     721
```

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MX99844 0-6 0817 05/13/89 U000      KZ NY48 SP  NX99844
      INPUT DEVICE  NX99844     SEQUENCE NUMBER  740

      CAR TONNAGE PROFILE FOR 1MJLBP1 11                       MJV-LGB-LD

CARS: 069/000/06151/03474 TRAIN: L1H 03748 UNITS 04 OKHP 13800 HPT   2.2
DPT MOJAVE    CA 0830 12   CONSIST LAST REPORTED BY MOJAVE    CA

TONS    (TONS PER OPERATIVE BRAKE   69.9)
                                        NNNNNNNNN NNNNNNN
110                                    NNNNNNNNNNN NNNNNNN
100      N NNNNNNNNN NNNNNN NNNN NNNNNNNNNNN NNNNNNNNNNN    NNNNNNNNN NNNNNNNNNN
 90       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 80       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 70       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 60       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 49       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 40       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 30       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 25       NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
 22   T1  NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN
             455  912   1367 1821   2315 2834   3354 3805   4208 4613   5017 5424
             246  505    750 1007   1258 1506   1763 2014   2262 2519   2776 302

 S.  EE
      T1
 GRAPH READS FROM THE REAR FORWARD
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APPENDIX D

2-4 - OUTBOUND CONSIST DISPLAY FOR IHOLID1 11 NPT 0350 12

CAR NUMBER	L E	CAR KND	GRO WGT	CAR DESTN	HIY CDE	SYS BLK	SHADE/ CNTNTS	SPECIAL HANDLING	SVC RLQ	PLT "C"	NO CD	Y H	TAG/ SPIKS
SETOUT 22090													
SPTP 90194	E	ZTD	000	17900	A		7	SPEZTD		X			
SPMP 9193	E	ZTD	060	17900	A		7	SPMZTD		X			
SETOUT 22000													
SP 481013	L	HO3	092	21980	X	450	SDCOMP	21980		B			250
SP 481051	L	HO3	090	21980	X	450	SDCOMP	21980		B			250
SP 481099	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481001	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
DRGW 19167	L	HO3	092	21980	X	450	SDCOMP	21980		B			250
DRGW 16090	L	HO3	092	21980	X	450	SDCOMP	21980		B			250
DRGW 16734	L	HO3	092	21980	X	450	SDCOMP	21980		B			250
DRGW 16007	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
DRGW 19843	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481141	L	HO3	091	21980	X	450	SDCOMP	21960		B			250
SP 481023	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481074	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481024	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481045	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481027	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
SP 481115	L	HO3	090	21980	X	450	SDCOMP	21900		B			250
DRGW 19701	L	HO3	091	21900	X	450	SDCOMP	21980		B			250
DRGW 16941	L	HO3	091	21980	X	450	SDCOMP	21900		B			250
DRGW 16552	L	HO3	091	21980	X	450	SDCOMP	21900		B			250
DRGW 19874	L	HO3	091	21900	X	450	SDCOMP	21980		B			250
DRGW 16282	L	HO3	091	21980	X	450	SDCOMP	21900		B			250
SP 481090	L	HO3	091	21980	X	450	SDCOMP	21980		B			250
DRGW 19141	L	HO3	105	21980	X	450	SDCOMP	21980		B			250
SP 481070	L	HO3	103	21980	X	450	SDCOMP	21900		B			250
SP 481052	L	HO3	104	21980	X	450	SDCOMP	21900		B			250
DRGW 19194	L	HO3	104	21980	X	450	SDCOMP	21900		B			250
SP 481060	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
SP 481004	L	HO3	104	21900	X	450	SDCOMP	21900		B			250
SP 481120	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
SP 481144	L	HO3	103	21900	X	450	SDCOMP	21980		B			250
SP 481071	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 19168	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 19046	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 19902	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 19815	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
SP 481006	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 16277	L	HO3	104	21980	X	450	SDCOMP	21980		B			250
DRGW 19655	L	HO3	081	21980	X	450	SDCOMP	21900		B			250
SP 481028	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
SP 481119	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
DRGW 19730	L	HO3	080	21980	X	450	SDCOMP	21980		B			250
SP 481083	L	HO3	080	21900	X	450	SDCOMP	21980		B			250
SP 481077	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
SP 481093	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
SP 481127	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
SP 481076	L	HO3	081	21900	X	450	SDCOMP	21980		B			250
DRGW 12006	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
DRGW 19694	L	HO3	081	21900	X	450	SDCOMP	21980		B			250
DRGW 16010	L	HO3	081	21980	X	450	SDCOMP	21980		B			250
DRGW 12342	L	HO3	081	21900	X	450	SDCOMP	21980		B			250

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SP   481147 L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 16530  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 16265  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 19004  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 19623  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 14368  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 16811  L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481143 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481007 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481026 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481033 L H03 080 21980  X  450 SDCOMP  21980    B    250
SP   481145 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481137 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481021 L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 16378  L H03 081 21980  X  450 SDCOMP  21980    B    250
DRGW 12273  L H03 080 21980  X  450 SDCOMP  21980    B    250
SP   481100 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481125 L H03 081 21980  X  450 SDCOMP  21980    B    250
SP   481138 L H03 081 21980  X  450 SDCOMP  21980
SETOUT TOTAL            069 LDS  000 MTYS  06151 TONS  03474 FEET
TRAIN TOTAL             069 LDS  000 MTYS  06151 TONS  03474 FEET
TONS PER OPERATIVE BRAKE - 0070
END
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APPENDIX E

OPS HAZARDOUS FACILITY ORDER AND SUBSEQUENT AMENDED ORDERS

DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
WASHINGTON, D.C.

IN THE MATTER OF CALNEV PIPELINE COMPANY RESPONDENT	)	CPF NO. 5087 - H

FINAL ORDER

Following a rupture on May 25, 1989, the Office of Pipeline
Safety (OPS), through its Western Region, initiated an
investigation of Respondent's 14-inch interstate hazardous liquid
(petroleum product) pipeline in San Bernardino, California on the
site, and in the vicinity, of a derailment on May 12, 1989 of a
Southern Pacific train. As the result of the rupture and the
release of gasoline, an ensuing fire caused at least three
fatalities and 31 injuries as well as extensive property damage.

Based on the preliminary findings made below, I find that if
placed into service under the same circumstances as existed after
the rupture, that portion of Respondent's pipeline subject to the
required corrective actions prescribed in Section 3 below, would
be hazardous to life and property. Accordingly, pursuant to the
authority of section 209(b) of the Hazardous Liquid Pipeline
Safety Act of 1979, as amended (49 App. U.S.C. 2008(b) (HLPSA), I
hereby order Respondent to take the actions prescribed in Section
3 of this Order before the subject portion of ~~Respondent's~~ 14-
inch pipeline may be returned to operation.

Respondent desires not to delay progress toward resuming safe
operations and has orally waived prior written notice and an
opportunity for hearing. Respondent has received oral notice of
the terms of this Order. Therefore, this Order is issued without
prior written notice and hearing.

1. <u>Preliminary Findings.</u>

    a. After the May 12, 1989 train derailment, the line had not been completely exposed and visually examined for damage.

    b. The portion of the pipeline potentially affected by the derailment was reported to be at least 500 feet. Respondent did not ascertain the structural integrity of the entire section of affected pipeline after the May 12, 1989 derailment. In addition to structural damage, coating damage may have occurred as a result of the derailment and clean-up efforts.

c. It was reported that various wreckage debris (rail, train parts, etc) was found near the pipeline when exposed after the failure. This debris may have a detrimental affect on the integrity of the pipeline.

d. The line is used for the transportation of petroleum products under pressure. A failure in the line can result in injury to persons and property. The failure on May 25, 1989 indicates this circumstance.

e. The line runs adjacent to a residential area.

2. Pipeline Covered by This Order.

The portion of Respondent's 14-inch petroleum pipeline to which the requirements of this Order apply is hereby described as follows:

> All of that pipe between a point 100 yards south of the check valve on the down stream side of the derailment impact area, (Calnev designation, station 363 + 40) and a point 200 yards upstream of the road casing at Highland Avenue. (Calnev designation station 352 + 92).

3. Required Corrective Actions.

The corrective actions required herein are designed to assure that operation of the subject pipeline, if resumed, is safe. Pursuant to section 209(b) of the HLPSA, I hereby order CalNev Pipeline Company to take the following actions with respect to operation of the pipeline:

a. Excavate and expose the full circumference of pipe between a point 50 feet north of the casing beneath Highland Avenue and the south end of the levee adjacent to the check valve.

b. Conduct a thorough visual inspection of the entire circumference of the pipe exposed under paragraph a. of this Section to locate any damage to the coating or the pipe itself and repair or replace coating or pipe as appropriate.

APPENDIX E

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c. Hydrostatically (water under pressure) test the pipe to 1.25 times its maximum operating pressure. The test must be conducted in accordance with the applicable requirements of 49 CFR Part 195.

The Chief of the OPS Western Region will review and approve Respondent's hydrostatic testing and inspection program. OPS will monitor the test. The pipeline shall not be returned to service until all actions required herein are determined by the Chief of the OPS Western Region to have been successfully completed.

Failure to comply with the terms of this Order may result in the assessment of civil penalties or referral to the Attorney General for relief in the appropriate United States District Court. This Order is effective upon issuance.

Richard L. Beam
Director, Office of Pipeline Safety

DATE ISSUED: MAY 26 1989

APPENDIX E

DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
WASHINGTON, D.C.

IN THE MATTER OF CALNEV PIPE LINE COMPANY RESPONDENT	CPF NO. 5087A - H

AMENDED FINAL ORDER

Following a rupture on May 25, 1989, the Office of Pipeline Safety (OPS), through its Western Region, initiated an investigation of Respondent's 14-inch interstate hazardous liquid (petroleum product) pipeline in San Bernardino, California, on the site, and in the vicinity, of a derailment on May 12, 1989, of a Southern Pacific train. As the result of the rupture and the release of gasoline, an ensuing fire caused fatalities and injuries as well as extensive property damage.

