December 1, 1998 SECY-98-278

FOR: The Commissioners

FROM: William D. Travers /s/
Executive Director for Operations

SUBJECT: PROPOSED RULE — "CHANGES TO REQUIREMENTS FOR ENVIRONMENTAL REVIEW FOR RENEWAL OF NUCLEAR POWER PLANT OPERATING LICENSES (10 CFR PART 51)"

PURPOSE

To request Commission approval to publish in the *Federal Register* a proposed rule to amend environmental protection requirements for license renewal and to release for public comment the supporting draft supplemental generic environmental impact statement.

SUMMARY

The rule, "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," would eliminate from 10 CFR Part 51 the requirement that license renewal applicants address the generic and cumulative environmental impacts associated with transportation in the vicinity of a high-level waste (HLW) repository site and would increase the fuel enrichment level and the burnup rate that are accounted for in the environmental effects of transportation of fuel and waste codified in Part 51. Also, this amendment would add the requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term. This requirement was inadvertently omitted from the current rule.

BACKGROUND

The Commission revised its environmental protection regulations (10 CFR Part 51) for license renewal on December 18, 1996 (61 FR 66537). The amendment was based on the analyses and conclusions reported in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996). In response to the comments received on a version of the rule published on June 5, 1996 (61 FR 28467), the Commission made the following statement: "As part of its effort to develop regulatory guidance for this rule, the Commission will consider whether further changes to the rule are desirable to generically address: (1) The issue of cumulative transportation impacts and (2) the implications that the use of higher burn-up fuel have for the conclusions in Table S-4. After consideration of these

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issues, the Commission will determine whether the issue of transportation impacts should be changed to Category 1."*

In SECY-97-279, dated December 3, 1997, the staff informed the Commission that it was the staff's preliminary view that the staff's supplemental analyses of the generic and cumulative impacts of the transportation of HLW and of the implications of higher fuel burnup for transportation impacts supports a reasonable technical and legal determination that transportation of HLW is a Category 1 issue and may be generically adopted in a license renewal application. In a Staff Requirements Memorandum (SRM) dated January 13, 1998, the Commission directed the staff to proceed with rulemaking to amend 10 CFR 51.53(c)(3)(ii)(M) to categorize the impacts of transportation of HLW as a Category 1 issue. In a memorandum dated July 1, 1998, the staff informed the Commission of its plans for amending 10 CFR Part 51.

In that memorandum the staff also proposed, as an administrative amendment to the rule, to add the requirement to include in license renewal reviews the environmental impacts of transportation on local services in the vicinity of the plant during the renewal term. This issue was identified as a Category 2 issue in NUREG-1437, Section 4.7.3.2. However, the issue was inadvertently omitted from 10 CFR 51.53(c)(3)(ii)(J) and its inclusion in Table B-1 is not explicitly stated. This rule would correct that omission.

RESOURCES

Resources to conduct this rulemaking are included in the current budget.

COORDINATION

The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has reviewed this Commission Paper for resource implications and has no objection. The Office of the Chief Information Officer has reviewed the rulemaking plan for information technology and information management implications and concurs in it.

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*In NUREG-1437 and in the rule, Category 1 issues are those environmental issues for which the analysis and findings have been determined to be applicable to all nuclear power plants or to plants with specific types of cooling systems or other common plant or site characteristics. Absent new information that significantly changes the finding, these generic findings may be adopted in plant license renewal reviews. Category 2 issues are those environmental issues for which the analysis did not result in finding common to all or plants with common characteristics. Plant-specific reviews are required for Category 2 issues.

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RECOMMENDATION

That the Commission

1. Approve for publication in the *Federal Register* the proposed amendment to 10 CFR Part 51 (Attachment 1) and the Notice of Availability (Attachment 2) of NUREG-1437, Addendum 1 (Attachment 3).

2. In order to satisfy requirements of the Regulatory Flexibility Act, 5 U.S.C. 605(b), certify that this rule, if promulgated, will have no negative economic impact on a substantial number of small entities

3. Note that

   a. The staff has scheduled the rulemaking activities so that the changes to Part 51 will be completed before the scheduled completion of the licensing process for the pending license renewal applications.

   b. The rulemaking would be published in the *Federal Register* for a 60-day public comment period;

   c. A Notice of Availability of NUREG-1437, Addendum 1 would be published in the *Federal Register* for a 60-day public comment period;

   d. After Commission approval to publish and before submittal to the Office of the Federal Register, the staff will submit the draft of NUREG-1437, Addendum 1 to the U.S. Environmental Protection Agency (EPA) pursuant to Section 309 of the Clean Air Act. The staff will also send copies of the *Federal Register* notices to EPA;

   e. As required by the Regulatory Flexibility Act, the Chief Counsel for Advocacy of the Small Business Administration will be informed of the proposed certification regarding economic impact on small entities and the reasons for it;

   f. This proposed rule would amend information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). This rule has been reviewed by the Office of Management and Budget, and the paperwork requirements were approved on November 10, 1998;

g. A press release (Attachment 4) will be issued; and

h. The appropriate Congressional committees will be informed (Attachment 5).

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Attachments: As stated (5)

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NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

RIN 3150-AG05

Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed Rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing to amend its regulations on the environmental information required in applications to renew the operating licenses of nuclear power plants. This amendment would expand the generic findings that are currently codified in the regulations to include the cumulative environmental impacts of transporting spent fuel to the proposed repository at Yucca Mountain, Nevada and account for the environmental impacts of transportation attributable to use of higher enriched fuel and higher burnup during the renewal term. This action would reduce the regulatory burden on applicants for license renewal by replacing with a generic review the requirements that these topics be addressed in individual plant renewal reviews. Also, this amendment would add the requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term. This requirement was inadvertently omitted from the current rule.

DATES: Submit comments by (insert date 60 days after publication in the Federal Register). Comments received after this date will be considered if it is practical to consider them, but the Commission is able to ensure consideration only for comments received on or before this date.

ADDRESSES: Comments may be sent to: Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemakings and Adjudications Staff, Mail Stop O16-C1.

Deliver comments to: One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 am and 4:15 pm on Federal workdays.

Copies of comments received may be examined at: NRC Public Document Room, 2120 L Street, NW. (Lower Level), Washington, DC.

You may also submit comments via the NRC's interactive rulemaking website through the NRC home page (http://www.nrc.gov). From the home page, select "Rulemaking" from the tool bar. The interactive rulemaking website can then be accessed by selecting "New Rulemaking Website." This site provides the ability to upload comments as files (any format), if your web browser supports that function. For information about the interactive rulemaking website, contact Ms. Carol Gallagher, telephone: 301-415-5905; e-mail: CAG@nrc.gov.

FOR FURTHER INFORMATION CONTACT: Donald P. Cleary, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone: 301-415-3903; e-mail: DPC@nrc.gov.

SUPPLEMENTARY INFORMATION:

Background

On June 5, 1996 (61 FR 28467), the Commission published in the Federal Register a final rule amending its environmental protection regulations in 10 CFR Part 51 to improve the efficiency of the process of environmental review for applicants seeking to renew a nuclear power plant operating license for up to an additional 20 years. The rulemaking was based on the analyses reported in NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” (May 1996). The rulemaking was initiated with the objective of improving the efficiency of the license renewal process drawing on the considerable experience of operating nuclear power reactors to generically assess many of the environmental impacts, to report the analyses and findings in NUREG-1437, and to codify the findings in the Commission’s environmental protection regulations so that repetitive reviews of those impacts that are well understood could be avoided. In the statement accompanying the final rule, the Commission stated that before the final rule became effective the Commission was seeking comments on the treatment of low-level waste storage and disposal impacts, the cumulative radiological effects from the uranium fuel cycle, and the effects from the disposal of high-level waste and spent fuel. A number of commenters argued that the requirements for the review of transportation of high-level waste in the rule were unclear with respect to (1) the use and legal status of 10 CFR 51.52, “Environmental effects of transportation of fuel and waste—Table S-4," in plant-specific license renewal reviews; (2) the conditions that must be met before an

applicant may adopt Table S-4; and (3) the extent to which the generic effects of transporting spent fuel to a high-level waste repository should be considered in a plant-specific license renewal review.

After considering the comments received on the rule, the Commission republished the rule in the Federal Register on December 18, 1996 (61 FR 66537). The rule at 10 CFR 51.53(c)(ii)(M) continued to require, "The environmental effects of transportation of fuel and waste shall be reviewed in accordance with 10 CFR 51.52." However, in accordance with comments received, added to that paragraph was the requirement that:

> The review of impacts shall also discuss the generic and cumulative impacts associated with transportation operation in the vicinity of a high-level waste repository site. The candidate site at Yucca Mountain should be used for the purpose of impact analysis as long as that site is under consideration for licensing.

Also in response to the comments, the Commission stated that:

> As part of its effort to develop regulatory guidance for this rule, the Commission will consider whether further changes to the rule are desirable to generically address: (1) The issue of cumulative transportation impacts and (2) the implications that the use of higher burn-up fuel have for the conclusions in Table S-4. After consideration of these issues, the Commission will determine whether the issue of transportation impacts should be changed to Category 1.[**]

[**] In NUREG-1437 and in the rule, Category 1 issues are those environmental issues for which the analysis and findings have been determined to be applicable to all nuclear power plants or to plants with specific types of cooling systems or other common plant or site characteristics. Absent new information that significantly changes the finding, these generic findings may be adopted in plant license renewal reviews. Category 2 issues are those environmental issues for which the analysis did not result in a finding common to all plants or to plants with common characteristics. Plant-specific reviews are required for Category 2 issues.

In SECY-97-279, dated December 3, 1997, the NRC staff informed the Commission that it was the NRC staff's preliminary view that the NRC staff's supplemental analyses of the generic and cumulative impacts of the transportation of HLW and of the implications of higher fuel burnup for transportation impacts support a reasonable technical and legal determination that transportation of HLW is a Category 1 issue and may be generically adopted in a license renewal application. The supplemental analyses are reported in NUREG-1437, Addendum 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplemental Analyses for Cumulative Environmental Impacts of Spent Nuclear Fuel Transport and Implications of Higher Burnup Fuel for the Conclusions in 10 CFR 51.52, 'Environmental Effects of Transportation of Fuel and Waste—Table S-4,' Draft for Comment," December 1998. In a Staff Requirements Memorandum (SRM) dated January 13, 1998, the Commission directed the NRC staff to proceed with rulemaking to amend 10 CFR 51.53(c)(3)(ii)(M) to categorize the impacts of transportation of high-level waste (HLW) as a Category 1 issue. In a memorandum dated July 1, 1998, the NRC staff informed the Commission of its plans for amending 10 CFR Part 51.

In that memorandum the NRC staff also proposed, as an administrative amendment, to add to the rule the requirement to include in license renewal reviews the environmental impacts of transportation on local services in the vicinity of the plant during the renewal term. This issue was identified as a Category 2 issue in NUREG-1437, Section 4.7.3.2 and the overall issue of transportation was designated as Category 2 in the rule (see 10 CFR Part 51, Appendix B, Table B-1, "Public Services, Transportation"). However, the specific issue of impacts on local services during the renewal term was inadvertently omitted from 10 CFR 51.53(c)(3)(ii)(J) and its inclusion in Table B-1 is not explicitly stated. This rule would correct that omission.

Proposed Action

Addendum 1 alters Section 6.3 and Table 9.1 of NUREG-1437 by supplementing the analysis, amending the findings, and changing the designation from Category 2 to Category 1 for the issue of transportation. These changes to NUREG-1437 would be codified in 10 CFR Part 51 by this rulemaking. Specifically, the requirement for an applicant to "discuss the generic and cumulative impacts associated with transportation operation in the vicinity of a high-level waste repository site" would be removed and the following language would be added:

> The environmental impacts presented in Summary Table S-4 of §51.52 may be adopted in individual nuclear power plant license renewal reviews as long as the candidate site at Yucca Mountain is under consideration for licensing. The contribution to impacts of transportation of higher enrichment and higher burnup fuel need be assessed only when the fuel to be used during the license renewal term is enriched to greater than 5 percent uranium-235 or average burnup for the peak rod will be greater than currently approved by the NRC up to 62,000 MWd/MTU. If the applicant anticipates exceeding these values for enrichment or burnup during the renewal term and has received or applied for a license amendment for the values anticipated and an environmental assessment has been prepared by the NRC, which considers transportation of that fuel to and from the reactor, then that environmental assessment may be cited in the renewal application and no further information is required.

An amendment to the rule is also proposed to correct the inadvertent omission of a requirement to consider possible increases in traffic in the vicinity of the plant during the license renewal term. This is a Category 2 issue as found in NUREG-1437.

Discussion

Introduction

The current regulations require applicants for license renewal to review the environmental effects of transportation of fuel and waste in accordance with 10 CFR 51.52, and to discuss the generic and cumulative impacts associated with transportation operation in the vicinity of the candidate high-level waste (HLW) repository site at Yucca Mountain (see 10 CFR 51.53(c)(3)(ii)(M)). However, the NRC staff has now assessed these generic and cumulative impacts. Because only Yucca Mountain has been identified as a potential HLW repository site, this analysis would be applicable to all license renewal applicants. The Commission proposes to codify this analysis. In addition, the NRC staff has generically considered the potential impacts of transporting higher enriched and higher burnup fuel than is currently covered in 10 CFR 51.52 and would codify these findings. Therefore, the Commission proposes to amend the rule to change the issue of transportation of fuel and waste from Category 2 to Category 1.

Cumulative Impacts in the Vicinity of Yucca Mountain

The analysis of potential cumulative health risks from radiation exposure and highway accidents associated with spent nuclear fuel transport within Clark County, Nevada is presented in NUREG-1437, Addendum 1.[***] For the purposes of this rulemaking to assess the potential

[***] Las Vegas and vicinity, Clark County, Nevada is taken to be "the vicinity of Yucca Mountain."

impacts of the transportation of spent fuel to a single repository at Yucca Mountain, it is assumed that all spent fuel generated by all commercial power reactors during both their initial 40-year operating license and a renewed operating term of 20 years will be disposed of at Yucca Mountain, a total of up to 126,000 metric ton heavy metal (MTHM).[****] Although a portion of the shipments of spent fuel are expected to be by rail, it is assumed that all shipments will be by truck. Truck transport will result in higher population doses than rail transport because of the greater number of shipments required and the proximity of highways to larger populations.

The analysis was designed to be conservative, that is, intentionally structured to overestimate the likely impacts. This approach is used in situations where the impacts are expected to be of little significance to avoid unproductive analytical effort and because it shows that the conclusions are robust.