In response to the accident, and to ensure that the pipeline could be safely operated in the future, on May 26, 1989, I ordered (CPF No. 5087-H) Respondent to take certain actions (Section 3) before putting the pipeline back in service. Based on information obtained by OPS since issuance of the Order as part of its ongoing investigation of the rupture, I am hereby amending the Order as set forth below.

Based on the preliminary findings made below, I find that if placed into service under the same circumstances as existed after the rupture, that portion of Respondent's pipeline subject to the required corrective actions prescribed in Section 2 below, would be hazardous to life and property. Accordingly, pursuant to the authority of section 209(b) of the Hazardous Liquid Pipeline Safety Act of 1979, as amended (49 App. U.S.C. 2008(b) (HLPSA), I hereby order Respondent to take the actions prescribed in Section 2 of this Amended Final Order before the subject portion of Respondent's 14-inch pipeline may be returned to operation.

Respondent desires not to delay progress toward resuming safe operations and has orally waived prior written notice and an opportunity for hearing. Respondent has received oral notice of the terms of this Amended Final Order. Therefore, this Amended Final Order is issued without prior written notice and hearing.

1. Preliminary Findings.

   a. After the May 12, 1989, train derailment, the line had not been completely exposed and visually examined for damage.

APPENDIX E

b. The portion of the pipeline potentially affected by the derailment was reported to be at least 500 feet. Respondent did not ascertain the structural integrity of the entire section of affected pipeline after the May 12, 1989, derailment. In addition to structural damage, coating damage may have occurred as a result of the derailment and clean-up efforts.

c. It was reported that various wreckage debris (rail, train parts, etc.) was found near the pipeline when exposed after the failure. This debris may have a detrimental affect on the integrity of the pipeline.

d. The line is used for the transportation of petroleum products under pressure. A failure in the line can result in injury to persons and property. The failure on May 25, 1989, indicates this circumstance.

e. The line runs adjacent to a residential area.

2. Required Corrective Actions.

The corrective actions required herein are designed to assure that operation of the subject pipeline, if resumed, is safe. The actions prescribed herein supercede the actions prescribed in Section 3 of the Order issued to Respondent on May 26, 1989.

Pursuant to section 209(b) of the HLPSA, I hereby order CalNev Pipe Line Company to take the following actions with respect to operation of the pipeline:

a. Excavate and expose the full circumference of pipe between a point 10 feet north (downstream) of the casing beneath Highland Avenue and the south (upstream) rise of the Muscoy Levee.

b. Conduct a visual inspection of the entire circumference of the pipe exposed under paragraph a. of this Section to determine any damage to the pipe or pipe coating.

c. Replace all pipe between the points identified in paragraph a. of this Section with new pipe.

d. Install a block valve between the check valve and the Muscoy Levee.

e. Hydrostatically (water under pressure) test the pipe between a point 50 feet south of the Highland Avenue casing and the block valve required under paragraph d. of this Section to 1.25 times its maximum operating pressure.

f. Each action required by this Amended Final Order must be performed in accordance with all applicable requirements of 49 CFR Part 195.

The Chief of the OPS Western Region will review and approve Respondent's hydrostatic testing and inspection program. OPS will monitor the test. The pipeline shall not be returned to service until all actions required herein are determined by the Chief of the OPS Western Region to have been successfully completed.

Failure to comply with the terms of this Amended Final Order may result in the assessment of civil penalties or referral to the Attorney General for relief in the appropriate United States District Court. This Amended Final Order is effective upon issuance.

Richard L. Beam
Richard L. Beam
Director, Office of Pipeline Safety

DATE ISSUED: MAY 30 1989

APPENDIX E

DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
WASHINGTON, DC

IN THE MATTER OF CALNEV PIPE LINE COMPANY, RESPONDENT.	CPF No. 5087-H

FURTHER AMENDMENT TO
AMENDED FINAL ORDER

Pursuant to section 209(b) of the Hazardous Liquid Pipeline Safety Act of 1979 (HLPSA), 49 U.S.C. app. § 2008(b), I issued a hazardous facility order to Respondent on May 26, 1989. That order required Respondent to take certain corrective action with respect to its 14-inch hazardous liquid pipeline in San Bernardino, California. On May 30, 1989, I amended that order (Amended Final Order).

During the course of the corrective action required by the Amended Final Order, namely during the physical exposure of the line required by paragraph a. of that order, it was discovered that the line has a bend at the casing. This condition renders it technically impractical, if not impossible, to tie-in new pipe at that location (10 feet north of the casing) as required by paragraph b. By letter of June 6, 1989, Respondent has requested relief from this requirement. Review of the exposed pipe by a representative of the Office of Pipeline Safety indicates no apparent damage to the pipe at that location. Furthermore, the line will by hydrostatically tested prior to return to service, assuring safety.

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Accordingly, I hereby further amend the Amended Final Order by replacing paragraph c. with the following new paragraph c.:

> c. Replace all pipe between the points identified in paragraph a. of this Section with new pipe except that replacement need not be done between the exposed point 10 feet north of the casing and the point approximately 35 to 40 feet north of the casing at which a tie-in becomes technically practical. The selection of that point shall be concurred in orally by a representative of the Office of Pipeline Safety.

In all other respects, the Amended Final Order remains the same.

Richard L. Beam, Director
Office of Pipeline Safety

Date Issued: JUN 6 1985

APPENDIX E

06/09/89 11:52 ☎303 986 2779 OPS ━━ Headquarters ☎002

U.S. Department of Transportation

Research and Special Programs Administration

Western Region, Pipeline Safety

[illegible] Zang Street
Lakewood CO [illegible]

June 9, 1989

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. David Andries
Manager of Operations
Calnev Pipe Line Company
412 W. Hospitality Lane
P.O. Box 6346
San Bernardino, CA 92412

CPF No. 5087-H

Dear Mr. Andries:

I have reviewed the Calnev hydrostatic testing and inspection program and the results of the program and other actions required by the terms of the Order (as amended) in this case.

I find that the terms and conditions of the Order have been successfully completed.

Sincerely,

Jack C. Overly

Jack C. Overly
Chief, Western Region
Office of Pipeline Safety

Copy to: Richard Beam, Director, OPS
Jim Wait, Chief, Pipeline Safety, CSFM
Arnold Moodie, CSFM
James Penmann, City Attorney, San Bernardino, CA

APPENDIX F

ASSESSMENT OF DAMAGES TO RESIDENCES AND PROPERTY

Table I.--City assessment of damages to residences from train derailment.

Residence	Damages
2314 Duffy	90 percent destroyed: entire roof, rear exterior and two side exterior walls, and all but one small interior wall at front entrance destroyed
2326 Duffy	100 percent destroyed
2336 Duffy	99 percent destroyed: only a portion of front exterior wall left standing
2348 Duffy	99 percent destroyed: only a portion of front exterior wall left standing
2360 Duffy	rear 40 percent of walls and ceiling destroyed
2372 Duffy	97 percent destroyed: portion of front exterior wall and one small interior wall left standing
2382 Duffy	20 percent destroyed: entire garage and corner of dining room and kitchen destroyed; electrical service destroyed; all rear windows broken
2394 Duffy	all rear windows broken and electrical service damage
2404 Duffy	all rear windows broken

APPENDIX F

Table II.--Residences and damages incurred from pipeline rupture.

Residence	Damages
2373 West Adams	heat and smoke damage
2395 West Adams	house and 3 vehicles destroyed by fire
2348 San Carlo	house and 1 vehicle destroyed by fire
2360 San Carlo	house and 1 vehicle destroyed by fire
2372 San Carlo	smoke damage
2382 San Carlo	garage damaged by fire, back of house received heat and smoke damage
2383 Duffy	minor heat damage
2351 Duffy	house and 2 vehicles destroyed by fire
2349 Duffy	house and 1 vehicle destroyed by fire
2337 Duffy	house and 2 vehicles destroyed by fire
2327 Duffy	house destroyed by fire (location of one fatality)
2315 Duffy	house and 1 vehicle destroyed by fire (location of one fatality)
2302 Duffy	house and 3 vehicles destroyed by fire
2395 Donald	heat and smoke damage
2379 Donald	minor smoke damage
2382 Donald	house and 6 vehicles destroyed by fire
2358 Donald	house and 1 vehicle destroyed by fire
2344 Donald	minor smoke damage

APPENDIX G

FRA LETTER REGARDING FUNCTIONING DYNAMIC BRAKES

US Department of Transportation
Federal Railroad Administration

400 Seventh St. S.W.
Washington, D.C. 20590

18 OCT 1989

Mr. Lee Dickinson
Member of the Board
National Transportation Safety Board
800 Independence Avenue, S.W., Room 840
Washington, D.C. 20594

Dear Mr. Dickinson:

This refers to your request relative to the Federal Railroad Administration's enforcement policy concerning defective or inoperative dynamic brakes for locomotives.

The Railroad Power Brake and Drawbars Regulations does not require the presence of a dynamic brake. However, dynamic brakes are referred to in the Locomotive Safety Standards, which states in part "If a dynamic brake or regenerative brake system is in use, that portion of the system in use shall respond to control from the cab of the controlling locomotive."

This part makes clear that both the equipping and the use of dynamic brake is optional. The FRA will not take exception, ~~if a~~ dynamic brake is found inoperative or operates at less than maximum designed capacity.

Sincerely,

J. W. Walsh
Associate Administrator
for Safety

APPENDIX H

SOUTHERN PACIFIC TIMETABLE INSTRUCTIONS

(MAXIMUM TONS PER OPERATIVE BRAKE)

LOS ANGELES DIVISION
MOJAVE SUBDIVISION

RULE 33. Grades exceeding 1.8% — Tehachapi to MP 332.6, Cameron MP 371.5 to Mojave, Cruel to Mojave, Searles to MP 412.0, Palmdale to Sylmar and Hiland to bottom of both legs of wye at West Colton.

This restriction will not apply to locals, road-switchers and yard engines operating between MP 486.9 and bottom of both legs of wye at West Colton.

Maximum tons per operative brake .... 80 tons

Exceptions:

Unit oil train, BKDOL, with not more than 400 tons per axle of dynamic brake, and not exceeding 25 MPH .... 140 tons.

Trains with not more than 400 tons per axle of dynamic brake, and not exceeding 20 MPH .... 125 tons.

Trains with not more than 300 tons per axle of dynamic brake, and not exceeding 25 MPH .... 125 tons.

Trains with not more than 300 tons per axle of dynamic brake, and not exceeding 20 MPH .... 140 tons.

Trains with not more than 225 tons per axle of dynamic brake, and not exceeding 30 MPH .... 140 tons.

Trains with not more than 400 tons per axle of dynamic brake, and not exceeding 25 MPH, Searles to MP 412.0.. 140 tons.

Trains with not more than 550 tons per axle of dynamic brake, and not exceeding 10 MPH, Oak Creek Branch and Searles to MP 412.0.. 150 tons.

Insufficient dynamic brake capacity or failure of dynamic brake which results in exceeding these tonnages per axle, is to be considered as operating without dynamic brake.

Should dynamic brake failure occur on one or more locomotives resulting in insufficient dynamic brake capacity, train must stop and all retaining valves turned up. Train may then proceed not exceeding 15 MPH if, in the judgment of the conductor and engineer, it is safe to do so.

RULE 39. Applies at Vincent and Summit Switch and to eastward trains at Hiland.

RULE 58. Section L. On both legs of wye at West Colton dynamic brake must not exceed:

No. of Axles	Load Meter Amps
20 - 24	500
Less than 20	Maximum

RULE 65. Maximum Horsepower Per Ton Ratios:

All Westward Trains 5.0
Eastward Trains (Bakersfield to Summit Switch) 6.0
Eastward Trains (Summit Switch to Los Angeles) 5.0*
Eastward Trains (Summit Switch to West Colton) 4.0*
All Other Eastward Trains 5.0

* Reduce to these HP/Ton ratios at first opportunity after reaching Summit Switch.

LOS ANGELES DIVISION
BAKERSFIELD SUBDIVISION

WESTWARD		STATIONS	EASTWARD	
Station Number	Siding Feet	Fresno Line		Mile Post
17300		BAKERSFIELD BCPOTY	DT ABS	[illegible]
17083		OIL JCT P		[illegible]
17080	8350	SACO P		[illegible]
17065	8330	CAWELO P		[illegible]
17055	8350	FAMOSO P		[illegible]
16486	8350	DELFAR P		[illegible]
16482		DELANO P	C	[illegible]
16474	8350	EARLIMART P	T	[illegible]
16464	8350	TIPTON P	C	[illegible]
16440	8200	TULARE P		[illegible]
...		ATSF CROSSING WP		[illegible]
16430	11170	GOSHEN JCT TP		[illegible]
...		GOSHEN X-OVER P		[illegible]
16428	8300	TRAVER P		[illegible]
16420	8350	SUN-MAID P		[illegible]
16412	8350	GOBLE P		[illegible]
16207		CALWA TOWER (ATSF CROSSING) MPY	DT ABS	[illegible]
....		FRESNO TPY		[illegible]
16000		FRESNO YARD BCPOTY	ABS	[illegible]
		(111 1)		

Oil City Branch

17395		MALTHA Y		[illegible]
17083		OIL JCT PTY		[illegible]

MAXIMUM AUTHORIZED SPEED FOR TRAINS

BETWEEN	PSGR	FRT
KERN JCT. and FRESNO YARD	70	70

Exceptions:	PSGR	FRT	Exceptions:		
313.6 and 312.8	10	10	216.3* and 214.5*	45	45
312.8 and 310.8	40	40	WESTWARD		
250.7* and 249.2*	35	35	209.1 and 202.0	50	50
221.3* and 220.0*			202.0 and 201.9	35	35
11 PM and 6 AM	60	60	EASTWARD		
221.3* and 220.0*			209.1 and 202.0	50	50
6 AM and 11 PM	45	45	202.0 and 201.9	25	25

OIL CITY BRANCH

OIL CITY and MALTHA 20

*RULE 10(E). At these locations, speed may be increased as soon as lead engine has passed increase speed sign.

APPENDIX I

SELECTED PROVISIONS OF ASA CODE B31.4

1. The design requirements for this Code are adequate for public safety under conditions usually encountered in liquid petroleum transportation piping systems, including lines within villages, towns, cities, and industrial areas. However, the design engineer shall provide reasonable protection to prevent damage to the pipeline from unusual external conditions which may be encountered in river crossings, bridges, areas of heavy traffic, long self-supported spans, unstable ground, vibration, weight of special attachments, or forces resulting from abnormal thermal conditions. Some of the protective measures which the design engineer may provide are encasing with steel pipe of larger diameter, adding concrete protective coating, increasing the wall thickness, lowering the line to a greater depth, or indicating the presence of the line with additional markers. (402.1)

2. The right-of-way shall be selected so as to minimize the possibility of hazard from future industrial or urban development or encroachment on the right-of-way.

3. The piping component at any point in the piping system shall be designed for an internal design pressure which shall not be less than the maximum steady state operating pressure at that point, or less than the static head pressure at that point with the line in a static condition. The maximum steady state pressure shall be the sum of the static head pressure, pressure required to overcome friction losses, and any required back pressure. Variations in pressure above the maximum steady state operating pressure due to surges are allowed in accordance with 402.2.4. (401.2.2)

4. Portions of the piping system to be operated at hoop stresses exceeding 20 percent of the specified minimum yield strength of the pipe shall be subjected at any point to a hydrostatic test equivalent to not less than 1.25 times the internal design pressure at that point (see 401.2.2). (437.4.1 (a))

5. The duration of the hydrostatic test specified in 437.4.1(a) shall be not less than 24 hours. (437.4.1(b))

6. Mainline valves shall be installed at accessible locations on both sides of major river crossings and at such other locations, appropriate for the terrain traversed by the pipeline. (434.15.2)

7. Consideration in the design shall be given to piping systems located in regions where earthquakes are known to occur. (401.5.3)

APPENDIX I

8. Depth of ditch shall be appropriate for the route location, surface use of the land, terrain features, and loads imposed by roadways and railroads. (434.6)

9. The safety of the general public and the prevention of damage to the pipeline by reason of its location are primary considerations. Casing of the pipeline may be required and acceptable details are covered in API [American Petroleum Institute] Code No. 1102, Recommended Practice on Form Agreement and Specifications for Pipe Line Crossings Under Railroad Tracks. (434.14.5)

APPENDIX J

PERTINENT PROVISIONS OF 49 CFR 195

[illegible]

APPENDIX J

APPENDIX J

APPENDIX J

[illegible]

§ [illegible] Test leads.

(a) Except for offshore pipelines, electrical test leads used for corrosion control or electrolysis testing must be installed at intervals frequent enough to obtain electrical measurements indicating the adequacy of the cathodic protection.

(b) Test leads must be installed as follows:

(1) Enough looping or slack must be provided to prevent test leads from being unduly stressed or broken during backfilling.

(2) Each lead must be attached to the pipe so as to prevent stress concentration on the pipe.

(3) Each lead installed in a conduit must be suitably insulated from the conduit.

§ [illegible] Installation of pipe in a ditch.

[illegible]

§ [illegible] Cover over buried pipeline.

[illegible]

[illegible]

(b) Less cover than the minimum required by paragraph (a) of this section and § [illegible] may be used if—

(1) It is impracticable to comply with the minimum cover requirements; and

(2) Additional protection is provided that is equivalent to the minimum required cover.

[illegible]

§ [illegible] Clearance between pipe and underground structures.

[illegible]

§ [illegible] Backfilling.

[illegible]

§ [illegible] Above ground components.

[illegible]

(4) Areas under the direct control of the operator.

(5) In any area inaccessible to the public.

(b) Each component covered by this section must be protected from the forces exerted by the anticipated loads.

§ [illegible] Crossing of railroads and highways.

The pipe at each railroad or highway crossing must be installed so as to adequately withstand the dynamic forces exerted by anticipated traffic loads.

§ [illegible] Valves: General.

(a) Each valve must be installed in a location that is accessible to authorized employees and that is protected from damage or tampering.

(b) Each submerged valve located offshore or in inland navigable waters must be marked, or located by conventional survey techniques, to facilitate quick location when operation of the valve is required.

§ [illegible] Valves: Location.

A valve must be installed at each of the following locations:

[illegible]

(f) On each side of a reservoir holding water for human consumption.

[Amdt. 195-22, 46 FR 38360, July 27, 1981; 47 FR 32721, July 29, 1982]

§ 195.262 Pumping equipment.

(a) Adequate ventilation must be provided in pump station buildings to prevent the accumulation of hazardous vapors. Warning devices must be installed to warn of the presence of hazardous vapors in the pumping station building.

(b) The following must be provided in each pump station:

(1) Safety devices that prevent overpressuring of pumping equipment, including the auxiliary pumping equipment within the pumping station.

(2) A device for the emergency shutdown of each pumping station.

(3) If power is necessary to actuate the safety devices, an auxiliary power supply.

(c) Each safety device must be tested under conditions approximating actual operations and found to function properly before the pumping station may be used.

(d) Except for offshore pipelines pumping equipment may not be installed—

(1) On any property that will not be under the control of the operator; or

(2) Less than 50 feet from the boundary of the station.

(e) Adequate fire protection must be installed at each pump station. If the fire protection system installed requires the use of pumps, motive power must be provided for those pumps that is separate from the power that operates the station.

§ 195.264 Above ground breakout tanks.

For above ground breakout tanks—

(a) A means must be provided for containing hazardous liquids in the event of spillage or tank failure.

(b) Tank areas must be adequately protected against unauthorized entry.

(c) Normal and emergency relief venting must be provided for each tank.

§ 195.266 Construction records.