In Addendum 1, analyses of potential radiation doses were performed using the HIGHWAY routing computer code and the RADTRAN 4 risk assessment computer code. The HIGHWAY code was used to generate population density estimates within 0.8 km [0.5 mile] of the highway routes that would be used for spent fuel transport within Clark County, Nevada. The code uses current and projected demographic data and data on existing and planned highways. Two highway scenarios were analyzed: the current freeway system and the proposed beltway around the city of Las Vegas. Because the beltway is expected to be complete before the year 2005 and because regulations require that spent fuel shipments avoid high population concentrations where possible, analysis of transportation on the route through downtown on the current interstate system yields higher exposure estimated than would actually occur. The RADTRAN 4 code was used to estimate potential radiation doses related to

[****] Currently, the U.S. Department of Energy is authorized by the Nuclear Waste Policy Act to dispose of up to 70,000 MTHM. Ninety percent (63,000 MTHM) of this material is expected to be spent nuclear fuel from commercial power reactors.

the SNF transport crew and the public from incident-free transport, and to the public from a potential transport accident with radiological releases. The calculations account for the estimated radiation levels per shipment, number of shipments, package dimensions, route distance within Clark County, vehicle speed, population densities along the routes and, for various accident scenarios, the radiological inventory, dispersibility, accident severity, probability of occurrence, and estimated radiological risk assessment for each scenario.

In Addendum 1, it is shown that estimated cumulative person-Sivert (Sv) [person-rem], of exposure and resulting estimated cumulative lifetime risk of fatal cancer (LRFC) that may result from the transportation of all commercially generated spent fuel through the Las Vegas area are extremely small. Assuming that the spent fuel generated during the current operating license term and a 20-year renewed term from all currently operating reactors is shipped on highways through Las Vegas, the cumulative radiation exposure is estimated to be 3.309 person-Sv [331 person-rem] for the truck crews, 1.27 person-Sv [127 person-rem] for the public, and 2.46 person-Sv [246 person-rem] for the public from transport accidents. These cumulative doses would be expected to result in cumulative LRFC of 0.13 for crews, 0.06 for the public, and 0.12 for the public from transport accidents. Far less than 1 fatal cancer within the population of Clark County, Nevada is estimated to be caused from transporting the spent fuel that could be generated over 60 years by all currently operating nuclear power plants.

For perspective, the natural incidence of lifetime fatal cancer in the U.S. is 0.20 [20 percent]. Assuming a Las Vegas population of about 300,000 and an average life expectancy of 70 years, this lifetime incidence of fatal cancer would correspond to about 900 LRFC/year. In the Las Vegas area, the average radiation exposures resulting from cosmic

and naturally occuring terrestial gamma radiation are 0.75 to 0.77 mSv/year [75 to 77 mrem/year]. [*****] Assuming a Las Vegas population of about 300,000, this natural radiation leads to a risk estimate of about 11 LRFC/year. The average annual excess risk to the Las Vegas area population from SNF transport is about 0.0031 LRFC/year which is a risk estimate of 3,000 times less than the estimate for background radiation and 300,000 times less than the normal incidence of fatal cancer.

The dose estimates currently displayed in the Table S-4 account for the total population exposed by the transport of both high-level and low-level waste for one reactor-year of operation. These estimates represent total population exposure from both high-level and low-level waste over the transportation routes from individual nuclear power plants to multiple destinations. The NRC staff has reviewed the documents reporting on the data and methods used to develop Table S-4 and finds that the environmental values contained therein continue to be valid. These documents are WASH-1238, “Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants” (December 1972 and NUREG-75/038, Supplement 1 to WASH-1238, “Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants Supplement 1" (April 1975).

An estimate of total cumulative dose can be developed from Table S-4 for comparison with the cumulative dose estimate in Addendum 1. It should be noted that the cumulative doses are comprised of annual doses to individuals that are well below the regulatory limits set by the NRC and the Department of Transportation. Multiplying the “per reactor-year” values in

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[*****] This outdoor dose rate estimate was provided by Harold L. Beck (Harold L. Beck, Director, Environmental Sciences Division, Environmental Measurements Laboratory, U.S. Department of Energy, New York, personal communication via electronic mail to Alan k. Roecklein, NRC, Rockville, Md., Nov. 4, 1998) and based on extensive background radiation measurements summarized, in part, in NCPP Report No. 94, *Exposure of the Population in the United States and Canada from Natural Background Radiation,* National Council on Radiation Protection and Measurements, Bethesda, Md. Dec. 30, 1987.

Table S-4 X 100 reactors X 60 years of operation gives a total cumulative dose of 240 person-Sv [24,000 person-rem] to transportation workers and 180 person-Sv [18,000 person-rem] to the general public. The total cumulative dose during incident-free transport that transport crews would receive while within Clark County is then about 1 percent of the total cumulative dose received by all exposed transportation workers estimated from Table S-4. In addition, the total cumulative dose during incident-free transport that the general public within Clark County would receive is also less than 1 percent of the total cumulative dose received by the exposed population nationwide estimated from Table S-4. The NRC estimates that the cumulative dose of 2.46 person-Sv [246 person-rem] to the public from accidents for the Las Vegas area translates into 0.12 LRFC, which is a small fraction (1/100,000) of the annual risk from natural background radiation to the general population.

Addendum 1 also addresses nonradiological risk of vehicle accidents. On the bases of national truck accident statistics, about 0.035 traffic fatality can be expected on Las Vegas area highways from transport of all spent fuel generated from current operation and operation during renewed license. This adds little to the total of 60 traffic fatalities that can be derived from the data in Table S-4: 1 fatal injury in 100 reactor years X 60 years of operation per reactor.

Implications of Higher Burnup Fuel

The environmental consequences of incremental increases in the burnup of fuel and the associated use of higher enrichment fuel are discussed in Section 6.2.3 of NUREG-1437. Section 6.2.3 addresses the sensitivity of the data presented in Table S-3 and Table S-4 to the growing use of higher enriched fuel and higher fuel burnup. Table S-3 summarizes natural resource use and effluents to the environment for the uranium fuel cycle, from mining to

ultimate disposal of spent fuel. The discussion of the implications for the environmental impact data reported in Table S-4 was not repeated or referenced, as it should have been, in Section 6.3, which addresses the incremental impacts of license renewal on the transportation of fuel and radioactive materials to and from nuclear power plants. Addendum 1 and this proposed rule clarify the public record regarding the NRC findings on the sensitivity of values in Table S-4 to the use of higher enrichment fuel and extended fuel burnup.

NUREG-1437 and Addendum 1 draw heavily on existing studies of the environmental impacts of the use of higher enriched fuel and higher fuel burnup. The analysis in Section 6.2.3 of NUREG-1437 relies heavily on NUREG/CR-5009, "Assessment of the Use of Extended Burnup Fuel in Light Water Power Reactors" (February 1988). Addendum 1 considers other available studies that may supplement the information in NUREG-1437. These other studies include NUREG/CR-2325, "The Transportation of Radioactive Material (RAM) to and from U.S. Nuclear Power Plants, Draft Environmental Assessment" (December 1983); an Atomic Industrial Forum study, AIF/NE SP-032, "The Environmental Consequences of Higher Fuel Burnup" (June 1985); "Extended Burnup Fuel Used in Commercial LWRs; Environmental Assessment and Finding of No Significant Impact" (53 FR 6040), February 29, 1988; and "NRC Assessment of the Environmental Effects of Transportation Resulting From Extended Fuel Enrichment and Irradiation" (53 FR 30355), August 11, 1988.

These studies have assessed the environmental impacts associated with fuel enrichment up to 5 percent uranium-235 and fuel burnup to 60,000 MWd/MTU. The findings have been robust. During the 1990s, the NRC has reviewed and approved vendor topical reports requesting approval for higher burnup rates. Approved average burnup for the peak rod now range from 50,000 MWd/MTHM to 62,000 MWd/MTHM. The higher burnup rates are associated with uranium-235 enrichment levels of up to 5 percent by weight. These studies

support the finding that the impacts attributable to higher burnup and enrichment of fuel are no greater than and likely less than the impacts currently in 10 CFR 51.52(c), "Summary Table S-4—Environmental Impact of Transportation of Fuel and Waste to and From One Light-Water-Cooled Nuclear Power Reactor." The analysis in Section 6.2.3 of NUREG-1437 as supplemented by Addendum 1 is consistent with the staff assessment of the environmental effects of transportation resulting from extended fuel enrichment and irradiation presented in 53 FR 30355. This conclusion is applicable to any nuclear power plant license renewal application.

Finding of No Significant Environmental Impact: Availability

The NRC has determined that this proposed rule is the type of action described as a categorical exclusion in 10 CFR 51.22(c)(3). Therefore, neither an environmental impact statement nor an environmental assessment has been prepared for this regulation. This action is procedural in nature and pertains only to the type of environmental information to be reviewed.

Paperwork Reduction Act Statement

This proposed rule decreases the overall burden on licensees by eliminating the requirement that the license renewal applicants address the generic and cumulative environmental impacts associated with transportation operation in the vicinity of a high-level

waste (HLW) repository site (-400 hours, -2 responses), and adds a new requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term (+20 hours, +2 responses). The public burden for these information collections is estimated to average a reduction of 200 hours for each of 2 responses for the elimination of the above mentioned requirement, and an increase of 10 hours for each of 2 responses for the new requirement, for a net burden reduction of 380 hours. Because the burden for this information collection is insignificant, Office of Management and Budget clearance is not required. Existing requirements were approved by the Office of Management and Budget, approval number 3150-0021.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Regulatory Analysis

The regulatory analysis prepared for the final rule published on June 5, 1996 (61 FR 28467) and amended on December 18, 1996 (61 FR 66537) to make minor clarifying and conforming changes and add language unintentionally omitted from the June 5, 1996 rule, is unchanged except for an increase in benefits derived from a reduction in the applicant burden

of 190 hours of effort in preparing an application for renewal of a nuclear power plant operating license.

This change increases the substantial cost saving of the final rule estimated in NUREG-1440. NUREG-1440 is available for inspection in the NRC Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC. In addition, copies of NRC final documents cited here may be purchased from the Superintendent of Documents, U.S. Government Printing Office, PO Box 37082, Washington, DC 20013-7082. Copies are also available for purchase from the National Technical Information Service, 5285 Port Royal, Springfield, VA 22161.

Regulatory Flexibility Act Certification

As required by the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)), the Commission certifies that this proposed rule will not have a significant impact on a substantial number of small entities. The proposed rule would reduce the amount of information to be submitted by nuclear power plant licensees to facilitate NRC's obligations under the National Environmental Policy Act. Nuclear power plant licensees do not fall within the definition of small businesses as defined in Section 3 of the Small Business Act (15 U.S.C. 632) or the Commission 's Size Standards, April 11, 1995 (60 FR 18344).

Backfit Analysis

The NRC has determined that these amendments do not involve any provisions that would impose backfits as defined in 10 CFR 50.109(a)(1); therefore, a backfit analysis need not be prepared.

List of Subjects in 10 CFR Part 51

Administrative practice and procedure, Environmental impact statement, Nuclear materials, Nuclear power plants and reactors, Reporting and recordkeeping requirements.

For the reasons set out in the preamble to this notice and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; the National Environmental Policy Act of 1969, as amended; and 5 U.S.C. 552 and 553, the NRC is adopting the following amendments to 10 CFR Part 51.

PART 51--ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS

1. The authority citation for Part 51 continues to read as follows:

AUTHORITY: Sec. 161, 68 Stat. 948, as amended, Sec. 1701, 106 Stat. 2951, 2952, 2953 (42 U.S.C. 2201, 2297f); secs. 201, as amended, 202, 88 Stat. 1242, as amended, 1244 (42 U.S.C. 5841, 5842).

Subpart A also issued under National Environmental Policy Act of 1969, secs. 102, 104, 105, 83 Stat. 853-854, as amended (42 U.S.C. 4332, 4334, 4335); and Pub. L. 95-604, Title II, 92 Stat. 3033-3041; and sec.193, Pub. L. 101-575, 104 Stat. 2835, (42 U.S.C. 2243). Sections 51.20, 51.30, 51.60, 51.61, 51.80, and 51.97 also issued under secs. 135, 141, Pub. L. 97-425, 96 Stat. 2232, 2241, and sec. 148, Pub. L. 100-203, 101 Stat. 1330-223 (42 U.S.C. 10155,

10161, 10168). Section 51.22 also issued under sec. 274, 73 Stat. 688, as amended by 92 Stat. 3036-3038 (42 U.S.C. 2021) and under Nuclear Waste Policy Act of 1982, sec. 121, 96 Stat. 2228 (42 U.S.C. 10141). Sections 51.43, 51.67, and 51.109 also issued under Nuclear Waste Policy Act of 1982, sec. 114(f), 96 Stat. 2216, as amended (42 U.S.C. 10134(f)).

2. Section 51.53, paragraphs (c)(3)(ii)(J) and (M) are revised to read as follows:

§ 51.53 Postconstruction environmental reports.

* * * * *

(c) * * *

(3) * * *

(ii) * * *

(J) All applicants shall assess the impact of the proposed project on local transportation during periods of license renewal refurbishment activities and during the term of the renewed license.

(M) The environmental impacts presented in Summary Table S-4 of §51.52 may be adopted in individual nuclear power plant license renewal reviews as long as the candidate site at Yucca Mountain is under consideration for licensing. The contribution to impacts of transportation of higher enrichment and higher burnup fuel need be assessed only when the

fuel to be used during the license renewal term is enriched to greater than 5 percent uranium-235 or average burnup for the peak rod will be greater than currently approved by the NRC up to 62,000 MWd/MTU. If the applicant anticipates exceeding these values for enrichment or burnup during the renewal term and has received or applied for a license amendment for the values anticipated and an environmental assessment has been prepared by the NRC, which considers transportation of that fuel to and from the reactor, then that environmental assessment may be cited in the renewal application and no further information is required.

* * * * *

3. The Transportation issue under the Uranium Fuel Cycle and Waste Management Section of Table B-1, Appendix B to Subpart A to 10 CFR Part 51 is revised to read as follows:

Table B-1.—Summery of Findings on NEPA Issues for License Renewal of Nuclear Power Plants[1]

* * * * *

Uranium Fuel Cycle and Waste Management

Issue	Category	Findings
Transportation	1	SMALL. Cumulative impacts of transporting high-level waste to a single repository site at Yucca Mountain, Nevada and the impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU are found to not appreciably change the impact values contained in 10 CFR 51.52(c), Summary Table S-4—Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. See §51.53(c)(3)(ii)(M).

[1] Data supporting this table are contained in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996) and NUREG-1437, Addendum 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplemental Analysis for Cumulative Environmental Impacts of Spent Nuclear Fuel Transport and Implications of Higher Burnup Fuel for the Conclusions in 10 CFR 51.52, 'Environmental Effects of Transportation of Fuel and Waste—Table S-4'" (December 1998).

Dated at Rockville, Maryland, this __ day of _____ 1998.

For the Nuclear Regulatory Commission.

John C. Hoyle,
Secretary of the Commission.

[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

RIN 3150-AG05

Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, Availability of Supplemental Environmental Impact Statement

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice of availability.

SUMMARY: The Nuclear Regulatory Commission (NRC) is announcing the completion and availability of NUREG-1437, Addendum 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplemental Analyses for Cumulative Environmental Impacts of Spent Nuclear Fuel Transport and Implications of Higher Burnup Fuel for the Conclusions in 10 CFR 51.52, 'Environmental Effects of Transportation of Fuel and Waste—Table S-4,' Draft for Comment" (December 1998).