A complete record that shows the following must be maintained by the operator involved for the life of each pipeline facility:

(a) The total number of girth welds and the number nondestructively tested, including the number rejected and the disposition of each rejected weld.

(b) The amount, location, and cover of each size of pipe installed.

(c) The location of each crossing of another pipeline.

(d) The location of each buried utility crossing.

(e) The location of each overhead crossing.

(f) The location of each valve and corrosion test station.

[Amdt. 195-22, 46 FR 38360, July 27, 1981, as amended by Amdt. 195-34, 50 FR 34474, Aug. 26, 1985]

Subpart E—Hydrostatic Testing

§ 195.300 Scope.

This subpart prescribes minimum requirements for hydrostatic testing of the following. It does not apply to movement of pipe covered by § 195.424.

(a) Newly constructed steel pipeline systems;

(b) Existing steel pipeline systems that are relocated, replaced, or otherwise changed;

(c) Onshore steel interstate pipelines constructed before January 8, 1971, that transport highly volatile liquids; and

(d) Onshore steel intrastate pipelines constructed before October 21, 1985, that transport highly volatile liquids.

[Amdt. 195-33, 50 FR 15898, Apr. 23, 1985]

§ 195.302 General requirements.

(a) Each new pipeline system, each pipeline system in which pipe has been relocated or replaced, or that part of a pipeline system that has been relocated or replaced, must be hydrostatically tested in accordance with this subpart without leakage.

(b) No person may transport a highly volatile liquid in an onshore steel interstate pipeline constructed before January 8, 1971, or an onshore steel intrastate pipeline constructed before October 21, 1985, unless the pipeline has been hydrostatically tested in accordance with this subpart or, except for pipelines subject to § 195.5, its maximum operating pressure is established under § 195.406(a)(5). Dates to comply with this requirement are:

(1) For onshore steel interstate pipelines in highly volatile liquid service before September 8, 1980—

(i) Planning and scheduling of hydrostatic testing or actual reduction in maximum operating pressure to meet § 195.406(a)(5) must be completed before September 15, 1981; and

(ii) Hydrostatic testing must be completed before September 15, 1986, with at least 50 percent of the testing completed before September 15, 1983.

(2) For onshore steel intrastate pipelines in highly volatile liquid service before April 23, 1985—

(i) Planning and scheduling of hydrostatic testing or actual reduction in maximum operating pressure to meet § 195.406(a)(5) must be completed before April 23, 1986; and

(ii) Hydrostatic testing must be completed before April 23, 1990 with at least 50 percent of the testing completed before April 23, 1988.

(c) The test pressure for each hydrostatic test conducted under this section must be maintained throughout the part of the system being tested for at least 4 continuous hours at a pressure equal to 125 percent, or more, of the maximum operating pressure and, in the case of a pipeline that is not visually inspected for leakage during test, for at least an additional 4 continuous hours at a pressure equal to 110 percent, or more, of the maximum operating pressure.

[Amdt. 195-22, 46 FR 38360, July 27, 1981, as amended by Amdt. 195-33, 50 FR 15898, Apr. 23, 1985; 50 FR 38660, Sept. 24, 1985]

§ 195.304 Testing of components.

(a) Each hydrostatic test under § 195.302 must test all pipe and attached fittings, including components, unless otherwise permitted by paragraph (b) of this section.

(b) A component that is the only item being replaced or added to the pipeline system need not be hydrostatically tested under paragraph (a) of

APPENDIX K

PERTINENT PROVISIONS OF 49 CFR 192

192.5 Class locations.

(a) Offshore is Class 1 location. The Class location onshore is determined by applying the criteria set forth in this section: The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. Except as provided in paragraphs (d)(2) and (f) of this section, the class location is determined by the buildings in the class location unit. For the purposes of this section, each separate dwelling unit in a multiple dwelling unit building is counted as a separate building intended for human occupancy.

(b) A Class 1 location is any class location unit that has 10 or less buildings intended for human occupancy.

(c) A Class 2 location is any class location unit that has more than 10 but less than 40 buildings for human occupancy.

(d) A Class 3 location is:

(1) Any class location unit that has 46 or more buildings intended for human occupancy; or

(2) An area where the pipeline lies within 100 yards of either a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period. (The days and weeks need not be consecutive.)

(e) A Class 4 location is any class location unit where buildings with four or more stories above ground are prevalent.

(f) The boundaries of the class locations determined in accordance with paragraphs (a) through (e) of this section may be adjusted as follows:

(1) A Class 4 location ends 220 yards from the nearest building with four or more stories above ground.

(2) When a cluster of buildings intended for human occupancy requires a Class 3 location, the Class 3 location ends 220 yards from the nearest building in the cluster.

(3) When a cluster of buildings intended for human occupancy requires a Class 2 location, the Class 2 location ends 220 yards from the nearest building in the cluster.

192.179 Transmission Line Valves

(a) Each transmission line, other than offshore segments, must have sectionalizing block valves spaced as follows:

(1) Each point on the pipeline in a Class 4 location must be within 2 1/2 miles of a valve.

(2) Each point on the pipeline in a Class 3 location must be within 4 miles of a valve.

(3) Each point on the pipeline in a Class 2 location must be within 7 1/2 miles of a valve.

(4) Each point on the pipeline in a Class 1 location must be within 10 miles of a valve.

APPENDIX L

ALERT BULLETIN ISSUED BY RSPA ON NOVEMBER 13, 1989

US Department of Transportation

Research and Special Programs Administration

NOV 13 1989

TO: All Gas Transmission and Hazardous Liquid Pipeline Operators

The purpose of this Alert Notice is to advise you of the results of an investigation conducted by the Office of Pipeline Safety of a recent pipeline accident and the relevance of that investigation to the safe operation of check valves. With this notice, the Office of Pipeline Safety is alerting each gas transmission operator and hazardous liquid pipeline operator of the need to test check valves located in critical areas to assure that they close properly.

Sincerely,

Richard L. Beam
Director
Office of Pipeline Safety

Enclosure

APPENDIX L

ALERT NOTICE

The Office of Pipeline Safety (OPS) is alerting all operators of gas transmission and hazardous liquid pipelines to test check valves located in critical areas to assure the proper closure during a pipeline failure. The failure of such valves to close during an incident could increase the risk to the public safety or damage to the environment. A recent pipeline accident has caused OPS to reevaluate the safety of pipeline check valves.

On May 12, 1989, a Southern Pacific Transportation Company freight train derailed in San Bernardino, California with some of the engines and rail cars coming to rest over a buried 14-inch products pipeline being operated by Calnev Pipe Line Company. After learning of the derailment, Calnev personnel stopped pumping product through the pipeline to reduce the pipeline pressure in the area of the derailment.

On May 16, 1989, the pipeline was returned to normal operation. However, on May 25, 1989, Calnev's 14-inch products pipeline ruptured in the area of the train derailment releasing gasoline which sprayed over houses in the adjacent neighborhood and ignited. Two persons were killed, 31 injured, 10 houses destroyed, 5 houses were extensively damaged, and 18 automobiles were destroyed. Additionally, about 1,000 people were evacuated during the emergency. Later, Calnev personnel inspected one of the check valves in the 14-inch pipeline and found it in the fully open position. Also, it became apparent during the refill of the pipeline, prior to its return to operation, that at least one and possibly two additional check valves did not close, otherwise less volume of product would have been required to refill the pipeline.

While Calnev has many check valves installed in its pipelines, each of the check valves in question were 14-inch "All-Clear Check Valves," Model ACB-976 that were manufactured by Frank Wheatley Industries of Tulsa, Oklahoma. The clapper in these valves is hinged on the side rather than at the top. Calnev had not previously experienced a release of product or other circumstance sufficient to demonstrate that these valves functioned properly to prevent backflow of product in the pipeline. Reportedly, maintenance or operational tests of these valves had never been performed since the pipeline began operations in 1970.

APPENDIX L

In view of the above, operators should take the following actions:

1. Each hazardous liquid pipeline operator that has "All-Clear Check Valves" manufactured by Frank Wheatley Industries or its successor, FWI Inc., Tulsa, Oklahoma installed in critical locations* in its pipeline systems should test these valves for proper closure and replace any of these valves that fail to close.

2. Each gas transmission and hazardous liquid pipeline operator should test to assure the proper closure of each type of check valve that is necessary for the safe operation of its pipeline system.

In addition, valves in noncritical locations should also be inspected for proper operation at the first opportunity the valves can be by-passed, or otherwise taken out of operational service.

OPS is reviewing its pipeline safety regulations regarding valve maintenance and will conduct a study to determine the feasibility of establishing inspection, maintenance, and test requirements to assure the proper functioning of check valves installed in pipeline systems.

*Although areas that would be designated "critical" will vary between operators, the following are examples of critical locations where check valves installed to prevent backflow should be tested in accordance with this notice:

1. Valves installed to protect an urban populated area.

2. Valves installed to protect an environmentally sensitive area.

APPENDIX L

U.S. Department of Transportation
Research and Special Programs Administration

The Administrator

400 Seventh Street, S.W.
Washington, D.C. 20590

NOV 13 1989

Mr. James L. Kolstad
Acting Chairman
National Transportation Safety Board
Washington, D.C. 20594

Dear Chairman Kolstad:

This responds to your letter of August 9, 1989, in which the National Transportation Safety Board (NTSB) recommends that the Research and Special Programs Administration (RSPA) do the following:

NTSB Recommendation P-89-5

Require pipeline operators that have "All-Clear Check Valves" manufactured by the Wheatley Company installed in their pipeline systems to test these valves for proper closure and require the replacement of any that fail to close properly.

RSPA Response

An Alert Bulletin (copy enclosed) has been issued that alerts all hazardous liquid pipeline operators to test in critical locations all check valves for proper closure and recommends the replacement of any check valve that fails to close properly. Also, the advisory recommends that valves located in noncritical areas be inspected for operation at the first opportunity the valves can be bypassed or otherwise taken out of operational service.

NTSB Recommendation P-89-6

Establish inspection, maintenance, and test requirements to demonstrate and maintain the proper functioning of check valves installed in pipeline systems.

APPENDIX L

RSPA Response

We have initiated a study to determine the feasibility of establishing inspection, maintenance, and test requirements to demonstrate and maintain the proper functioning of check valves installed in pipeline systems. We plan to complete this study within 9 months. If the study supports a need for such a regulation, we will initiate rulemaking.

Please call me if you have any questions.

Sincerely,

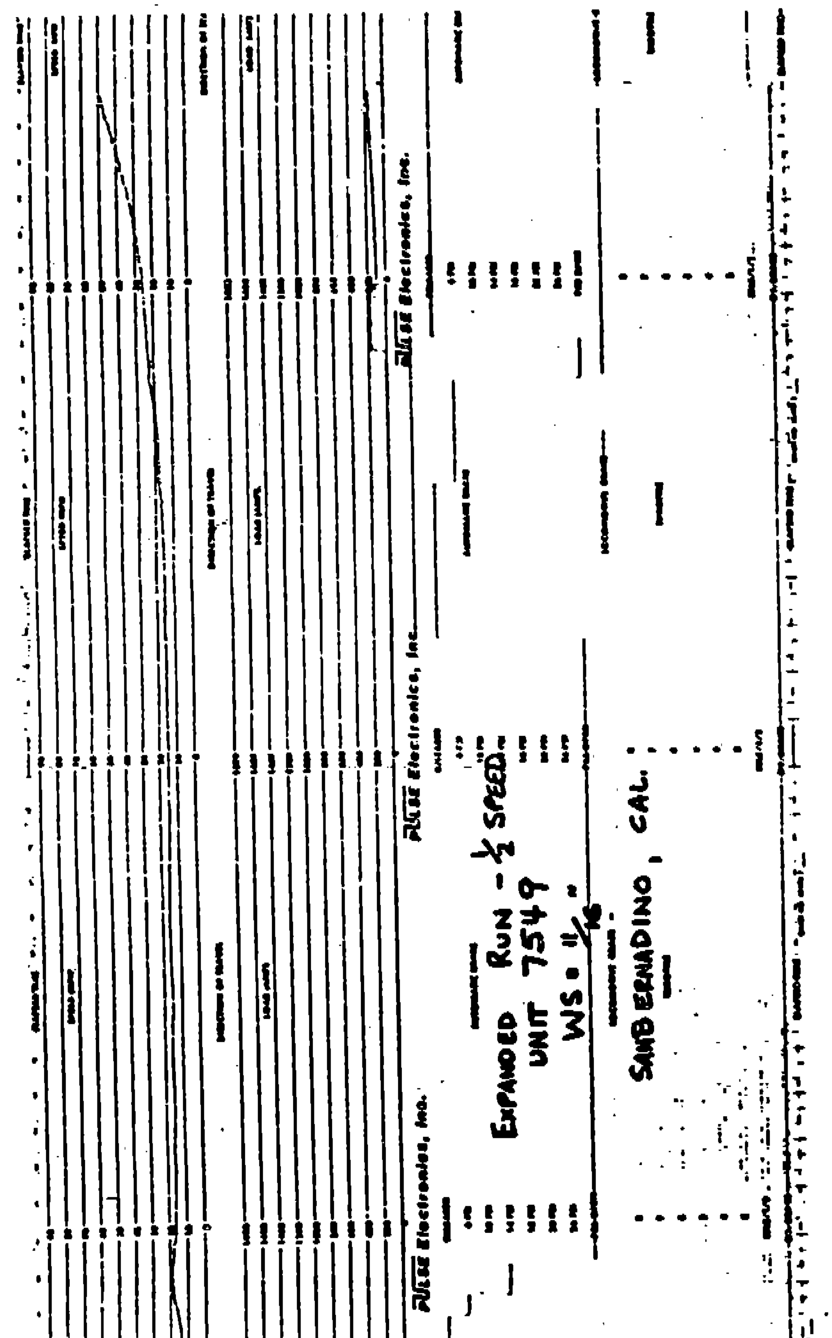
Travis P. Dungan

Travis P. Dungan

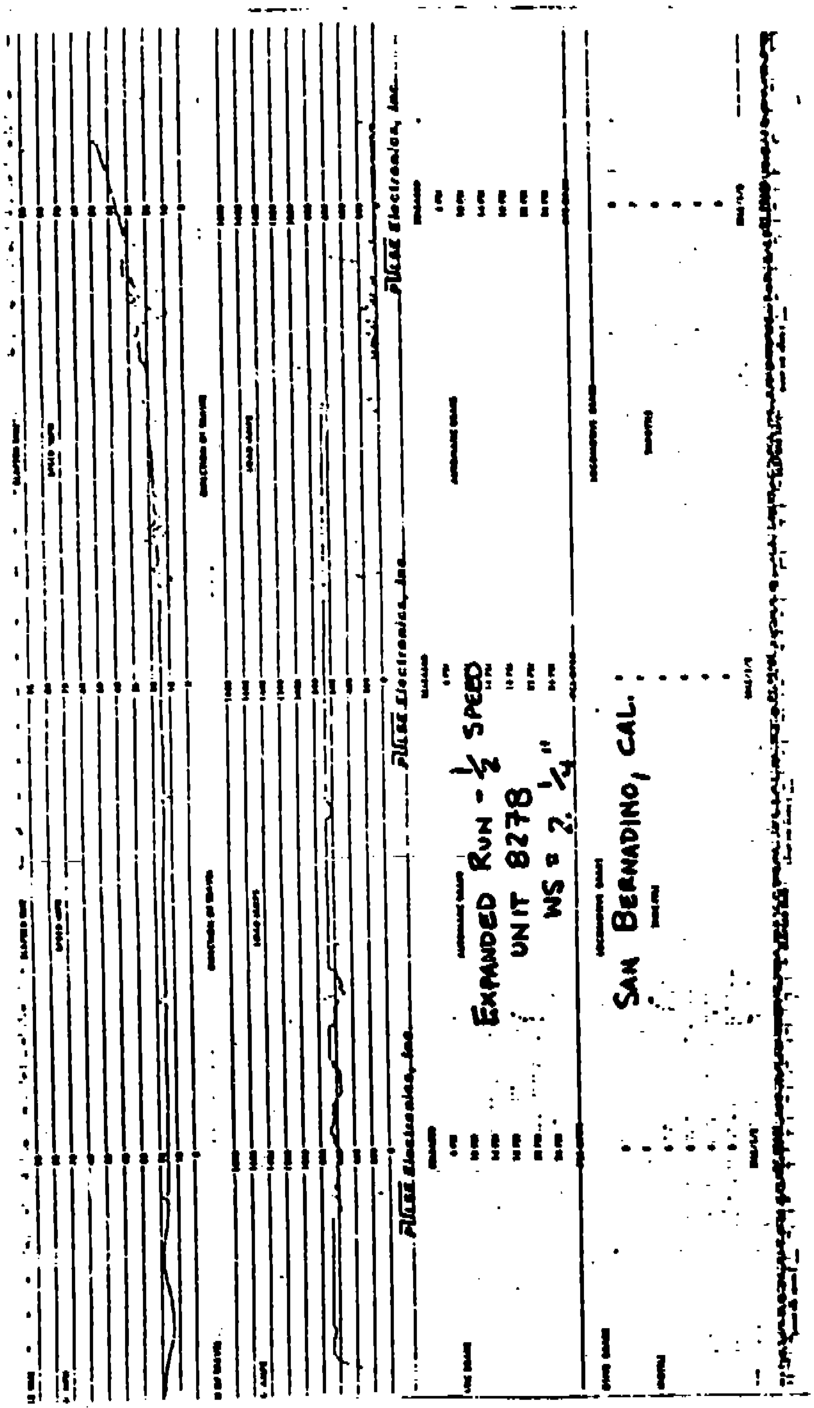
Enclosure

APPENDIX M

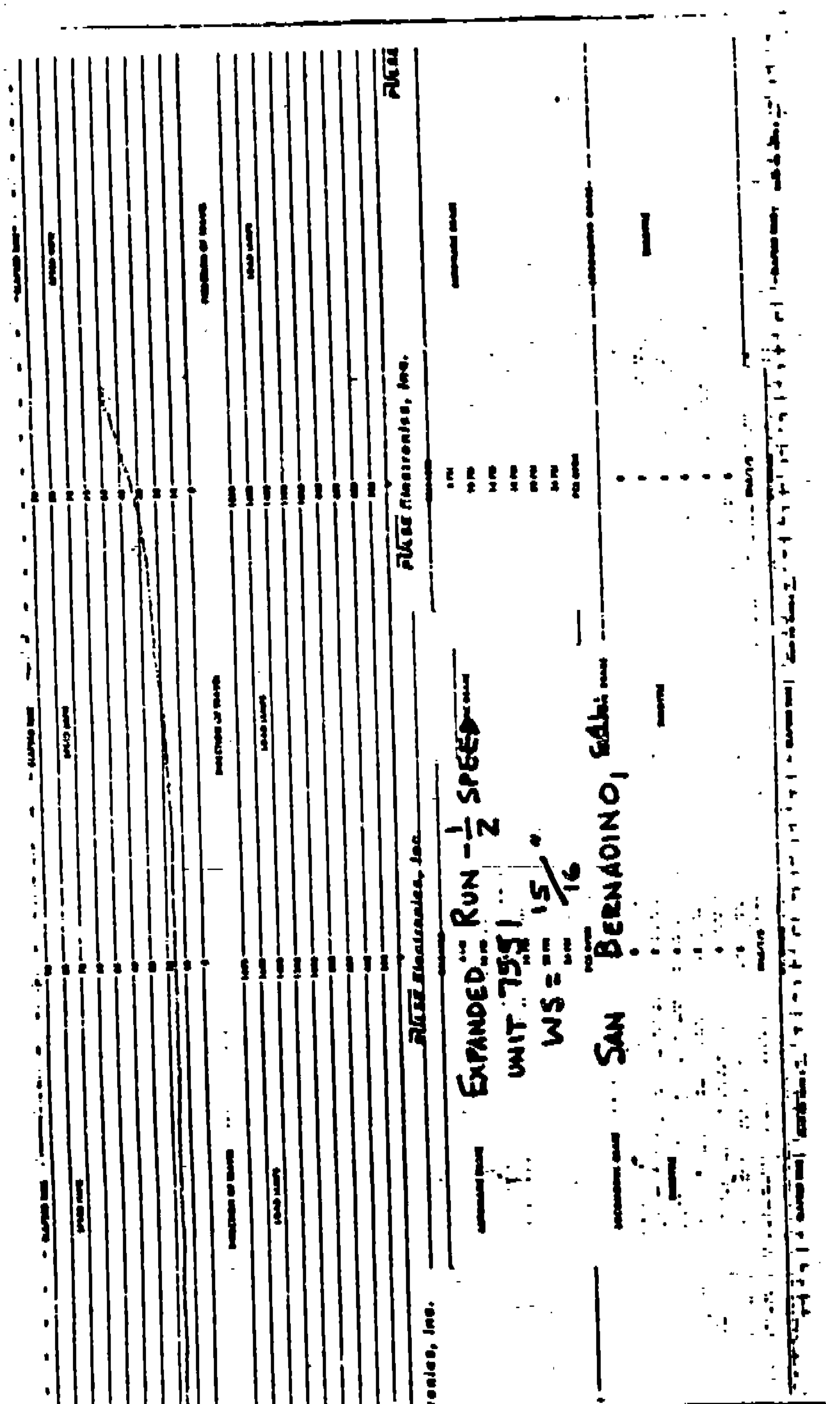
STRIPCHARTS FROM EVENT RECORDERS OF EXTRA 7551 EAST



APPENDIX M


PULSE Electronics, Inc.