DATES: Submit comments by (insert date 60 days after publication in the Federal Register). Comments received after this date will be considered if it is practical to consider them, but the Commission is able to ensure consideration only for comments received on or before this date.

ADDRESSES: Comments may be sent to: Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemakings and Adjudications Staff, Mail Stop O16C1.

Deliver comments to: One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 a.m. and 4:15 p.m. on Federal workdays.

Copies of comments received may be examined at: NRC Public Document Room, 2120 L Street, NW. (Lower Level), Washington, DC.

You may also submit comments via the NRC's interactive rulemaking website through the NRC home page (http://www.nrc.gov). From the home page, select "Rulemaking" from the tool bar. The interactive rulemaking website can then be accessed by selecting "New Rulemaking Website." This site provides the ability to upload comments as files (any format), if your web browser supports that function. For information about the interactive rulemaking web site, contact Ms. Carol Gallagher, telephone: 301-415-5905; e-mail cag@nrc.gov.

FOR FURTHER INFORMATION CONTACT: Donald P. Cleary, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone: 301-415-3903; e-mail: dpc@nrc.gov.

SUPPLEMENTARY INFORMATION:

Background

On June 5, 1996 (61 FR 28467), the Commission published in the Federal Register a final rule amending its environmental protection regulations, 10 CFR Part 51, to improve the efficiency of the process of environmental review for applicants seeking to renew a nuclear power plant operating license for up to an additional 20 years. The amendment is based on the analyses reported in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996). The rulemaking was initiated with the objective of improving the efficiency of the license renewal process drawing on the considerable experience of operating nuclear power reactors to generically assess many of the environmental impacts,

to report the analyses and findings in NUREG-1437, and to codify the findings in the Commission's environmental protection regulations so that repetitive reviews of those impacts that are well understood could be avoided. In 61 FR 28467, the Commission stated that before the final rule became effective, the Commission was seeking comments on (1) the treatment of low-level waste storage and disposal impacts, (2) the cumulative radiological effects from the uranium fuel cycle, and (3) the effects from the disposal of high-level waste and spent fuel.

After considering the comments received on the rule, the Commission published the rule with minor nonsubstantive changes in the Federal Register on December 18, 1996 (61 FR 66537). In response to comments, the Commission stated that:

> As part of its effort to develop regulatory guidance for this rule, the Commission will consider whether further changes to the rule are desirable to generically address: (1) The issue of cumulative transportation impacts and (2) the implications that the use of higher burn-up fuel have for the conclusions in Table S-4. After consideration of these issues, the Commission will determine whether the issue of transportation impacts should be changed to Category 1.

In NUREG-1437 and in the rule, Category 1 issues are those environmental issues for which the analysis and findings have been determined to be applicable to all nuclear power plants or to plants with specific types of cooling systems or other common plant or site characteristics. Absent new information that significantly changes the finding, these generic findings may be adopted in plant license renewal reviews. Category 2 issues are those environmental issues for which the analysis did not result in a finding common to all plants or to plants with common characteristics. Plant-specific reviews are required for Category 2 issues.

The NRC staff has completed analyses of these topics as reported in NUREG-1437, Addendum 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplemental Analyses for Cumulative Environmental Impacts of Spent Nuclear Fuel Transport and Implications of Higher Burnup Fuel for the Conclusions in 10 CFR 51.52, 'Environmental Effects of Transportation of Fuel and Waste—Table S-4,' Draft for Comment" (December

1998). Addendum 1 provides the bases for designating transportation of high-level waste a Category 1 issue. Addendum 1 would supplement the analysis and amend the findings and the Category 2 category designation for the issue of Transportation in Section 6.3 and Table 9.1 of NUREG-1437. These amendments to NUREG-1437 would be codified in 10 CFR Part 51.

Dated at Rockville, Maryland, this __ day of _____ 1998.

For the Nuclear Regulatory Commission.

_____
John C. Hoyle,
Secretary of the Commission.

NUREG-1437
Vol. 1, Addendum 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Main Report
Section 6.3—Transportation
Table 9.1 Summary of findings on NEPA issues for license
renewal of nuclear power plants

Draft Report for Comment

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

NUREG-1437
Vol. 1, Addendum 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Main Report
Section 6.3—Transportation
Table 9.1 Summary of findings on NEPA issues for license
renewal of nuclear power plants

Draft Report for Comment

Manuscript Completed: November 1998
Date Published: December 1998

Division of Reactor Program Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ABSTRACT

This supplement to NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* documents the staff's analysis of the potential cumulative impacts to human health of transporting spent nuclear fuel in the vicinity of the proposed Yucca Mountain high-level waste repository.

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ACRONYMS AND ABBREVIATIONS

CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EIS	environmental impact statement
Fed. Regist.	*Federal Register*
ft	foot
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GWd	gigawatt-days
km	kilometer
lb	pound
LRFC	lifetime risk of fatal cancer
m	meter
mrem	millirem
mSv	millisievert
MTHM	metric tons of heavy metal (a conventional unit for high-level nuclear waste)
MT	metric ton [i.e., 1000 kilograms (about 2200 pounds)]
MTU	metric tons uranium
MWd	megawatt-days
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
SNF	spent nuclear fuel
Sv	sievert

1. INTRODUCTION

1.1 PURPOSE OF THE SUPPLEMENT

This Supplement to NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) addresses two aspects of high-level waste transportation that were not adequately addressed in the GEIS: (1) cumulative impacts of transportation of high-level radioactive waste in the vicinity of the proposed repository at Yucca Mountain, Nevada, and (2) the impacts of transporting higher-burnup fuel. These issues are currently designated as Category 2 in 10 CFR Part 51.53(c)(3)(ii)(M) and Table B-1 of Subpart A, Appendix B of Part 51. Designation of an issue as Category 2 requires that it be evaluated in each license renewal application. Currently, therefore, the environmental impacts of the transportation of fuel and waste must be reviewed in each renewal application, creating the potential for repetitive reviews among those applications. Designating an issue as Category 1 provides the basis for codification of the findings in 10 CFR Part 51 and adoption of the findings in individual license renewal reviews, with no further analysis required. This Supplement provides an assessment that supports changing the transportation impacts in 10 CFR 51 and Table B-1 from Category 2 to Category 1.

1.2 BACKGROUND

The purpose of the GEIS was to provide the technical basis for an amendment to the Nuclear Regulatory Commission's (NRC's) regulations at 10 CFR Pt. 51 (*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*), with regard to the renewal of nuclear power plant operating licenses. The final rule, *Environmental Review for Renewal of Nuclear Power Plant Operating Licenses*, which amends 10 CFR Pt. 51, was published in the *Federal Register* on Dec. 18, 1996 (61 *Fed. Regist.* 66537) and codified the findings reported in NUREG-1437. The rule amendment and the GEIS analysis were initiated with the objective of improving the efficiency of the license renewal process by documenting in the GEIS and codifying in the Commission's regulations those environmental impacts that are well understood so that repetitive reviews of those impacts could be avoided.

Chapter 6 of the GEIS addresses the environmental impacts associated with the management of radiological and nonradiological wastes resulting from license renewal. Section 6.3, "Transportation," addresses the environmental impacts resulting from the shipment of (1) low-level radioactive waste and mixed waste to off-site disposal facilities, (2) fresh fuel to the plant, and (3) spent nuclear fuel (SNF) from the plant to a monitored retrievable storage facility or permanent repository. Section 6.3 also provides an assessment of the applicability to license renewal of 10 CFR 51.52 "Environmental Effects of Transportation of Fuel and Waste—Table S-4." In Section 6.3.4, the NRC concluded that "The environmental impacts from the transport of fuel and waste attributable to license renewal are found to be small when they are within the range of impact parameters identified in Table S-4."

However, it was assumed in developing the data in Table S-4 that SNF would be shipped to a number of destinations rather than a single repository. Therefore, Table S-4 does not explicitly take into account the cumulative environmental impacts of the convergence of high-level

waste shipments on a proposed repository at Yucca Mountain. This Supplement provides that explicit consideration. Further, although the environmental implications of the use of more highly enriched fuel and of a higher burnup than is considered in 10 CFR 51.51 (Table S-3) and in 10 CFR 51.52 (Table S-4) is assessed in the GEIS in Section 6.2.3, that section focuses on Table S-3 and not on Table S-4. The analysis and conclusions relative to Table S-4 presented in Section 6.2.3 are not referenced in the assessment of transportation, Section 6.3. This Supplement corrects that omission and expands the GEIS discussion of the use of more highly enriched fuel and higher burnup.

This Supplement to NUREG-1437 and the rulemaking that it supports were anticipated at the time of the final rule published on Dec. 18, 1996. The Commission stated,

> "As part of its efforts to develop regulatory guidance for this rule, the Commission will consider whether further changes to the rule are desirable to generically address: (1) The issue of cumulative transportation impacts and (2) the implications that the use of higher burn-up fuel have for the conclusions in Table S-4. After consideration of these issues, the Commission will determine whether the issue of transportation impacts should be changed to Category 1" (64 *Fed. Regist.* 66538).

2. CUMULATIVE IMPACTS OF TRANSPORTATION

2.1 BACKGROUND

The generation of SNF at power reactors and its on-site and off-site storage is addressed in Section 6.4.6 "Spent Fuel" of the GEIS. The contribution of license renewal to the inventory of SNF is discussed in Section 6.4.6.2 "Effects of License Renewal." The environmental impacts of transporting the SNF to a monitored retrievable storage facility or to a permanent repository are addressed in Section 6.3, "Transportation," of the GEIS.

The Nuclear Waste Policy Act of 1982 (NWPA) gave the U.S. Department of Energy (DOE) the responsibility for finding a site for disposal of commercial SNF and other high-level waste, and for building and operating an underground disposal facility called a geologic repository. In 1987, Congress amended the NWPA and directed DOE to study only Yucca Mountain. Congress instructed DOE that if at any time Yucca Mountain was found to be unsuitable, studies would be stopped, the site would be restored, and DOE would seek new direction from Congress. DOE is in the process of preparing an environmental impact statement (EIS) for a repository at Yucca Mountain, Nevada. After the EIS process is completed and assuming the facility receives a license from NRC, it is anticipated that construction of the repository would begin. When construction is completed, SNF and high-level waste would be shipped to the site, beginning with the oldest materials.

Under the NWPA as amended, any NRC license for the repository must prohibit DOE from disposing of more than 70,000 metric tons of heavy metal (MTHM) in the repository until a second repository is in operation. Ninety percent (63,000 MTHM) of this material is expected to be SNF from commercial nuclear power plants. The first repository will accommodate the SNF generated through about the year 2010. Unless larger capacity is authorized for the first repository, a second repository will be required for the SNF generated by plants that are operating under their initial operating licenses. Whether a second repository would have an authorized capacity large enough to accommodate the SNF generated by plants with renewed operating licenses cannot be known at this time. Although there is a potential for SNF generated as a result of license renewal to be placed in a second and third repository, this analysis of cumulative effects of transportation assumes that all the SNF resulting from the initial 40-year operating licenses and the 20-year renewal licenses will be transported to the first repository (i.e., a repository at Yucca Mountain currently under study). Further, it is assumed in this analysis that all shipments of SNF converge on and are moved through Clark County, Nevada.

2.2 APPROACH

The analysis estimates the potential cumulative health risk from radiation exposure and highway accidents associated with SNF transport in the vicinity of Las Vegas (Clark County), Nevada. Cumulative health risks are the total potential fatalities within the Clark County population over the period of shipment of SNF. Analyses of the radiation doses related to SNF transport in the Las Vegas vicinity were performed using the HIGHWAY routing computer code and the RADTRAN 4 risk assessment computer code (see Appendix). Radiation exposures are reported as collective dose to a population (person-mSv [person-rem]) and the dose to the maximally exposed individual (mSv [mrem]). Health risks from exposure to radiation are reported as estimated lifetime risk of fatal cancer (LRFC) resulting from accident free transportation of SNF and from highway accidents involving potential radiation releases. Expected fatalities from truck accidents not involving radiation releases are also reported.

The NAS report (1990, Table 4-2), commonly called the BEIR V report, gives estimates of the number of cancer deaths expected to occur from a continuous exposure of 10 mSv/year [1 rem/year] above background from age 18 until age 65. This value results in a risk factor of 4.0×10^{-2} LRFC per person-Sv [4.0×10^{-4} LRFC per person-rem] that is most applicable to occupational exposures. The BEIR V report also estimates the number of cancer deaths expected to occur from a continuous lifetime exposure of 1 mSv/year [0.1 rem/year] above background, which results in a risk factor of 5.0×10^{-2} LRFC per person-Sv [5.0×10^{-4} LRFC per person-rem] that is most applicable to exposures of the general public. Note that the general public LRFC risk factor is slightly higher than the occupational risk factor because the general public dose is assumed to be experienced by people of all ages while the occupational exposures are assumed to be experienced only by people from age 18 until age 65. Children and adolescents are presumed to be more susceptible to radiation-induced health effects than adults.

The analysis was designed to be conservative, that is, intentionally structured to overestimate the likely impacts. This approach is used in situations where the impacts are expected to be of little significance to avoid unproductive analytical effort and because it shows that

the conclusions are very robust. The other side of conservative analysis is that it may lead the casual reader to the impression that the expected impacts are larger than could actually occur. To avoid such confusion, the conservative nature of that analysis is emphasized in the reminder of this section.

For purposes of this analysis, it is assumed that all SNF will be shipped by truck and that the trucks will be routed on interstate highways to the maximum possible extent, consistent with the U.S. Department of Transportation regulations for highway route controlled quantities of nuclear materials (49 CFR 397.101). Rail transport of SNF is also anticipated. However, rail transport would have smaller risks than truck transport (Dyer and Reich 1993). Evaluation of cumulative impacts in the vicinity of Las Vegas carried out in this analysis, therefore, represents an upper bound because it assumes all SNF would move by truck rather than by rail or a combination of rail and truck to reach the repository.

The regulations governing allowable radiation levels during transport of radioactive materials are found at 49 CFR 173.441 and 10 CFR 71.47. Those regulations require, in part, that the external radiation level be no more than 0.10 mSv/hour [10 mrem/hour] at any point 2 m [6.6 ft] from the outer surface of the vehicle. This analysis used the conservative assumption that the radiation level would be 0.10 mSv/hour [10 mrem/hour] at all points 1 m [3.3 ft] from the surface. This assumption corresponds to a radiation level of about 0.07 mSv/hour [7 mrem/hour] at all points 2 m [6.6 ft] from the surface.[******]

Because shipment must be designed so that radiation levels do not exceed 0.10 mSv/hour [10 mrem/hr] at any point 2 m [6.6 ft] from the surface, average radiation levels must be much lower. Consequently, the assumption that the radiation level is 0.07 mSv/hour [7 mrem/hour] at all points 2 m [6.6 ft] from the surface, is conservative and actual average radiation levels are expected to be much lower than 0.07 mSv/hour [7 mrem/hour] at 2 m [6.6 ft] assumed in this analysis.