EXPANDED RUN - 1/2 SPEED
UNIT 8278
WS = 2 1/4"
SAN BERNADINO, CAL.

APPENDIX M



APPENDIX N
CONVERSE CONSULTANTS REPORT

Converse Consultants Inland Empire

Consulting Engineers
and Geologists

630 East Brier Drive Suite 10
San Bernardino California

Telephone 714 ...
FAX 714 ...

August 30, 1989

Mr. Charles P. Diamond
O'Melveny & Myers
1800 Century Park East
Los Angeles, California 90067-1589

Subject: Report of Findings
Geotechnical Consulting Services
CalNev Pipeline/Duffy Street
San Bernardino, California
CCIE Project No. 89-81-131-01

INTRODUCTION

This report presents the results, to date, of our geotechnical investigation performed along a portion of the CalNev pipeline situated adjacent to the west side Lots 74 through 79 of Tract 3948, Duffy Street, San Bernardino, California.

OBJECTIVE

The investigation was performed to evaluate the subsurface conditions in the vicinity of the pipeline rupture in order to locate areas where the soils may have been disturbed by excavating equipment. It is our understanding that excavating equipment may have been utilized in the vicinity of the pipe rupture during CalNev post derailment pipe inspection and/or during clean-up of the derailment debris.

SCOPE OF WORK

Our scope of work consisted of visual inspection of backhoe pits, in-situ field density testing, chemical testing of soils for the presence of Trona, and preparation of this report. The locations of the field density tests are shown on Drawing 1, Site Plan. The results of the field density tests are shown on Tables I and II. The analytical test results are enclosed in Appendix A.

APPENDIX N

O'Melveny & Myers
CCIE Project 89-81-131-01
August 30, 1989

METHODOLOGY

Our initial investigation consisted of evaluating in-situ relative densities of existing soil conditions in order to delineate locations of probable CalNev inspection-pits, subsurface excavations and/or areas of significant soil disturbance.

The site was visually observed on the evening of May 25, 1989, approximately 4 hours after the burning gasoline had been extinguished. Between approximately 12:30am and 3:30am on May 26, 1989, four field density tests were performed on either side of rupture area (tests 1 through 4 on Drawing 1).

On June 5, 1989 - the day the pipe in the derailment area was excavated and replaced - ten additional field density tests were performed to the south of the pipe rupture (tests 5 through 14 on Drawing 1). These tests are believed to have been taken in relatively undisturbed site soils and served as our "control points".

Our methodology consisted of comparing in-situ field densities obtained within areas of possible subsurface excavations, or soil disturbance, and comparing those data to in-situ field densities obtained from the "control area". The "control area" was located adjacent a portion of the pipeline that had apparently not been disturbed.

Areas of low field densities relative to the control tests are believed to indicate subsurface disturbances, such as the excavation of inspection-pits and/or disturbances resulting from site clean-up or slope repairs. The presence of Trona in areas where low relative field densities were obtained would further substantiate mixing of surface and subsurface soils which would be expected to have occurred during backfilling of excavations or disturbances related to the use of heavy excavating equipment (such as was used during site clean-up and slope repairs).

INVESTIGATIVE METHODS

A total of fourteen field densities tests were performed along the pipeline. Density of the soils were determined in the field using the ASTM D1556 Sand Cone Test Method. Field moisture content was determined using the Speedy Moisture Tester, calibrated with oven-dried samples. Test results are presented in Table I - "Table of Test Results".

Bulk samples of representative soil types were collected for moisture-density determinations. The moisture-density relation-

APPENDIX N

ships of the soils encountered in our field density tests were determined in our laboratory in accordance with the ASTM D1557-78 Test Method. The maximum dry density and optimum moisture content from these tests are presented in Table II - "Moisture-Density Relationship Test Summary".

Selected soil samples obtained from the field density test locations, were also analytically tested for the presence of the mineral Trona. Significant quantities of Trona were present on the surface of the site following the train derailment. The presence of Trona in subsurface soils would indicate mixing of surface and subsurface materials. One sample was obtained from an area off-site and was analyzed to provide background levels in the area (sample OS-1A, in Appendix A). This sample was obtained approximately one mile north of the project area as shown on Drawing 2.

TEST LOCATIONS

Field density tests 1 through 4 were obtained from an area within 16 feet south and 10 feet north of the rupture. As shown on Drawing 1, field density test 1, 2 and 3, were taken directly above the pipeline; field density test 4 was taken approximately 1.5 feet west of the pipeline. The depth of these tests relative to the pipeline (as existing on May 26, 1989), are shown on Table 1.

Field density tests 5 through 14 were performed over an area approximately 130 to 220 feet south of the rupture zone, as shown on Drawing 1. These tests were taken approximately 1.5 to 5.5 feet west of center line of pipe, at depths ranging from approximately 2 to 2.5 feet below ground surface (as existing on June 5, 1989). Approximate depth below ground surface, of each test location is shown on Table I.

TEST RESULTS

Field density tests 1 trough 4, taken in the immediate vicinity of the pipe rupture, indicate relatively low field dry densities. Such densities are indicative of disturbed or poorly compacted earth materials. Samples collected from field density test location 4, and a composite sample of field density locations 2 and 3, contained significant ,quantities of the mineral Trona (see Appendix A). These samples were obtained approximately 0.5 and 2.0 feet, respectively, above the pipeline.

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O'Melveny & Myers
CCIE Project 89-81-131-01
August 30, 1989

Field density tests 5 through 14, taken approximately 1.5 to 5.5 feet west of center line of pipe, have relatively higher field dry densities, indicative of earth materials that have not been recently disturbed, or that have been compacted. Chemical analyses of samples collected from field density locations 5 and 6 did not indicate the presence of the mineral Trona within the "control area" (see Appendix A).

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CCIE Project 89-81-131-01
August 30, 1989

Should you have any questions regarding the contents of this letter, please feel free to call the undersigned. This opportunity to be of service is appreciated.

Respectfully submitted,
CONVERSE CONSULTANTS INLAND EMPIRE

Robert M. Pride
Robert M. Pride, RCE 697
President

David B. Simon
David B. Simon, CEG 1400
Senior Engineering Geologist

DBS/RMP;89A

Dist: 40/Addressee

Encl: Tables 1 and 2
Drawings 1 and 2
Appendix A

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August 30, 1989

TABLE I
FIELD DENSITY TESTS

TEST NO.	APPROXIMATE TEST HEIGHT, FT. ABOVE PIPE (5/26/89)	APPROXIMATE TEST DEPTH, FT. BELOW GROUND SURFACE (6/5/89)	DRY DENSITY* (PCF)	FIELD MOISTURE CONTENT (%)	SOIL TYPE*	RELATIVE COMPACTION (%)
1	1.0	—	104	4.5	1	80
2	2.0	—	95	4.8	1	73
3	1.0	—	91	4.8	1	70
4	0.5	—	108	2.4	2	85
5	—	2.0	117	4.3	3	93
6	—	2.0	117	4.8	3	93
7	—	2.0	118	3.5	3	94
8	—	2.0	111	3.9	3	89
9	—	2.0	117	3.5	3	93
10	—	2.1	118	5.0	3	94
11	—	2.2	120	4.8	3	96
12	—	2.5	113	5.0	3	90
13	—	2.5	118	5.0	3	94
14	—	2.4	117	5.0	3	93

Density of the compacted fill was determined in the field using the ASTM D1556 Sand Cone Test Method. Field moisture content was determined using the Speedy Moisture Tester, calibrated with oven-dried samples.

* Soil Type is given on Table II, Moisture-Density Relationship Test Summary.

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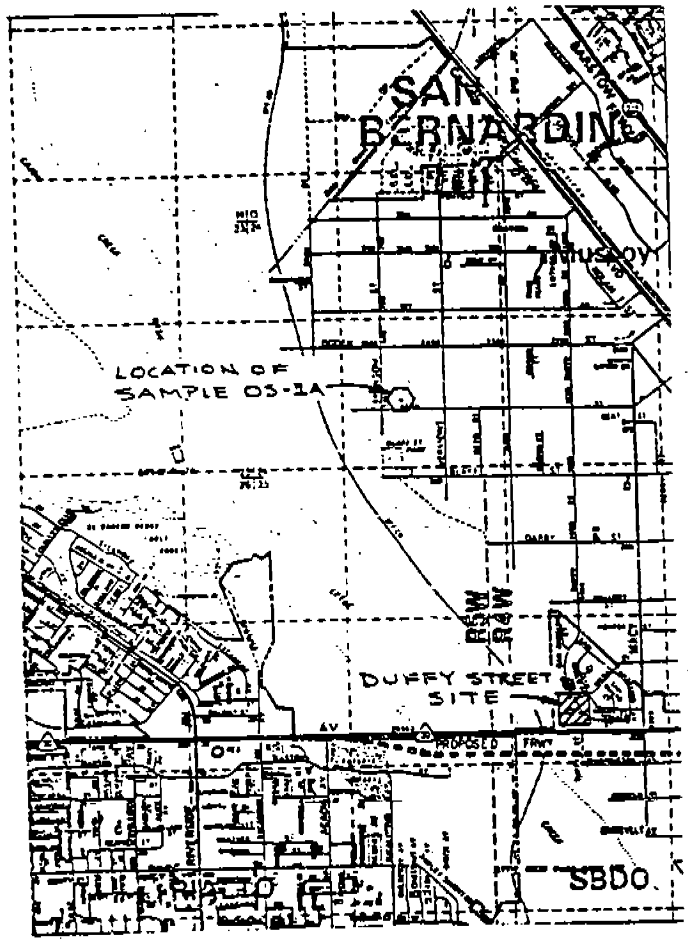
TABLE II
MOISTURE - DENSITY RELATIONSHIP TEST
SUMMARY *

Soil* Type	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
1	Light Gray - Brown Sand	9.5	129
2	Brown Fine to Medium Sand with Trace Gravel	8.3	130
3	Brown Fine to Medium Sand Scattered Gravel	8.0	125

*ASTM D1557 Test Method



Ref: THOMAS BROS. MAP GUIDE, SAN BERNARDINO COUNTY, 1989

LOCATION OF OFF-SITE SAMPLE 03-1A

CALNEV PIPELINE
DUFFY STREET, SAN BERNARDINO, CA.
for: O'Melveny & Myers

Converse Consultants Geotechnical Engineering and Applied Sciences

Scale 1" = ½ mile	Project No. 89-81-131-01
Prepared by JH	Date 8/30/89
Checked by DBS	Drawing No. 2
Approved by RMP	

APPENDIX N

ANALYSIS OF SAMPLES FOR TRONA

PROJECT/CLIENT : CAL-NEV
PROJECT NO : 09-31-131-01
PROJECT ENG/MGR : Dave Simon

REPORT DATE : Aug. 30, 1989
DATE ANALYZED : Aug. 3-30, 1989
DATE RECEIVED : July 28-Aug.29,1989

RESULTS

Sample ID	CARBONATE	BICARBONATE	SODIUM
Composite Sample of Test Locations 2 & 3	21,000	20,000	28,000
Composite Sample of Test Location 2 & 3 (Duplicate)	22,000	21,000	30,000
Test Location #4	22,000	20,000	28,000
Test Location #5	ND	220	120
Test Location #6,	ND	180	100
Sample OS-1A	ND	ND	3.4

UNITS: mg/kg (PPM)
ND : Not Detected

Reviewed by:

Shu-Teh Pan
Organics Lab Manager

Approved by:

George Colovos, Ph.D
Laboratory Director

CONVERSE ENVIROLAB

APPENDIX O

AGREEMENT BETWEEN THE SOUTHERN PACIFIC AND THE CITY OF SAN BERNARDINO

AGREEMENT RELATIVE TO THE SOUTHERN PACIFIC TRAIN DERAILMENT OF MAY 12, 1989

THIS AGREEMENT is entered into on this 17th day of May, 1989, by and between the CITY OF SAN BERNARDINO, a charter city of the State of California (hereinafter "CITY"), and the Southern Pacific Transportation Company, a Delaware corporation (hereinafter "RAILROAD").

R E C I T A L S :

WHEREAS, on May 12, 1989, a freight train owned and operated by Railroad derailed in the City; and,

WHEREAS, such derailment caused the loss of life and the destruction of, and extensive damage to, private homes and property and public improvements in City, and required the extensive employment of emergency services personnel and equipment in response to such derailment; and,

WHEREAS, City and Railroad wish to take joint and expeditious action to address the destruction of and extensive damage to private homes and property and public improvements within the City, without the necessity of litigation.

IT IS THEREFORE AGREED AS FOLLOWS:

1. Railroad shall within seven (7) days make a good faith offer to purchase, at the fair market value before the accident, the properties commonly known as:

/ / /

/ / /

a. 2314 Duffy Street

b. 2326 Duffy Street

c. 2336 Duffy Street

d. 2348 Duffy Street

e. 2360 Duffy Street

f. 2372 Duffy Street

g. 2382 Duffy Street

The legal description of such real properties is attached hereto marked Exhibit "A" and by this reference made a part hereof.

If said offer is accepted, Railroad shall expeditiously conclude the purchases of the subject properties.

It is hereby acknowledged and agreed by Railroad that the above listed properties contained residential structures which were damaged beyond repair as a result of the derailment.

2. In addition to the residential properties identified in Paragraph 1, the parties agree that four (4) other residential properties, namely:

a. 2394 Duffy Street

b. 2404 Duffy Street

c. 2428 Duffy Street

d. 2450 Duffy Street

also were damaged or otherwise affected by the derailment accident. Railroad agrees to offer to purchase said residential properties from the owners thereof at the fair market value before the accident. Railroad agrees to raze the structures at

APPENDIX O

2394 Duffy and 2404 Duffy, provided that the owners thereof agree to sell them.

The legal description of such real properties listed directly above is attached hereto marked Exhibit B" and by this reference made a part hereof.

Railroad's obligation to conclude any purchase hereunder shall be conditional upon Railroad's receipt of reasonable releases from property owners for damage to or destruction of the residential properties.

With respect to all property upon which the residences have been razed, Railroad agrees that such property shall be maintained as open space. At Railroad's expense, said property shall be appropriately landscaped, including the installation of a sprinkling system. Railroad shall thereafter grant to City a beautification easement. City shall be thereafter responsible for the maintenance of such property.

Should the owners of the properties located at 2314 through 2404 Duffy Street, inclusive, refuse to sell and the City subsequently makes the findings necessary to support an action in condemnation and determines to proceed with such condemnation, Railroad agrees to prosecute such condemnation action on behalf of City, bearing all costs therefor, and agrees to otherwise pay the costs of such properties.

City agrees to permit Railroad to re-sell or rent the two other residential structures for occupancy, provided that:

(a) Railroad gives full notice to future owners/occupants of the proximity of the railroad right-of-way and the subject derailment accident: and,

(b) Railroad agrees to indemnify City from and against any future railroad-caused liability arising out of the continued occupancy of the two residences.

Within five (5) days of the date of this agreement, City and Railroad shall enter into negotiations with respect to the purchase and removal by Railroad of such additional improvements as may be necessary to secure such health, safety and welfare.

3. In addition to the purchase of the properties set forth at paragraphs 1 and 2 above, Railroad agrees to offer to pay to the occupants of such residences, which are purchased by the railroad or condemned by the City, costs of moving within a 50-mile radius of the location of the accident and 90 days' costs of housing for a residence of comparable quality to that listed herein. Comparability shall be determined by the Community Development Department of the City pursuant to the standards of comparability used in the administration of any of the various programs administered by that department.

With respect to all properties covered hereby, which are purchased by the Railroad or condemned by City, Railroad shall pay for moving, towing and storage for up to ninety (90) days of all furniture, furnishings, boats and automobiles at the residences and in the street in front of such properties, and

APPENDIX O

shall defend and indemnify all such persons and City from any claims arising from the towing, moving and storage of such personalty. Railroad's obligation under this paragraph shall be conditioned upon receipt of reasonable releases from owners.

4. It is further hereby acknowledged and agreed by the parties that a Cal-Neva gas line runs adjacent to the location of the derailment; that the health, safety and welfare of the persons in the vicinity of the derailment requires that such line be fully exposed to allow visual and other examination to the satisfaction of the City Fire Department. As between City and Railroad, Railroad shall bear all costs incurred thereby and for replacement of the line. Railroad's obligation to Cal-Neva shall be determined by the contract between Cal-Neva and Railroad, if any.

5. This agreement may be amended only in writing by and between the parties hereto.

6. Time is of the essence with respect to the performance of Railroad under this agreement. Railroad shall at all times act expeditiously and keep the City apprised of all work schedules and timetables in regard to Railroad's performance hereunder.

7. If Railroad breaches this agreement, City may complete any and all actions it deems necessary to secure the health, safety and welfare of the citizens of the City.

8. Railroad agrees to pay to City, within thirty (30) days of presentation of a list of the costs therefor, all costs

of whatever type incurred by City with respect to the derailment. Such costs shall include, but not be limited to, all extraordinary overtime costs: incident-related workers' compensation claims filed within one (1) year of the date of the incident; costs of contractual services; all costs for City crews used in cleanup; Railroad agrees to provide at its cost a course of additional training in the handling of hazardous materials, as they relate to railroad operations, to selected members of the City Fire Department.

Railroad hereby agrees to defend, indemnify, save and hold harmless the City, its officers, agents and employees, from any and all claims and/or lawsuits of whatsoever kind or nature, arising from this derailment, the incidents and actions resulting therefrom. Railroad further agrees to defend, indemnify, save and hold harmless the City, its officers, agents and employees, against further derailment accidents of this type, at this location, which are the result of the negligence of the Railroad not contributed to by City.

9. The prevailing party in any action brought for breach of any provision hereof shall be entitled to reasonable costs incurred thereby, including attorneys' fees.

10. No third party shall be deemed to have any rights hereunder against any of the parties hereto as a result of this agreement.

11. Nothing herein shall be deemed to be an admission of liability of either the Railroad or the City in regard to this

accident, or their obligations, if any, arising therefrom.