To examine the effects of license renewal, the staff used two estimates of SNF that would be transported to the repository. The first was based on the assumption that no nuclear plants have their licenses renewed, and the second was based on the assumption that all existing nuclear plants operate through a 20-year license renewal period. The assumption used for the second estimate is conservative because some plant owners have already decided not to request renewal of plant operating licenses.

As noted above, the NWPA prohibits DOE from accepting more than 70,000 MTHM at the Yucca Mountain repository. Based on this limit, DOE estimates 37,639 truck shipments of SNF to Yucca Mountain, assuming all SNF travels by truck in legal-weight casks (K. Skipper, Yucca Mountain Site Office, personal communication to D. P. Cleary, NRC, July 11, 1997). The Nuclear Waste Technical Review Board (1997) estimates that by the time the currently operating nuclear plants terminate

[******] The exact wording of the relevant requirement of §71.47(b) is that ... "radiation levels for such shipment must not exceed the following during transportation" ... "(3) 0.1 mSv/h (10 mrem/h) *at any point* 2 meters (80 in) from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle); or in the case of a flat-bed style vehicle, *at any point* 2 meters (6.6 feet) from the vertical planes projected by the outer edges of the vehicle (excluding the top and underside of the vehicle)." [Emphasis added]

operations (assuming no license renewal), about 85,000 MTHM of SNF will have been generated.

For this analysis, the staff assumed that all current and committed SNF, about 84,000 MTHM, would be disposed of at Yucca Mountain.[*******] Scaling DOE's estimated number of shipments with the amount of SNF leads to an estimate of 50,185 truck shipments without license renewal. Assuming all plants renew their licenses and operate for an additional 20 years, the estimate increases to 75,278 truck shipments.

Construction has begun on a beltway that would extend around much of Las Vegas. Two transportation route scenarios were analyzed: SNF is transported on the current freeway system, and SNF is transported on the proposed beltway. Because the beltway is expected to be complete before 2005 and because regulations require that spent fuel shipments avoid high population concentrations where possible, analysis of transportation on the route through downtown on the current interstate system yields higher exposure estimates than would actually occur.

The affected population is assumed to be those residents of Clark County, Nevada, who live within 0.8 km [0.5 mile] of the route followed by the trucks transporting SNF. Because doses fall off quickly with distance from the route, persons close to the route receive and account for much more of the population dose than those who live away from it. The contributions to population doses contributed by exposures to persons living more than 0.8 km [0.5 mile] from the route is negligible. The population density estimates were produced by the HIGHWAY computer code (Joy and Johnson 1983) based on 1990 census data. Because the action would occur over 40 to 60 years, population growth in Clark County is expected. For the purpose of this analysis, population densities in downtown urban areas and existing suburban areas are assumed to remain constant. Population growth is assumed to occur by development of the outlying areas; the population densities in the vicinity of the proposed beltway are assumed to be similar to those of other urban and suburban areas of Las Vegas.

2.3 CUMULATIVE HEALTH RISKS

Health risks associated with SNF transport include both those associated with radiation exposures and those associated with the movement of heavy trucks carrying SNF through the area (i.e., traffic accidents).

2.3.1 Radiological Risks

Radiation exposures can occur in two ways—exposure to radiation emitted by the SNF cask during normal (incident-free) transport and exposures in the event of an accident that leads to release of radioactive materials. For incident-free transportation, the staff used the RADTRAN computer model to calculate total body doses to the transport crew and the general population. The radiation source is characterized for RADTRAN by the radiation dose rate at 1 m from the package surface. The regulatory limit is 0.10 mSv/hour [10 mrem/hour] at 2 m [6.6 ft] from the vehicle or container surface (10 CFR 71.47). The rate of 0.10 mSv/hour [10 mrem/hour] at 1 m [3.3 ft] (which corresponds to about 0.07 mSv/hour [7 mrem/hour] at 2 m [6.6 ft]) was assumed because most shipments are not expected to be close to the regulatory limit, so the

[*******] Although this estimate exceeds the 70,000 MTHM limit in the first repository in the NWPA, it represents a conservative assumption (i.e., an overestimate) that would define an upper bound of potential impact for a repository at Yucca Mountain.

average dose rate was assumed to be lower than the regulatory limit.[********]

Potential radiological accident effects include both acute fatalities resulting from very high radiation exposures (as might occur in the unlikely event of failure of an SNF shipping container or cask), and the LRFC resulting from smaller radiation exposures that occur at the time of or after the hypothetical accident. Accident risk is estimated by summing the product of estimated dose and the associated probability of occurrence for each of the accident-severity categories analyzed by RADTRAN.

The expected population doses estimated by the staff (see Appendix) are displayed in Table 1. Table 2 shows the health risks implied by the doses listed in Table 1. An examination of Table 2 shows that the probability of excess fatal cancer among the public as a result of the entire campaign of SNF transport in the Las Vegas area is less than 0.2E-1 (0.2) for all scenarios. The sum of incident-free and accident risks is 0.1865E-1 (0.1865) LRFC for the city-route-with-license-renewal scenario; other scenarios have lower estimated risks.

For perspective, the natural incidence of lifetime fatal cancer in the U.S. is 0.20 [20 percent]. Assuming a Las Vegas population of about 300,000 and an average life expectancy of 70 years, this lifetime incidence of fatal cancer would correspond to about LRFC/year. In the Las Vegas area, the average radiation exposures resulting from cosmic and naturally occuring terrestrial gamma radiation are 0.75 to 0.77 mSv/year [75 to 77 mrem/year].[*********] Assuming a Las Vegas population of about 300,000, this natural radiation leads to a risk estimate of about 11 LRFC/year. The average annual excess risk to the Las Vegas area population from SNF transport is about 0.0031 LRFC/year which is a risk estimate of 3,000 times less than the estimate for background radiation and 300,000 times less than the normal incidence of fatal cancer.

[********]The regulations at 10 CFR 71.47 also limit dose rate at any point on the outer surface of the package or vehicle to 2.0 mSv/hour [200 mrem/hour]. Doses rates at most parts of the surface would necessarily be much lower than 200 mrem/hour in order to meet the 0.10 mSv/hour [10-mrem/hour] at 2 m [6.6 ft] limit. To be exposed to a dose rate this high, an individual would have to be in contact with the package at its most radioactive spot. To receive a significant dose, an individual would have to lie in contact with the container at its most radioactive spot for a substantial time period. It is very unlikely that an individual would spend any time in physical contact with the package and even more unlikely that he or she would inadvertently choose the most radioactive spot on the package. Because such an occurrence is so unlikely, this exposure scenario is not considered relevant to analysis of cumulative impacts.

[*********] This outdoor dose rate estimate was provided by Harold L. Beck (Harold L. Beck, Director, Environmental Sciences Division, Environmental Measurements Laboratory, U.S. Department of Energy, New York, personal communication via electronic mail to Alan K. Roecklein, NRC, Rockville, Md., Nov. 4, 1998) and based on extensive background radiation measurements summarized, in part, in NCRP Report No. 94, *Exposure of the Population in the United States and Canada from Natural Background Radiation*, National Council on Radiation Protection and Measurements, Bethesda, Md., Dec. 30, 1987.

Table 1. Estimated cumulative radiation exposure resulting from SNF transport in the Las Vegas area [a]

Radiation exposure (person-Sv)[b]		
Incident-free transport		Transport accidents
Crew [c]	Public [d]	Public
Bypass without license renewal		
2.068	0.58	0.338
Bypass with license renewal		
3.102	0.87	0.506
City route without license renewal		
2.206	0.85	1.63
City route with license renewal		
3.309	1.27	2.46

[a] Transportation risks were calculated using RADTRAN (v. 4.0.19, Nov. 14, 1996).
[b] 1 person Sv = 100 person-rem.
[c] Truck crew size was assumed to be 2 persons. Crew dose is for the time spent driving approximately 161 km (100 miles) in the Las Vegas area; the dose involved in driving to the Las Vegas area is not included.
[d] The incident-free risk to the public does not include the risk to the crew.

Table 2. Cumulative radiological transportation risks resulting from SNF transport in the Las Vegas area [a]

Estimated lifetime risk of fatal cancer [b]		
Incident-free risk		Accident risk
Crew [c]	Public [d]	Public
Bypass without license renewal		
0.0827	0.0290	0.0169
Bypass with license renewal		
0.1241	0.0435	0.0253
City route without license renewal		
0.0882	0.0425	0.0815
City route with license renewal		
0.1324	0.0635	0.123

[a] Transportation risks were calculated using RADTRAN (v. 4.0.19, Nov. 14, 1996).
[b] For crew members, the dose conversion factor was 0.0004 estimated lifetime risk of fatal cancer (LRFC) per person-rem, and for the public, 0.0005 LRFC per person-rem. The U.S. average lifetime risk of fatel cancer from all causes is approximately 0.20.
[c] Truck crew size was assumed to be 2 persons. Crew risk is for the time spent driving approximately 161 km (100 miles) in the Las Vegas area; the risk involved in driving to the Las Vegas area is not included.
[d] The incident-free risk to the public does not include the risk to the crew.

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The highest estimated risk to the crews is 0.2324 LRFC. This already-small risk is spread over the 40- to 60-year period during which SNF will be transported to the repository. On an annual basis, the crew risk averages about 0.0039 LRFC per year of SNF transport as a result of radiation exposures. This risk is spread among all the truck crew members, so the risk to any one driver is extremely small.

The hypothetical maximally exposed individual would receive 0.31 mSv [31 mrem] for a 60-year campaign, about 0.12 percent of the average 70-year dose from background sources.********** The maximally exposed individual radiation dose is based on a hypothetical individual located 30 m [98 ft] from the highway during the entire shipment campaign (a very conservative assumption). This dose is the estimated risk from incident-free transport. The analysis overestimates impacts by assuming that all licensed nuclear power plants would operate for a 20-year license renewal term, although many plants will not renew their operating licenses. Also, if another repository were established, the already small effects on Las Vegas would be further reduced.

The above estimates of radiation dose are consistent with the doses reported in Table S-4. Table S-4 reports estimates of 0.04 person-Sv [4 person-rem] per reactor year for transportation workers, and 0.03 person-Sv [3 person-rem] per reactor year for the general public. Assuming that 100 power reactors operate for 60 years, Table S-4 leads to estimated worker and public doses of 240 person-Sv [24,000 person-rem] and 180 person-Sv [18,000 person-rem] for transportation workers and the general public, respectively. Comparing these dose estimates with the highest corresponding doses in Table 1 shows that the estimated cumulative dose from transportation of all SNF through the Las Vegas area is not greater than one percent of the cumulative dose from all fuel and waste transportation calculated from Table S-4.

Consequently, the cumulative doses for the Las Vegas area only a small fraction of the cumulative doses implied by Table S-4 for all transportation of SNF plus transportation of other nuclear power plant radwastes. It should be noted that the cumulative doses for both sets of estimates are comprised of annual doses to individuals that are well below the regulatory limits set by the NRC and by the Department of Transportation.

2.3.2 Nonradiological Risks

**********The background radiation dose is assumed to be 3.6 mSv/year [360 mrem/year], the current estimate given for average background radiation dose in the U.S. The value is based upon the following assumptions from the National Council on Radiation Protection and Measurements as summarized in Eisenbud and Gesell (1997). Doses are given in mSv/year:

Cosmic radiation that reaches the earth at sea level	0.27
Radiation from the natural elements in the earth	0.28
Radon gas in the home from ground sources	2.00
Radiation in the human body from food and water	0.39
Average medical exposure	0.25 to 0.55
Consumer products (e.g., smoke detectors)	0.10

The nonradiological impact of concern is vehicle collisions. Based on recent national average truck accident rates, between 12 and 20 vehicle accidents can be expected during SNF transport through the Las Vegas area. The probability of a fatalityfrom nonradiological transportation accidents is estimated to be about 0.023 without license renewal and about 0.035 with license renewal (see Appendix, Table A.2). These very low risks are smaller than the radiological risks of SNF transport in the Las Vegas area. Over a 40- or 60-year period, these risks amount to very small annual risks; approximately 0.0006 per year (with or without license renewal).

2.4 CONCLUSIONS

As shown in Table 2, the conservatively estimated LRFC resulting from radiation exposure related to transportation of SNF in the Las Vegas area are much less than one, with or without license renewal. For comparison, about 25 percent of the Las Vegas population is expected to develop a fatal cancer from causes unrelated to SNF transport. The estimates produced by this analysis do not appreciably change the cumulative dose estimates in Table S-4.

Nonradiological truck-vehicle accidents are possible as a result of transporting SNF through Las Vegas. The probability of a fatality is estimated to be less than 0.04 under all scenarios. For license renewal, the combined radiological and nonradiological risk to the public is estimated to be between about 0.10 and 0.22 fatalities over the course of SNF transport through Las Vegas, including incident-free and accident risks. Without license renewal, the combined probability of a fatality is estimated to be between about 0.07 and 0.15.

The above analysis shows that even with conservative assumptions, the cumulative radiological and accident risks of SNF transport in the vicinity of Las Vegas are within regulatory limits and small. It also shows that there are opportunities to further reduce human health impacts. Transporting SNF by rail rather than by truck would reduce human health effects by reducing the number of shipments and the likelihood of accidents. Shipping SNF via the proposed beltway would reduce health impacts compared to shipping via the current interstate highway system. However, because DOE will address transportation impacts, mitigation measures, and alternative transportation modes in its EIS for the proposed repository at Yucca Mountain, mitigation is not appropriate for consideration as a part of license renewal decisions.

3. IMPLICATIONS OF HIGHER BURNUP FUEL FOR THE CONCLUSIONS IN TABLE S-4

3.1 BACKGROUND

The rule promulgated in 61 FR 66537 gave license renewal applicants the responsibility to comply with the existing requirements of 10 CFR 51.52. Section 51.52(a) specifies six conditions that must be met in order for an applicant to adopt the values in Table S-4, which represent the contribution of transportation to the environmental costs of licensing the reactor. If the six conditions are not met, an applicant must submit a full analysis of the environmental impacts of transportation of fuel and waste in accordance with §51.52(c). Two of the conditions limit the fuel enrichment level and the burnup rate. Paragraph 51.52(a)(2) requires a uranium-235 enrichment not exceeding 4 percent by weight in the fuel. Paragraph 51.52(a)(3) requires that "The average level of irradiation of the irradiated fuel from the reactor does not exceed 33,000 megawatt-days per metric ton, and no irradiated fuel assembly is shipped until at least 90 days after it is discharged from the reactor." These two limiting conditions have been exceeded through nuclear power plant license amendments permitting incremental increases in the burnup of fuel. During the 1990s, the NRC has reviewed and approved vendor topical reports requesting approval for higher burnup rates. Approved average burnup for the peak rod now ranges from 50,000 to 62,000 MWd/MTHM. The higher burnup rates are associated with uranium-235 enrichment levels of up to 5 percent by weight. Thus, it is likely that at the time of a submittal of a license renewal application, many nuclear power plants will be operating at higher fuel burnup and will be using higher enrichment fuel.

3.2 ANALYSIS

The environmental consequences of incremental increases in the burnup of fuel and the associated use of higher enrichment fuel is discussed with respect to Table S-3 and Table S-4 on pages 6-24 and 6-25 of the GEIS. This discussion is based on the analyses in NUREG/CR-5009, which reviews the physical effects of extended burnup on the fuel and the fuel assemblies and the associated potential for impacts during normal operation and accident events. The environmental effects were reviewed for each stage of the fuel cycle, including transportation of enriched fuel to reactors and extended burnup of SNF from reactors. This issue is discussed in Section 6.2.3 of the GEIS, which addresses the sensitivity of values in Table S-3 and in Table S-4 to recent changes in the fuel cycle, including higher burnup fuel and the use of higher enrichment fuel. The discussion relative to Table S-4 was not repeated in Section 6.3, which specifically addresses the incremental impacts of license renewal on the transportation of fuel and radioactive materials to and from nuclear power plants. Because of that omission, this supplemental treatment has been developed to clarify the public record regarding the Commission's findings on the sensitivity of values in Table S-4 to the use of higher enrichment fuel and extended fuel burnup.

Concurrent with the publication of NUREG/CR-5009, the Commission published a notice: *Extended Burnup Fuel Use in Commercial LWRs; Environmental Assessment and Finding of No Significant Impact* (53 *Fed. Regist.* 6040). The environmental assessment was based on

NUREG/CR-5009, an Atomic Industrial Forum report (AIF/NESP-032), and NUREG/CR-2325. On the basis of these studies, the staff concluded

> ". . .that the environmental impacts summarized in Table S-3 of 10 CFR 51.51 and in Table S-4 of 10 CFR 51.52 for a burnup level of 33 GWd/MtU are conservative and bound the corresponding impacts for burnup levels up to 60 GWd/MtU and uranium-235 enrichments up to 5 percent by weight" (53 FR 6040).

The staff further concluded that a finding of no significant impact was supported by the collective studies:

> "The NRC staff has reviewed the anticipated widespread use of extended burnup fuel in commercial LWRs. Based upon the foregoing environmental assessment, the staff concluded that there are no significant adverse radiological or nonradiological impacts associated with the use of extended burnup fuel and that this use will not significantly affect the quality of the human environment" (53 FR 6040).

Subsequently, the staff has continued to perform plant-specific environmental assessments in reviews to raise fuel enrichment level, burnup rate, and longer fuel cycle limits in Operating Licenses and plant Technical Specifications. These assessments rely on the programmatic environmental assessment in 53 FR 6040 and on a staff assessment entitled *NRC Assessment of the Environmental Effects of Transportation Resulting From Extended Fuel Enrichment and Irradiation*, which was published in the *Federal Register* on Aug. 11, 1989 (53 FR 30355) in connection with the Shearon Harris Nuclear Power Plant, Unit 1, Environmental Assessment and Finding of No Significant Impact.

In assessing the environmental effects of transportation for 53 FR 30355, the staff reviewed the analyses in four studies (NUREG/CR-5009, NUREG/CR-2325, AIF/NESP-032, and WASH-1238) and compared the findings with the impacts given in Table S-4. The staff concluded that

> "The above evaluation sets forth the changes resulting from increased enrichment (up to 5 weight percent) and extended irradiation (up to 60 GWd/MT), in the environmental impacts of transportation of fuel and wastes to and from the light water reactors set forth in Table S-4, 10 CFR Part 51. The values set forth in this detailed analysis represent the contribution of the environmental effects of transportation of fuel enriched with uranium-235 above 4 weight percent and up to 5 weight percent, and irradiated to levels above 33 GWd/MT and up to 60 GWd/MT to the environmental costs of operating the reactors. As shown above, the environmental cost contributions of the stated increases in fuel enrichment and irradiation limits are either unchanged or may in fact be reduced from those summarized in Table S-4, as set out in 10 CFR 51.52(c)" (53 FR 30355).

In 53 FR 30355, the staff further stated that, until Table S-4 is revised to include the higher fuel enrichment and irradiation levels, it proposed to accept the analysis of the environmental effects of the transportation of such fuel and waste presented in that notice.

The values in Table S-4 and in the assessment of extended burnup fuel are

calculated as annualized reference reactor year values. Because these values are independent of the number of years any given reactor operates, they apply to the license renewal period as well as to the period of the initial operating license.

3.3 CONCLUSIONS

The staff has extensively studied the environmental impacts associated with fuel enrichment up to 5 percent uranium-235 and fuel burnup to 60,000 MWd/MTU and has found that these impacts are no greater than and likely less than the impacts currently in 10 CFR 51.52(c). The analysis in the GEIS is consistent with the staff assessment of the environmental effects of transportation resulting from extended fuel enrichment and irradiation presented in 53 FR 30355. These findings are robust. Further, the staff has reviewed and approved vendor topical reports requesting average burnup for peak rod ranging from 50,000 to 62,000 MWd/MTHM. The higher burnup rates are associated with uranium-235 enrichment levels of up to 5 percent by weight. Therefore, these conclusions are applicable to any nuclear power plant license renewal application. Further, these conclusions provide the bases for revision of 10 CFR 51.52(a)(2) and (3).

4. SUMMARY AND CONCLUSIONS

This supplement to the GEIS assesses (1) the cumulative impacts of transportation of high-level radioactive waste, specifically SNF, in the vicinity of the proposed repository at Yucca Mountain, Nevada, and (2) the impacts of transporting higher burnup fuel. The conclusions reached in these assessments provide the bases for revising the findings and the category designation of the Transportation issue in Table 9.1, "Summary of findings on NEPA issues for license renewal of nuclear power plants," of NUREG-1437. The findings and category designation for the transportation issue (NUREG-1437, p. 9-15) is revised as follows:

Issue	Sections	Category	Findings
Transportation	Supplement 1, 2.4 3.3	1	SMALL. The environmental impacts presented in Summary Table S-4 of Part 51.52 may be adopted in individual nuclear power plant license renewal reviews as long as the candidate site at Yucca Mountain is under consideration for licensing. The contribution to impacts of transportation of higher enrichment and higher burnup fuel need be assessed only when the fuel to be used during the license renewal term is enriched to greater than 5 percent uranium-235 or average burnup for the peak rod will be greater than currently approved by the NRC up to 62,000 MWd/MTU. If the applicant anticipates exceeding these values for enrichment or burnup during the renewal term and has received or applied for a license amendment for the values anticipated and an environmental assessment has been prepared by the NRC, which considers transportation of that fuel to and from the reactor, then that environmental assessment may be cited in the renewal application and no further information is required.

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APPENDIX

Cumulative Impacts from the Transportation of Spent Nuclear Fuel in the Vicinity of Las Vegas, Nevada, Associated with Nuclear Reactor License Renewal

Introduction

The purpose of this analysis is to supplement the analysis of transportation impacts in NUREG-1437 with estimates of cumulative radiological exposure and health risk resulting from spent nuclear fuel (SNF) shipments in the vicinity of the proposed high-level waste repository at Yucca Mountain, Nevada. The analysis addresses the impacts of transporting SNF generated by nuclear power plants during their initial license period, plus transporting SNF generated during a 20-year license renewal term. Conservative (i.e., overestimating) assumptions are used to ensure that the potential impacts are not underestimated.

This study describes the transportation risk assessment performed using the HIGHWAY routing code and the RADTRAN 4 risk assessment code to determine the cumulative transportation impacts near the Las Vegas area associated with the transport of commercial SNF to a proposed repository at Yucca Mountain, Nevada. The study considers the effects of nuclear reactor license extension that would extend existing 40-year operating licenses an additional 20 years and thus increase the amount of SNF being transported to a repository. The cumulative impacts considered were human health effects associated with both normal (incident-free) transport and with potential accidents severe enough to release radioactive material.

The focus of the analysis is on truck transportation since transport by rail would be expected to pose less risk to the general public. Rail lines tend to be located farther away from higher population densities than the comparable highway routes, rail transport allows a far greater payload and thus significantly reduces the number of shipments required, and the risk of accidents is less for rail shipments. When accident rates between truck and rail shipments are normalized for payload size and mileage, the accident rate for rail shipments is about 3 percent of the comparable accident rate for truck shipments (Dyer 1993).

For purposes of this analysis, it is assumed that all SNF generated by nuclear power plants is disposed of at Yucca Mountain. Current law prohibits NRC from licensing DOE's disposal of more than 70,000 metric tons (68,790 long ton) of heavy metal in a repository until a second repository is in operation. If another repository were established to accept additional SNF, the impacts on the area around the Yucca Mountain repository would be smaller than those estimated here because some of the SNF assumed to go to Yucca Mountain would go elsewhere.

Background on the HIGHWAY Model

The HIGHWAY computer code model (Joy 1983) was used to select routes and analyze each transportation scenario. The HIGHWAY model is designed to simulate routes on the highway system in the United

States The data base includes all interstates, most U.S. highways, and many roadways with state, county, or local classifications. It represents about 380,000 km [240,000 miles] of roadway. Several different routing options are available in the highway program, including probable commercial routes, routes on the interstate highway system, and routes that bypass major urbanized areas. Additional detailed routing analysis can be performed by blocking individual or sets of highway segments or intersections contained in the data base.

The selection of preferred routes assumes that each shipment consists of highway-route-controlled quantities of radioactive materials. Travel time is optimized based on maximum utilization of the interstate highway system, with preference given to bypasses around major cities, except where alternate routes have been designated by state or local officials. Selected output pages from the HIGHWAY computer code model are given in Attachment 1. These output pages supply additional information, including a detailed listing of each highway route as well as mileage and population density zones.

Table A.1. Transportation route parameters used in RADTRAN analysis [a]

Roadway population density zone [b]	Distance (km)	Average population density (persons/km^2)
Las Vegas N. bypass route		
Rural	157.6	2.2
Suburban	8.2	357
Other	0	0
Total	165.8	
Las Vegas city route		
Rural	153.8	1.7
Suburban	17.7	568
Other	5.4	2295
Total	176.9	

[a] Based on HIGHWAY analysis (see Attachment 1 to this appendix).
[b] "Rural" is defined as populations less than 54 persons/km^2. "Suburban" is defined as population densities between 54 and 1284 persons/km^2. "Urban" is defined as population densities greater than 1284 persons/km^2.

Analysis of Routes Using the HIGHWAY Model

The total travel distance and the fraction of travel in each population density zone are necessary inputs to the RADTRAN 4 code and are given in Table A.1. The routing data from the HIGHWAY model, which makes use of 12 population density zones, have been collapsed into 3 zones (i.e., rural, suburban, and urban) to simplify the analysis performed by the RADTRAN code.

Factors such as population density, accident rates, and vehicle speed can be varied for different zones. Each population zone, along with an associated road type, make up a RADTRAN 4 transport link. Population density estimates for the transport routes were based on 1990 Census data. The staff assumed that population growth of the Las Vegas area would occur primarily by expansion of urban and suburban areas, rather than increasing population densities. For the beltway route, population densities were assumed to be similar to those of other urban and suburban areas of Las Vegas to account for population growth induced by development of the beltway.

The Proposed Las Vegas Beltway

This section contains background information on the proposed Las Vegas beltway including a schematic shown in Figure A.1. Information in this section was obtained from the Clark County Department of Public Works World Wide Web page (Clark County 1997). The planned beltway will eventually consist of three connected segments including a southern, western, and northern route which together will create a freeway "ring" around the Las Vegas Valley to take vehicles around, rather than through, the congested urban core.

The southern segment of the beltway is being built in sections, with each segment opening to traffic upon completion. The first phase of the project, from I-15 to McCarran Airport (Airport Connector), was opened in 1994. Work on the second section, from Warm Springs Road to Windmill Lane, opened to traffic in Oct. 1995. In Feb. 1997, the third portion of the project—from Windmill Lane to Eastern Ave.—became fully operational. The fourth section of the southern beltway, Eastern Ave. to Pecos Road, was completed in 1997.

The proposed northern and western beltway may ultimately be a 10-lane facility (a combination of mixed use and high-occupancy vehicle lanes) with adequate right-of-way to permit construction of a fixed guideway facility. This is called the "ultimate facility" and will require a right-of-way width of 107 to 137 m [350 to 450 ft], plus land for interchanges or access to other transportation facilities. The planning horizon used for this transportation facility is 20 years. It is anticipated that within the next 20 years, a 4-lane freeway between Tropicana Ave. and Decatur Blvd. and a 4-lane arterial with signalized intersections at future inter-change locations will be needed between Decatur Blvd. and I-15 in North Las Vegas.

Cumulative Impacts of Spent Fuel Transportation in the Las Vegas Area

This section describes the analysis of cumulative impacts associated with the transport of SNF to the repository near Las Vegas, Nevada. The methodology of the risk assessment is presented, along with an analysis of the transportation routes, a characterization of the SNF, a description of the RADTRAN 4 code used to perform the radiological risk assessment, and a summary of cumulative transportation risks.

There are four transportation scenarios considered in this analysis, consisting of two routes, each with and without license renewal shipment volumes. The first route assumes that fuel will be shipped around the urban Las Vegas area using the proposed beltway, and the second route assumes that the shipments will be routed through the center of the city using the existing interstate system. It was assumed that with license renewal, the shipment volume of SNF would increase 50 percent. Without license renewal, the estimated number of SNF shipments was 50,185. With license renewal, shipments were assumed to increase to 75,278. No consideration was given to the SNF volume limits being considered for the proposed repository. If such limits were maintained,

Figure A.1. Proposed Las Vegas beltway. *Source:* Clark County Department of Public Works informational drawing, http://www.co.clark.nv.us/PUBWORKS/gif/beltmap.jpg (accessed Oct. 14, 1997).

the risks calculated by this study would decrease accordingly. In addition, for the license renewal scenarios, it was assumed that population density along the beltway would increase because of future growth and expansion. Population density within the city center was assumed not to increase. It was assumed that growth in population density along the new beltway would increase about 30 percent above 1990 Census levels because there will be ample room and newly created access routes.

SNF was assumed to be packaged in the General Atomics Corp. GA-4 and GA-9 legal-weight truck transportation casks (DOE 1990; GA 1991) because they are the only legal-weight spent fuel casks that are close to being certified, and because larger casks that are being considered for certification would lead to lower dose estimates (i.e., less conservative dose estimates.) Radiological characteristics of the SNF were obtained from an analysis of the characteristics of potential repository wastes (DOE 1992). Table S-4 (10 CFR 51) was based on the assumption that the legal-weight truck was 33,182 kg [73,000 lb]; the current legal-weight limit is 36,364 kg [80,000 lb]. Higher-legal-weight trucks allow fewer shipments and lower risks.