12. Railroad agrees to submit to mutually binding arbitration of all property claims submitted by any person arising from the accident. Railroad agrees to pay for the cost of arbitration for all property claims brought by owners, occupants and residents of properties within the boundaries set forth in Exhibit "C" attached hereto and by this reference made a part hereof.

City and Railroad shall mutually select the neutral arbitrator to be used in this process.

ATTEST:

City Clerk

CITY OF SAN BERNARDINO

Mayor

SOUTHERN PACIFIC TRANSPORTATION COMPANY

BY:

L. G. SIMPSON
(printed name)

GENERAL MANAGER
(title)

APPROVED AS TO FORM
AND LEGAL CONTENT:

JAMES F. PENMAN, City Attorney

APPENDIX O

EXHIBIT "A"
legal descriptions

2314 Duffy Street

Lot 78, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2326 Duffy Street

Lot 77, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2336 Duffy Street

Lot 76, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2348 Duffy Street

Lot 75, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2360 Duffy Street

Lot 74, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2372 Duffy Street

Lot 73, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2382 Duffy Street

Lot 72, Tract o. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

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EXHIBIT "B"
legal descriptions

2394 Duffy Street

Lot 71, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2404 Duffy Street

Lot 70, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2428 Duffy Street

Lot 69, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

2450 Duffy Street

Lot 68, Tract No. 3948, in the City of San Bernardino, County of San Bernardino, State of California, as per map recorded in Book 60, pages 51 through 53, inclusive, records of said County.

APPENDIX O

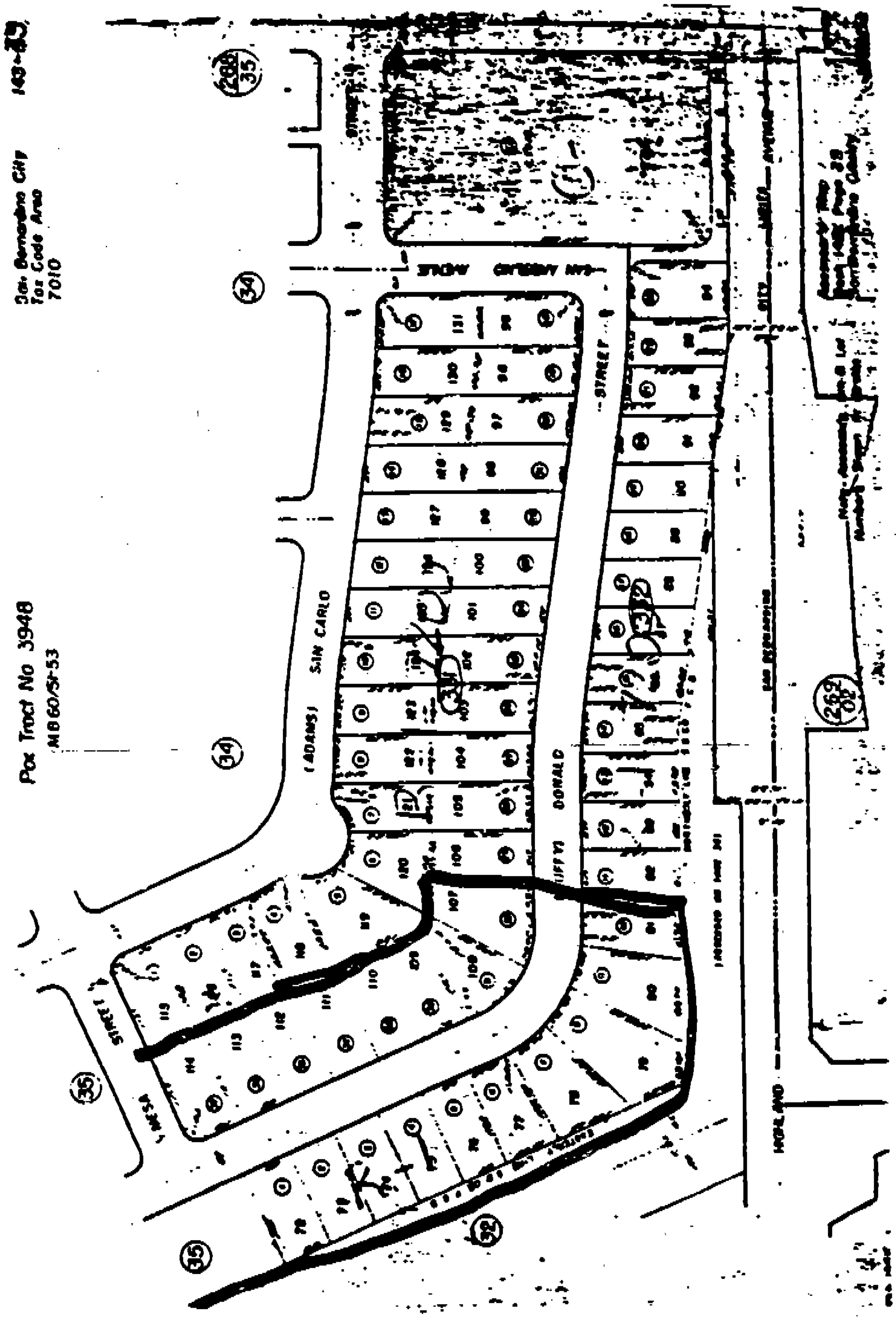
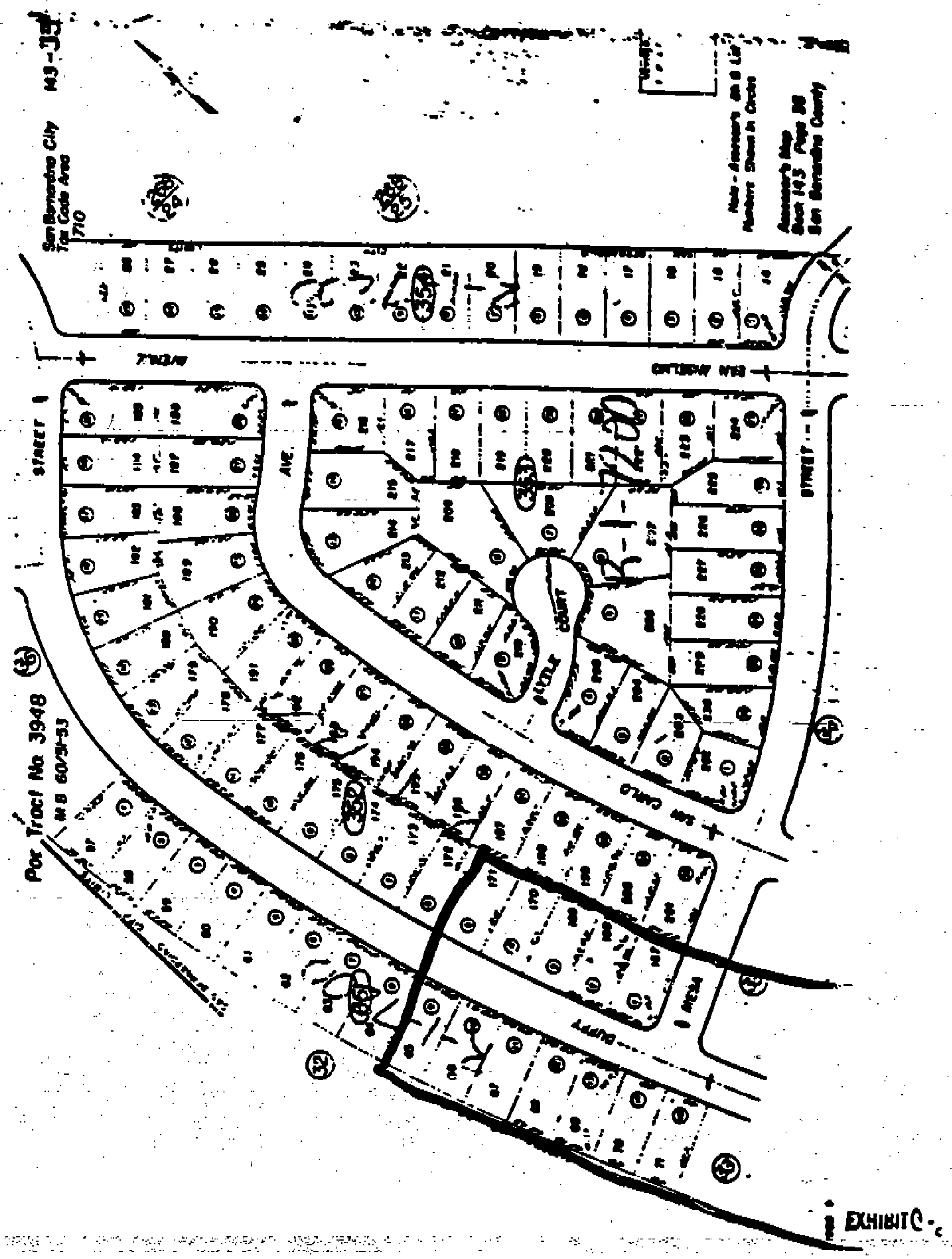


EXHIBIT C

APPENDIX O


San Bernardino City
Tax Code Area
710
Note - Assessor's Block Numbers Shown in Circles
Assessor's Map
Book 143 Page 36
San Bernardino County
Por Tract No 3948
M B 60/51-53
STREET
AVE.
COURT
DUFFY
EXHIBIT C

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In re: **U.S. DEPARTMENT OF ENERGY** **(High-Level Waste Repository)**	**Docket No. 63-001**

CERTIFICATE OF SERVICE

I hereby certify that the foregoing "State of California's Petition for Leave to Intervene in the Hearing" has been served via the Nuclear Regulatory Commission's Electronic Information Exchange ("EIE") upon those on the Service List maintained by the EIE for the above-captioned proceeding.

Dated: December 20, 2008

Respectfully submitted,

[Signed electronically]
TIMOTHY E. SULLIVAN
Deputy Attorney General
California Department of Justice
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P.O. Box 70550
Oakland, CA 94612-0550
Tel: (510) 622-4038
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