Truck Fatalities, Injuries and Accidents

The staff estimated the number of nonradiological truck accidents that may occur during the transport of SNF to the repository. A nonradiological accident is defined as a truck accident in which the injuries or fatalities are caused by the force of the impact; no release of or exposure to radiological materials occurs as a result of the truck accident. This is the most common type of accident expected to occur. Data on national accident statistics have been compiled from a number of sources by the U.S. Department of Transportation (DOT), Bureau of Transportation Statistics, between 1975 and 1995. Since 1990, data have been collected on the number of accidents, injuries, and fatalities per 100 million truck-miles (DOT 1997). Based upon the accident rate data from 1990 to 1995, the average rate of large truck accidents is 373 per 100 million truck-km [233 per 100 million truck-miles], the average rate of injury is 34 per 100 million truck-km [21 per 100 million truck-miles], and the average fatality rate is 0.67 per 100 million truck-km [0.42 per 100 million truck-miles]. On the basis of these statistics—along with the HIGHWAY route data—the expected number of nonradiological accidents, injuries, and fatalities is calculated as shown in Table A.2 for shipments during the 40-year (without license renewal) and 60-year (with license renewal) repository operations period.

Table A.2. Truck fatalities, injuries, and accidents [a]

Fatalities	Injuries	Accidents
Bypass without license renewal		
0.022	1.09	12.0
Bypass with license renewal		
0.033	1.63	18.1
City without license renewal		
0.023	1.16	12.9
City with license renewal		
0.035	1.74	19.3

[a] Estimates are based on mileages from HIGHWAY and rates from USDOT (1997).

Background on the RADTRAN Model

The RADTRAN 4 computer code (Neuhauser 1984, 1992) was used to model the incident-free radiological exposure and the consequences of radiological releases resulting from accidents. The incident-free risks are dependent on the radiation dose rate from the shipment, number of shipments, package dimensions, route distance, vehicle speed, and population densities along the travel routes. The accident risks are dependent on the radiological inventory, accident severity, probability of occurrence for each accident category, and the amount of inventory released, aerosolized, and inhaled, as well as the dispersibility of the waste form.

For incident-free transportation, RADTRAN calculates total body doses for the transport crew and the general population. The radiation source is characterized for RADTRAN by the radiation dose rate at 1 m from the package surface. The regulatory limit is 0.1 mSv/hour [10 mrem/hour] at 2 m (6.6 ft) from the container surface. The 0.10 mSv/hour [10-mrem/hour] at 1 m (3.3 ft) rate (which corresponds to about 0.07 mSv/hour [7 mrem/hour] at 2 m (6.6 ft)) was assumed because most shipments are not expected to be close to regulatory limit, so the average dose rate was assumed to be lower than the regulatory limit.[**********]

Both point- and line-source approximations were used based upon the distance between the exposed individuals and the radiation source. Each truck shipment of multiple fuel assemblies was modeled as a single package with a homogeneous distribution of the radiological inventory. The characteristic dimension (known in RADTRAN as the variable PKGSIZ) is the largest linear dimension of the configuration and is used in the line-source approximation to calculate total dose; 5 m [16.5 ft] was the assumed length of the source. Because transport casks are designed to absorb most neutron radiation and because neutron radiation is absorbed by the air in short distances, the radiation dose to the public from the casks was assumed to consist entirely of gamma radiation for calculation of the incident-free dose.

RADTRAN uses a dispersibility category that is based on the chemical and physical properties of the radiological inventory to determine the fractions of the total inventory that are aerosolized and respirable, and it contains default values for aerosolized and respirable fractions of the total inventory based on the assignment of dispersibility category. The user assigns a dispersibility category to each material and chooses release fractions based on the type of package as a function of accident severity.

[**********]10 CFR 71.47 also limits dose rate at any point on the outer surface of the package or vehicle to 2 mSv/hour [200 mrem/hour]. Doses rates at most parts of the surface would necessarily be much lower than 2 mSv/hour [200 mrem/hour] in order to meet the 0.10 mSv/hour [10 mrem/hour] at 2 m(6.6 ft) limit. To be exposed to a dose rate this high, an individual would have to be in contact with the package at its most radioactive spot. To receive a significant dose, he or she would have to lie in contact with the container at its most radioactive spot for a substantial time period. It is very unlikely that an individual would spend any time in physical contact with the package and even more unlikely that he or she would inadvertently choose the most radioactive spot on the package. Because such an occurrence is so unlikely, this exposure scenario is not considered relevant to the cumulative impacts analysis.

Accident risks include acute fatalities and latent cancer fatalities (chronic) for both the current and future generations. The accident risk (expected value of dose from accidents) is the summation of the products of estimated dose for each accident severity category and the associated probability of occurrence for the category.

Transportation Risk Assessment Using RADTRAN 4

The radiological health effects were estimated for two transportation routes (through Las Vegas on the current interstate system and on the proposed bypass) and for two license renewal scenarios [no license renewal (50,185 shipments) and all plants operate through one license renewal term (75,278 shipments)]. Table A.3 lists the estimated lifetime risk of fatal cancer (LRFC) for shipments of SNF expected to result from radiation exposure during incident-free transportation and accidents. Radiation doses to the population and truck crews were converted to LRFC using the upper limit risk coefficient suggested by the National Academy of Sciences (ICRP 1991; NAS 1990).

Table A.3. Cumulative radiological transportation risks in the Las Vegas area [a]

Estimated lifetime risk of fatal cancer [b]			
	Incident-free risk		Accident risk
	Crew [c]	Public [d]	Public
Bypass without license renewal			
	0.0827	0.0290	0.0169
Bypass with license renewal			
	0.1241	0.0435	0.0253
City without license renewal			
	0.0882	0.0425	0.0815
City with license renewal			
	0.1324	0.0635	0.123

[a] Transportation risks were calculated using RADTRAN (v. 4.0.19, Nov. 14, 1996).

[b] The dose conversion factor for crew members was 0.04 estimated lifetime risk of fatal cancer (LRFC) per person-Sv [0.0004 LRFC/person-rem] and for the public, 0.05 LRFC/person-Sv [0.0005 LRFC/person-rem]. The U.S. average lifetime risk of cancer from all causes is approximately 0.25.

[c] Truck crew size was assumed to be 2 persons. Crew risk is for the time spent driving approximately 161 km (100 miles) in the Las Vegas area; the risk involved in driving to the Las Vegas area is not included.

[d] Incident-free risk to the total population does not include the risk to the crew.

The NAS report (1990, Table 4-2), commonly called the BEIR V report, gives statistics on the number of cancer deaths expected to occur from a continuous exposure of 10 mSv/year [1 rem/year] above background from age 18 until age 65. This value results in a risk factor of 4.0×10^{-2} per person-Sv [4.0×10^{-4} LRFC per person-rem] that is most applicable to occupational exposures. The BEIR V report also considers the number of cancer deaths expected to occur from a continuous lifetime exposure of 1 mSv/year

[0.1 rem/year] above background,[**********] which results in a risk factor of 5.0×10^{-2} LRFC per person-Sv [5.0×10^{-4} LRFC per person-rem] that is most applicable to exposures of the general public. Note that even though the assumed general public exposure is less than the assumed occupational exposure, the general public LRFC risk factor is slightly higher—because the general public dose is assumed to be received by people of all ages rather than just by people in the workforce from age 18 until age 65. The younger population is more sensitive to radiation-induced health effects.

The results (Table A.3) show that the radiological risks of the truck shipments of SNF are low. The LRFC expected from the calculated exposures would not exceed 0.1324 LRFC for the crews or 0.0635 LRFC for members of the public exposed during incident-free transportation of SNF. It was assumed that each 2-person crew would perform 1 shipment per week over the lifetime of the 40- to 60-year shipment campaign (a very conservative assumption).

Even the hypothetical maximally exposed individual would receive only a small lifetime radiation dose due to SNF transport in the Las Vegas area. The maximally exposed individual radiation dose is based on exposure during incident-free transport to a hypothetical individual located 30 m (100 feet) from the highway during the entire shipment campaign. This is a very conservative assumption because the hypothetical person would have to live an entire life at the same spot to receive the calculated dose. The hypothetical maximally exposed individual would receive 0.31 mSv [31 mrem] for the entire campaign, which is 8.6% of the 3.6-mSv [360-mrem] average annual effective dose received from natural background radiation sources, or 0.12% of a 70-year dose from natural background sources.

The results of the RADTRAN analysis (Attachment 2) indicate that there would be no fatalities from acute radiation exposure as a result of the release of radioactive material from even the most severe hypothetical SNF transportation accident. The largest population risk due to radiological accidents for any of the SNF transportation scenarios would be 0.123 LRFC (Table A.3).

Attachment 2 provides a listing of selected pages from the RADTRAN 4 output files for each scenario including all necessary input parameters to duplicate the analysis, the incident-free summary showing the population exposure in person-rem along with the maximum individual in-transit dose, and the expected values of population risk in person-rem as a result of accidents.

The risk estimates listed on Table A.3 must be viewed in proper perspective. While the estimated risks are low, they are higher than usually seen for SNF shipments because of the extremely high volume of shipments assumed to pass through Las Vegas for purposes of this analysis. In addition, the analysis conservatively assumed that all shipments would move by truck. In reality, many shipments are expected to move by rail which would significantly reduce the risk.

[**********]The background radiation dose is assumed to be 3.6 mSv/year [360 mrem/year], the current estimate given for average background radiation dose in the U.S. The value is based upon the following assumptions from the National Council on Radiation Protection and Measurements as summarized in Eisenbud and Gesell (1997). Doses are given in mSv/year:

Cosmic radiation that reaches the earth at sea level	0.27
Radiation from the natural elements in the earth	0.28
Radon gas in the home from ground sources	2.00
Radiation in the human body from food and water	0.39
Average medical exposure	0.25 to 0.55
Consumer products (e.g., smoke detectors)	0.10

The study shows that use of the Las Vegas bypass would reduce the risk to the public. The analysis is also conservative because it assumes that virtually all licensed nuclear power plants would operate for a 20-year license renewal term; many plants will not renew their operating licenses. Finally, if another repository were established, the already small effects on Las Vegas would be further reduced.

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Attachment 1. Listings of HIGHWAY routes examined in this study.

The following listings of the routes examined for this study have been captured from the HIGHWAY computer routing model developed at Oak Ridge National Laboratory (Joy 1983).

Route 1. From I-15 northeast of Las Vegas through the spaghetti bowl.

```
From: OVERTON        N  I15  X93  NV      Leaving : 10/02/97 at  9:14 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/02/97 at 11:08 PDT

Route type: C with  2 driver(s)                     Total road time:  1:54
  Time bias:   .70  Mile bias:   .30  Toll bias:  1.00   Total miles:  110.0

The following constraints are in effect:
 1 - Links prohibiting truck use
 7 - Avoid ferry crossings
State mileage:
 NV  110.0
Mileage by highway sign type:
    Interstate:   51.0   U.S.:   59.0  State:     .0  Turnpike:     .0
        County:     .0  Local:     .0  Other:     .0
Mileage by highway lane type:
    Limited Access Multilane:   52.0  Limited Access Single Lane:     .0
           Multilane Divided:   58.0         Multilane Undivided:     .0
    Principal Highway:     .0    Through Highway:     .0   Other:     .0

From: OVERTON        N  I15  X93  NV      Leaving : 10/02/97 at  9:14 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/02/97 at 11:08 PDT

  Routing through:
    .0             OVERTON        N  I15  X93  NV      .0   0:00  10/02 @  9:14
  51.0 I15         LAS VEGAS                    NV    51.0   0:47  10/02 @ 10:01
   1.0 U95         LAS VEGAS      W  U95  U95B NV    52.0   0:48  10/02 @ 10:02
   7.0 U95BU       LAS VEGAS      NW U95  U95B NV    59.0   0:59  10/02 @ 10:13
  51.0 U95         MERCURY        S  U95  LOCL NV   110.0   1:54  10/02 @ 11:08

Population Density from: OVERTON        N  I15  X93  NV
                    to : MERCURY        S  U95  LOCL NV

          ------------------  Mileage within Density Levels  -------------------
               <0.0   5.0  22.7  59.7   139   326   821  1861  3326  5815
St Miles    0  -5.0 -22.7 -59.7  -139  -326  -821 -1861 -3326 -5815 -9996 >9996
-------------------------------------------------------------------------------

NV 110.0 45.7  27.3  21.9    .3    .4   1.0   2.1   4.7   3.3   2.1   1.0    .3

Totals
   110.0 45.7  27.3  21.9    .3    .4   1.0   2.1   4.7   3.3   2.1   1.0    .3
Percentages
         41.5  24.8  19.9    .2    .4    .9   1.9   4.3   3.0   2.0    .9    .2
Basis: 1990 Census
Do you want RADTRAN input data (Y/n) ?

   RADTRAN Input Data      Rural Suburban    Urban

   Weighted Population
        People/sq. mi.       4.4   1471.7   5945.2
        People/sq. km.       1.7    568.2   2295.4

   Distance                                    Total
        Miles               95.6     11.0      3.4    110.0
        Kilometers         153.8     17.7      5.4    177.0
        Percentage          86.9     10.0      3.1

   Basis (people/sq. mi.)   <139 139-3326    >3326   1990 Census

   Note: Due to rounding, the sum of the mileages in the individual
         population categories may not equal the total mileage shown
         on this report.
```

Route 2. From I-15 south of Las Vegas through the spaghetti bowl.

```
From: NIPTON         W  I15  S164 CA      Leaving : 10/01/97 at 16:37 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:38 PDT

Route type: Q with  2 driver(s)                      Total road time:  2:01
  Time bias:  1.00  Mile bias:   .00  Toll bias:  1.00   Total miles:  111.0

The following constraints are in effect:
 1 - Links prohibiting truck use
 6 - HM-164/State preferred routes
 7 - Avoid ferry crossings
11 - Nonintersecting Interstate Access
Weighting used with preferred highways: 10.0
State mileage:
 NV  101.0  CA   10.0
Mileage by highway sign type:
    Interstate:   52.0   U.S.:   59.0  State:     .0  Turnpike:     .0
        County:     .0  Local:     .0  Other:     .0
Mileage by highway lane type:
    Limited Access Multilane:   53.0  Limited Access Single Lane:     .0
           Multilane Divided:   58.0         Multilane Undivided:     .0
    Principal Highway:     .0    Through Highway:     .0   Other:     .0

From: NIPTON         W  I15  S164 CA      Leaving : 10/01/97 at 16:37 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:38 PDT

  Routing through:
    .0             NIPTON         W  I15  S164 CA      .0   0:00  10/01 @ 16:37
  52.0 I15         LAS VEGAS                   NV    52.0   0:54  10/01 @ 17:31
   1.0 U95         LAS VEGAS      W  U95  U95B NV    53.0   0:55  10/01 @ 17:32
   7.0 U95BU       LAS VEGAS      NW U95  U95B NV    60.0   1:06  10/01 @ 17:43
  51.0 U95         MERCURY        S  U95  LOCL NV   111.0   2:01  10/01 @ 18:38

Population Density from: NIPTON         W  I15  S164 CA
                    to : MERCURY        S  U95  LOCL NV

          ------------------  Mileage within Density Levels  -------------------
                <0.0   5.0  22.7  59.7   139   326   821  1861  3326  5815
St Miles    0  -5.0 -22.7 -59.7  -139  -326  -821 -1861 -3326 -5815 -9996 >9996
-------------------------------------------------------------------------------

NV 101.0 19.7  51.3  13.7    .9   1.8   3.0   2.6   4.2   2.0   1.0   1.0    .0
CA  10.0   .0  10.0    .0    .0    .0    .0    .0    .0    .0    .0    .0    .0

Totals
   111.0 19.7  61.3  13.7    .9   1.8   3.0   2.6   4.2   2.0   1.0   1.0    .0
Percentages
        17.7  55.2  12.3    .8   1.6   2.7   2.3   3.8   1.8    .9    .9    .0
Basis: 1990 Census

RADTRAN Input Data      Rural Suburban    Urban

   Weighted Population
        People/sq. mi.       5.7   1108.7   6181.1
        People/sq. km.       2.2    428.1   2386.5
   Distance                                      Total
        Miles               97.3     11.7      2.0    111.0
        Kilometers         156.6     18.9      3.2    178.6
        Percentage          87.6     10.6      1.8

   Basis (people/sq. mi.)   <139 139-3326    >3326   1990 Census

   Note: Due to rounding, the sum of the mileages in the individual population
categories may not equal the total mileage shown on this report.
```

Route 3. From I-15 northeast of Las Vegas using bypass.

```
From: OVERTON        N  I15  X93  NV      Leaving : 10/01/97 at 16:40 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:23 PDT

Route type: C with  2 driver(s)                     Total road time:  1:43
  Time bias:   .70  Mile bias:   .30  Toll bias:  1.00   Total miles:  103.0

The following constraints are in effect:
 1 - Links prohibiting truck use
 7 - Avoid ferry crossings
State mileage:
 NV  103.0
Mileage by highway sign type:
    Interstate:   43.0   U.S.:   48.0  State:     .0  Turnpike:     .0
        County:     .0  Local:     .0  Other:   12.0
Mileage by highway lane type:
    Limited Access Multilane:   55.0  Limited Access Single Lane:     .0
           Multilane Divided:   48.0         Multilane Undivided:     .0
    Principal Highway:     .0    Through Highway:     .0   Other:     .0

From: OVERTON        N  I15  X93  NV      Leaving : 10/01/97 at 16:40 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:23 PDT

  Routing through:
    .0             OVERTON        N  I15  X93  NV      .0   0:00  10/01 @ 16:40
  43.0 I15         N LAS VEGAS    N  I15  BYPS NV    43.0   0:40  10/01 @ 17:20
  12.0 BYPAS       LAS VEGAS      NW U95  BYPS NV    55.0   0:51  10/01 @ 17:31
  48.0 U95         MERCURY        S  U95  LOCL NV   103.0   1:43  10/01 @ 18:23


Population Density from: OVERTON        N  I15  X93  NV
                    to : MERCURY        S  U95  LOCL NV

          ------------------  Mileage within Density Levels  -------------------
               <0.0   5.0  22.7  59.7   139   326   821  1861  3326  5815
St Miles    0  -5.0 -22.7 -59.7  -139  -326  -821 -1861 -3326 -5815 -9996 >9996
-------------------------------------------------------------------------------

NV 103.0 45.8  28.1  22.0    .2   1.8    .7   2.4   1.6    .4    .0    .0    .0

Totals
   103.0 45.8  28.1  22.0    .2   1.8    .7   2.4   1.6    .4    .0    .0    .0
Percentages
         44.5  27.3  21.4    .2   1.7    .6   2.3   1.6    .4    .0    .0    .0
Basis: 1990 Census

RADTRAN Input Data      Rural Suburban    Urban

   Weighted Population
        People/sq. mi.       5.7    924.0       .0
        People/sq. km.       2.2    356.7       .0

   Distance                                        Total
        Miles              97.9      5.1       .0    103.0
        Kilometers        157.6      8.2       .0    165.8
        Percentage         95.0      5.0       .0

   Basis (people/sq. mi.)   <139 139-3326    >3326   1990 Census

   Note: Due to rounding, the sum of the mileages in the individual population
categories may not equal the total mileage shown on this report.
```

Route 4. From I-15 south of Las Vegas using bypass.

```
From: NIPTON         W  I15  S164 CA      Leaving : 10/01/97 at 16:44 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:48 PDT

Route type: C with  2 driver(s)                      Total road time: 2:04
  Time bias:   .70  Mile bias:   .30  Toll bias:  1.00   Total miles: 118.0

The following constraints are in effect:
 1 - Links prohibiting truck use
 7 - Avoid ferry crossings
State mileage:
 NV  108.0  CA   10.0
Mileage by highway sign type:
    Interstate:   44.0   U.S.:   48.0  State:     .0  Turnpike:     .0
        County:     .0  Local:     .0  Other:   26.0
Mileage by highway lane type:
    Limited Access Multilane:   70.0  Limited Access Single Lane:     .0
           Multilane Divided:   48.0         Multilane Undivided:     .0
    Principal Highway:     .0    Through Highway:     .0   Other:     .0

From: NIPTON         W  I15  S164 CA      Leaving : 10/01/97 at 16:44 PDT
to  : MERCURY        S  U95  LOCL NV      Arriving: 10/01/97 at 18:48 PDT

  Routing through:
    .0             NIPTON         W  I15  S164 CA      .0   0:00  10/01 @ 16:44
  44.0 I15         LAS VEGAS      SW I15  X34  NV    44.0   0:46  10/01 @ 17:30
  26.0 BYPAS       LAS VEGAS      NW U95  BYPS NV    70.0   1:12  10/01 @ 17:56
  48.0 U95         MERCURY        S  U95  LOCL NV   118.0   2:04  10/01 @ 18:48


Population Density from: NIPTON         W  I15  S164 CA
                    to : MERCURY        S  U95  LOCL NV

         ------------------  Mileage within Density Levels  --------------------
              <0.0   5.0  22.7  59.7   139   326   821  1861  3326  5815
St Miles    0  -5.0 -22.7 -59.7  -139  -326  -821 -1861 -3326 -5815 -9996 >9996
-------------------------------------------------------------------------------

NV 108.0 20.1  50.8  13.6   4.1   4.5   4.8   5.2   4.3    .6    .0    .0    .0
CA  10.0   .0  10.0    .0    .0    .0    .0    .0    .0    .0    .0    .0    .0

Totals
   118.0 20.1  60.8  13.6   4.1   4.5   4.8   5.2   4.3    .6    .0    .0    .0
Percentages
         17.0  51.5  11.5   3.5   3.8   4.1   4.4   3.6    .5    .0    .0    .0
Basis: 1990 Census
RADTRAN Input Data      Rural Suburban    Urban

   Weighted Population
        People/sq. mi.       9.3    766.5       .0
        People/sq. km.       3.6    295.9       .0

   Distance                                          Total
        Miles              103.1     14.9       .0    118.0
        Kilometers         165.9     24.0       .0    189.9
        Percentage          87.4     12.6       .0

   Basis (people/sq. mi.)   <139 139-3326    >3326   1990 Census

   Note: Due to rounding, the sum of the mileages in the individual population
categories may not equal the total mileage shown on this report.
```

Attachment 2. Selected pages from the RADTRAN 4 computer code runs.

```
RRRR    AAA   DDDD   TTTTT  RRRR    AAA   N   N
R   R  A   A  D   D    T    R   R  A   A  NN  N
R   R  A   A  D   D    T    R   R  A   A  N N N
RRRR   A   A  D   D    T    RRRR   A   A  N  NN
R R    AAAAA  D   D    T    R R    AAAAA  N   N
R  R   A   A  D   D    T    R  R   A   A  N   N
R   R  A   A  DDDD     T    R   R  A   A  N   N
```

```
    4
4   4
4   4
44444
    4
    4
    4
```

```
RADTRAN 4.0.19   VERSION DATE: NOVEMBER 14, 1996

           MODE DESCRIPTIONS

  NUMBER  NAME            CHARACTERIZATION
     1    TRUCK           LONG HAUL VEHICLE
     2    RAIL            COMMERCIAL TRAIN
     3    BARGE           INLAND VESSEL
     4    SHIP            OPEN SEA VESSEL
     5    CARGO AIR       CARGO AIRCRAFT
     6    PASS AIR        PASSENGER AIRCRAFT
     7    P-VAN           PASSENGER VAN
     8    CVAN-T          COMMERCIAL VAN
     9    CVAN-R          COMMERCIAL VAN
     10   CVAN-CA         COMMERCIAL VAN
```

ECHO CHECK

```
&& Edited Thu Oct  2 16:57:21 1997
&& _Las_Vegas_bypass_without_license_renewal_
&& _Version_1.0_
TITLE _BYPASS_WITHOUT_RENEWAL_
FORM UNIT
DIMEN 21 8 3 10 18
PARM 1 3 2 1 0
PACKAGE
   LABGRP
        GAS      SOLID      VOLAT
SHIPMENT
   LABISO
      H3GAS       FE55       CO60       KR85       SR90      RU106
      SB125     TE125M      CS134      CS137      CE144      PM147
      SM151      EU154      EU155      PU238      PU239      PU240
      PU241      AM241      CM244
NORMAL
   NMODE=1
       8.069E-01  1.916E-01  1.500E-03  8.856E+01  4.032E+01  2.416E+01
       2.000E+00  1.000E+01  0.000E+00  0.000E+00  0.000E+00  0.000E+00
       0.000E+00  0.000E+00  2.000E+01  0.000E+00  0.000E+00  0.000E+00
       2.000E+00  1.000E-01  0.000E+00  1.000E+00  4.700E+02  7.800E+02
       2.800E+03
ACCIDENT
   SEVFRC
     NPOP=1
       NMODE=1
       4.62E-01  3.02E-01  1.76E-01  4.03E-02  1.18E-02  6.47E-03
       5.71E-04  1.13E-04
     NPOP=2
       NMODE=1
       4.35E-01  2.85E-01  2.21E-01  5.06E-02  6.64E-03  1.74E-03
       6.72E-05  5.93E-06
     NPOP=3
       NMODE=1
       5.83E-01  3.82E-01  2.78E-02  6.36E-03  7.42E-04  1.46E-04
       1.13E-05  9.94E-07
RELEASE
   RFRAC
     GROUP=1
       0.00E+00  0.00E+00  0.00E+00  1.00E-02  1.00E-01  1.10E-01
       1.10E-01  1.10E-01
     GROUP=2
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  5.00E-08  5.00E-08
       5.00E-07  5.00E-07
     GROUP=3
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  2.00E-04  2.80E-04
       1.00E-03  1.00E-03
EOF
ISOTOPES  -1 50185     1.00   10.000   1.00   0.00  FRRSNF
        H3GAS  9.99E+02       GAS  10
         FE55  3.64E+02     SOLID   2
         CO60  4.31E+03     SOLID   2
         KR85  1.08E+04       GAS  10
         SR90  1.30E+05     SOLID   2
        RU106  1.05E+03     VOLAT   7
        SB125  2.92E+03     SOLID   2
       TE125M  7.13E+02     SOLID   2
        CS134  1.54E+04     VOLAT   7
        CS137  1.93E+05     VOLAT   7
        CE144  2.40E+02     SOLID   2
```

```
         PM147  1.60E+04     SOLID   2
         SM151  9.07E+02     SOLID   2
         EU154  1.20E+04     SOLID   2
         EU155  4.59E+03     SOLID   2
         PU238  1.00E+04     SOLID   2
         PU239  7.30E+02     SOLID   2
         PU240  1.13E+03     SOLID   2
         PU241  1.88E+05     SOLID   2
         AM241  4.26E+03     SOLID   2
         CM244  8.29E+03     SOLID   2
LINK  1 1.58E+02 8.80E+01 2.20E+00 4.70E+02 1.37E-07 R 1
LINK  1 8.20E+00 8.80E+01 3.57E+02 7.80E+02 3.00E-06 S 1
PKGSIZ
          FRRSNF     5.00
EOF
```

_BYPASS_WITHOUT_RENEWAL_

INCIDENT-FREE SUMMARY
******** **** *******

INCIDENT-FREE POPULATION EXPOSURE IN PERSON-REM

	PASSENGR	CREW	HANDLERS	OFF LINK	ON LINK	STOPS	STORAGE	TOTALS
LINK 1	0.00E+00	1.96E+02	0.00E+00	4.45E-01	4.97E+01	0.00E+00	0.00E+00	2.46E+02
LINK 2	0.00E+00	1.02E+01	0.00E+00	3.26E+00	4.28E+00	0.00E+00	0.00E+00	1.77E+01
RURAL	0.00E+00	1.96E+02	0.00E+00	4.45E-01	4.97E+01	0.00E+00	0.00E+00	2.46E+02
SUBURB	0.00E+00	1.02E+01	0.00E+00	3.26E+00	4.28E+00	0.00E+00	0.00E+00	1.77E+01
URBAN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTALS:	0.00E+00	2.06E+02	0.00E+00	3.70E+00	5.40E+01	0.00E+00	0.00E+00	2.64E+02

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

LINK 1 2.07E-02 REM
LINK 2 2.07E-02 REM

RUN DATE: [2-OCT-97 AT 16:57:53] PAGE 6

_BYPASS_WITHOUT_RENEWAL_

EXPECTED VALUES OF POPULATION RISK IN PERSON REM

	GROUND	INHALED	RESUSPD	CLOUDSH	*INGESTION	TOTAL
LINK 1	4.43E-01	2.04E-03	8.29E-03	5.89E-06	0.00E+00	4.54E-01
LINK 2	3.25E+01	1.47E-01	5.95E-01	5.19E-04	0.00E+00	3.33E+01
RURAL	4.43E-01	2.04E-03	8.29E-03	5.89E-06	0.00E+00	4.54E-01
SUBURB	3.25E+01	1.47E-01	5.95E-01	5.19E-04	0.00E+00	3.33E+01
URBAN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTALS:	3.30E+01	1.49E-01	6.03E-01	5.25E-04	0.00E+00	3.37E+01

```
* NOTE THAT INGESTION RISK IS A SOCIETAL RISK;
  THE USER MAY WISH TO TREAT THIS VALUE SEPARATELY.


                          _BYPASS_WITHOUT_RENEWAL_


                      EXPECTED RISK VALUES - OTHER

                        LINK    ECON       EARLY
                                 $$       FATALITY
                          1    0.00E+00   0.00E+00
                          2    0.00E+00   0.00E+00

                       TOTAL   0.00E+00   0.00E+00


                    TOTAL EXPOSED POPULATION: INCIDENT-FREE

                           LINK  1  5.56E+02 PERSONS
                           LINK  2  4.68E+03 PERSONS

                             TOTAL  5.24E+03 PERSONS


                      TOTAL EXPOSED POPULATION: ACCIDENT
              (PERSONS UNDER PLUME FOOTPRINT FOR A SINGLE ACCIDENT)

                           LINK  1  2.97E+03 PERSONS
                           LINK  2  4.82E+05 PERSONS
EOI
END OF RUN
```

```
                                ECHO CHECK

&& Edited Thu Oct  2 17:16:14 1997
&& _Las_Vegas_bypass_with_license_renewal_
&& _Version_1.0_
TITLE _BYPASS_WITH_RENEWAL_
FORM UNIT
DIMEN 21 8 3 10 18
PARM 1 3 2 1 0
PACKAGE
   LABGRP
        GAS      SOLID      VOLAT
SHIPMENT
   LABISO
      H3GAS       FE55       CO60       KR85       SR90      RU106
      SB125     TE125M      CS134      CS137      CE144      PM147
      SM151      EU154      EU155      PU238      PU239      PU240
      PU241      AM241      CM244
NORMAL
   NMODE=1
       8.069E-01  1.916E-01  1.500E-03  8.856E+01  4.032E+01  2.416E+01
       2.000E+00  1.000E+01  0.000E+00  0.000E+00  0.000E+00  0.000E+00
       0.000E+00  0.000E+00  2.000E+01  0.000E+00  0.000E+00  0.000E+00
       2.000E+00  1.000E-01  0.000E+00  1.000E+00  4.700E+02  7.800E+02
       2.800E+03
ACCIDENT
   SEVFRC
     NPOP=1
       NMODE=1
       4.62E-01  3.02E-01  1.76E-01  4.03E-02  1.18E-02  6.47E-03
       5.71E-04  1.13E-04
     NPOP=2
       NMODE=1
       4.35E-01  2.85E-01  2.21E-01  5.06E-02  6.64E-03  1.74E-03
       6.72E-05  5.93E-06
     NPOP=3
       NMODE=1
       5.83E-01  3.82E-01  2.78E-02  6.36E-03  7.42E-04  1.46E-04
       1.13E-05  9.94E-07
RELEASE
   RFRAC
     GROUP=1
       0.00E+00  0.00E+00  0.00E+00  1.00E-02  1.00E-01  1.10E-01
       1.10E-01  1.10E-01
     GROUP=2
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  5.00E-08  5.00E-08
       5.00E-07  5.00E-07
     GROUP=3
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  2.00E-04  2.80E-04
       1.00E-03  1.00E-03
EOF
ISOTOPES  -1 75278     1.00   10.000   1.00   0.00  FRRSNF
        H3GAS  9.99E+02       GAS  10
         FE55  3.64E+02     SOLID   2
         CO60  4.31E+03     SOLID   2
         KR85  1.08E+04       GAS  10
         SR90  1.30E+05     SOLID   2
        RU106  1.05E+03     VOLAT   7
        SB125  2.92E+03     SOLID   2
       TE125M  7.13E+02     SOLID   2
        CS134  1.54E+04     VOLAT   7
        CS137  1.93E+05     VOLAT   7
        CE144  2.40E+02     SOLID   2
        PM147  1.60E+04     SOLID   2
        SM151  9.07E+02     SOLID   2
        EU154  1.20E+04     SOLID   2
```

```
        EU155  4.59E+03     SOLID   2
        PU238  1.00E+04     SOLID   2
        PU239  7.30E+02     SOLID   2
        PU240  1.13E+03     SOLID   2
        PU241  1.88E+05     SOLID   2
        AM241  4.26E+03     SOLID   2
        CM244  8.29E+03     SOLID   2
LINK  1 1.58E+02 8.80E+01 2.20E+00 4.70E+02 1.37E-07 R 1
LINK  1 8.20E+00 8.80E+01 3.57E+02 7.80E+02 3.00E-06 S 1
PKGSIZ
         FRRSNF     5.00
EOF
```

_BYPASS_WITH_RENEWAL_

INCIDENT-FREE SUMMARY
******** **** *******

INCIDENT-FREE POPULATION EXPOSURE IN PERSON-REM

	PASSENGR	CREW	HANDLERS	OFF LINK	ON LINK	STOPS	STORAGE	TOTALS
LINK 1	0.00E+00	2.94E+02	0.00E+00	6.67E-01	7.46E+01	0.00E+00	0.00E+00	3.69E+02
LINK 2	0.00E+00	1.52E+01	0.00E+00	4.89E+00	6.42E+00	0.00E+00	0.00E+00	2.66E+01
RURAL	0.00E+00	2.94E+02	0.00E+00	6.67E-01	7.46E+01	0.00E+00	0.00E+00	3.69E+02
SUBURB	0.00E+00	1.52E+01	0.00E+00	4.89E+00	6.42E+00	0.00E+00	0.00E+00	2.66E+01
URBAN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTALS:	0.00E+00	3.09E+02	0.00E+00	5.55E+00	8.10E+01	0.00E+00	0.00E+00	3.96E+02

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

LINK 1 3.10E-02 REM
LINK 2 3.10E-02 REM

RUN DATE: [2-OCT-97 AT 17:16:36] PAGE 6

_BYPASS_WITH_RENEWAL_

EXPECTED VALUES OF POPULATION RISK IN PERSON REM

	GROUND	INHALED	RESUSPD	CLOUDSH	*INGESTION	TOTAL
LINK 1	6.65E-01	3.06E-03	1.24E-02	8.84E-06	0.00E+00	6.81E-01
LINK 2	4.88E+01	2.20E-01	8.92E-01	7.78E-04	0.00E+00	4.99E+01
RURAL	6.65E-01	3.06E-03	1.24E-02	8.84E-06	0.00E+00	6.81E-01
SUBURB	4.88E+01	2.20E-01	8.92E-01	7.78E-04	0.00E+00	4.99E+01
URBAN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTALS:	4.95E+01	2.23E-01	9.04E-01	7.87E-04	0.00E+00	5.06E+01

```
 * NOTE THAT INGESTION RISK IS A SOCIETAL RISK;
   THE USER MAY WISH TO TREAT THIS VALUE SEPARATELY.
```

```
                              _BYPASS_WITH_RENEWAL_


                          EXPECTED RISK VALUES - OTHER

                            LINK    ECON       EARLY
                                     $$       FATALITY
                              1    0.00E+00   0.00E+00
                              2    0.00E+00   0.00E+00

                           TOTAL   0.00E+00   0.00E+00



                        TOTAL EXPOSED POPULATION: INCIDENT-FREE

                               LINK  1  5.56E+02 PERSONS
                               LINK  2  4.68E+03 PERSONS

                                 TOTAL  5.24E+03 PERSONS


                         TOTAL EXPOSED POPULATION: ACCIDENT
                   (PERSONS UNDER PLUME FOOTPRINT FOR A SINGLE ACCIDENT)

                               LINK  1  2.97E+03 PERSONS
                               LINK  2  4.82E+05 PERSONS
EOI
END OF RUN
```

```
                                    ECHO CHECK


&& Edited Fri Oct  3 12:23:55 1997
&& _Las_Vegas_city_without_license_renewal_
&& _Version_1.0_
TITLE _CITY_WITHOUT_RENEWAL_
FORM UNIT
DIMEN 21 8 3 10 18
PARM 1 3 2 1 0
PACKAGE
   LABGRP
        GAS      SOLID      VOLAT
SHIPMENT
   LABISO
      H3GAS       FE55       CO60       KR85       SR90      RU106
      SB125     TE125M      CS134      CS137      CE144      PM147
      SM151      EU154      EU155      PU238      PU239      PU240
```

```
      PU241      AM241      CM244
NORMAL
   NMODE=1
       8.069E-01  1.916E-01  1.500E-03  8.856E+01  4.032E+01  2.416E+01
       2.000E+00  1.000E+01  0.000E+00  0.000E+00  0.000E+00  0.000E+00
       0.000E+00  0.000E+00  2.000E+01  0.000E+00  0.000E+00  0.000E+00
       2.000E+00  1.000E-01  0.000E+00  1.000E+00  4.700E+02  7.800E+02
       2.800E+03
ACCIDENT
   SEVFRC
     NPOP=1
       NMODE=1
       4.62E-01  3.02E-01  1.76E-01  4.03E-02  1.18E-02  6.47E-03
       5.71E-04  1.13E-04
     NPOP=2
       NMODE=1
       4.35E-01  2.85E-01  2.21E-01  5.06E-02  6.64E-03  1.74E-03
       6.72E-05  5.93E-06
     NPOP=3
       NMODE=1
       5.83E-01  3.82E-01  2.78E-02  6.36E-03  7.42E-04  1.46E-04
       1.13E-05  9.94E-07
RELEASE
   RFRAC
     GROUP=1
       0.00E+00  0.00E+00  0.00E+00  1.00E-02  1.00E-01  1.10E-01
       1.10E-01  1.10E-01
     GROUP=2
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  5.00E-08  5.00E-08
       5.00E-07  5.00E-07
     GROUP=3
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  2.00E-04  2.80E-04
       1.00E-03  1.00E-03
EOF
ISOTOPES  -1 50185     1.00   10.000   1.00   0.00  FRRSNF
        H3GAS  9.99E+02       GAS  10
         FE55  3.64E+02     SOLID   2
         CO60  4.31E+03     SOLID   2
         KR85  1.08E+04       GAS  10
         SR90  1.30E+05     SOLID   2
        RU106  1.05E+03     VOLAT   7
        SB125  2.92E+03     SOLID   2
       TE125M  7.13E+02     SOLID   2
        CS134  1.54E+04     VOLAT   7
        CS137  1.93E+05     VOLAT   7
        CE144  2.40E+02     SOLID   2
        PM147  1.60E+04     SOLID   2
        SM151  9.07E+02     SOLID   2
        EU154  1.20E+04     SOLID   2
        EU155  4.59E+03     SOLID   2
        PU238  1.00E+04     SOLID   2
        PU239  7.30E+02     SOLID   2
        PU240  1.13E+03     SOLID   2
        PU241  1.88E+05     SOLID   2
        AM241  4.26E+03     SOLID   2
        CM244  8.29E+03     SOLID   2
LINK  1 1.54E+02 8.80E+01 1.70E+00 4.70E+02 1.37E-07 R 1
LINK  1 1.77E+01 8.80E+01 5.68E+02 7.80E+02 3.00E-06 S 1
LINK  1 5.40E+00 7.20E+01 2.30E+03 2.80E+03 1.60E-05 U 1
PKGSIZ
        FRRSNF     5.00
EOF
```

_CITY_WITHOUT_RENEWAL_

INCIDENT-FREE SUMMARY
******** **** *******

INCIDENT-FREE POPULATION EXPOSURE IN PERSON-REM

	PASSENGR	CREW	HANDLERS	OFF LINK	ON LINK	STOPS	STORAGE	TOTALS
LINK 1	0.00E+00	1.91E+02	0.00E+00	3.35E-01	4.84E+01	0.00E+00	0.00E+00	2.40E+02
LINK 2	0.00E+00	2.19E+01	0.00E+00	1.12E+01	9.24E+00	0.00E+00	0.00E+00	4.24E+01
LINK 3	0.00E+00	8.18E+00	0.00E+00	3.49E-01	1.53E+01	0.00E+00	0.00E+00	2.38E+01
RURAL	0.00E+00	1.91E+02	0.00E+00	3.35E-01	4.84E+01	0.00E+00	0.00E+00	2.40E+02
SUBURB	0.00E+00	2.19E+01	0.00E+00	1.12E+01	9.24E+00	0.00E+00	0.00E+00	4.24E+01
URBAN	0.00E+00	8.18E+00	0.00E+00	3.49E-01	1.53E+01	0.00E+00	0.00E+00	2.38E+01
TOTALS:	0.00E+00	2.21E+02	0.00E+00	1.19E+01	7.30E+01	0.00E+00	0.00E+00	3.06E+02

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

LINK 1 2.07E-02 REM
LINK 2 2.07E-02 REM
LINK 3 2.07E-02 REM

RUN DATE: [3-OCT-97 AT 12:24:15] PAGE 6

_CITY_WITHOUT_RENEWAL_

EXPECTED VALUES OF POPULATION RISK IN PERSON REM

	GROUND	INHALED	RESUSPD	CLOUDSH	*INGESTION	TOTAL
LINK 1	3.34E-01	1.54E-03	6.24E-03	4.44E-06	0.00E+00	3.42E-01
LINK 2	1.12E+02	5.03E-01	2.04E+00	1.78E-03	0.00E+00	1.14E+02
LINK 3	4.75E+01	2.14E-01	8.68E-01	7.84E-04	0.00E+00	4.86E+01
RURAL	3.34E-01	1.54E-03	6.24E-03	4.44E-06	0.00E+00	3.42E-01
SUBURB	1.12E+02	5.03E-01	2.04E+00	1.78E-03	0.00E+00	1.14E+02
URBAN	4.75E+01	2.14E-01	8.68E-01	7.84E-04	0.00E+00	4.86E+01
TOTALS:	1.60E+02	7.19E-01	2.92E+00	2.57E-03	0.00E+00	1.63E+02

* NOTE THAT INGESTION RISK IS A SOCIETAL RISK;
THE USER MAY WISH TO TREAT THIS VALUE SEPARATELY.

_CITY_WITHOUT_RENEWAL_

EXPECTED RISK VALUES - OTHER

```
                    LINK    ECON       EARLY
                             $$       FATALITY
                      1    0.00E+00   0.00E+00
                      2    0.00E+00   0.00E+00
                      3    0.00E+00   0.00E+00

                    TOTAL  0.00E+00   0.00E+00



                TOTAL EXPOSED POPULATION: INCIDENT-FREE

                       LINK  1  4.19E+02 PERSONS
                       LINK  2  1.61E+04 PERSONS
                       LINK  3  1.99E+04 PERSONS

                         TOTAL  3.64E+04 PERSONS


                TOTAL EXPOSED POPULATION: ACCIDENT
          (PERSONS UNDER PLUME FOOTPRINT FOR A SINGLE ACCIDENT)

                       LINK  1  2.30E+03 PERSONS
                       LINK  2  7.67E+05 PERSONS
                       LINK  3  3.11E+06 PERSONS
EOI
END OF RUN
```

ECHO CHECK

```
&& Edited Fri Oct  3 12:21:37 1997
&& _Las_Vegas_city_with_license_renewal_
&& _Version_1.0_
TITLE _CITY_WITH_RENEWAL_
FORM UNIT
DIMEN 21 8 3 10 18
PARM 1 3 2 1 0
PACKAGE
   LABGRP
        GAS      SOLID      VOLAT
SHIPMENT
   LABISO
      H3GAS       FE55       CO60       KR85       SR90      RU106
      SB125     TE125M      CS134      CS137      CE144      PM147
      SM151      EU154      EU155      PU238      PU239      PU240
      PU241      AM241      CM244
NORMAL
   NMODE=1
       8.069E-01  1.916E-01  1.500E-03  8.856E+01  4.032E+01  2.416E+01
       2.000E+00  1.000E+01  0.000E+00  0.000E+00  0.000E+00  0.000E+00
       0.000E+00  0.000E+00  2.000E+01  0.000E+00  0.000E+00  0.000E+00
       2.000E+00  1.000E-01  0.000E+00  1.000E+00  4.700E+02  7.800E+02
       2.800E+03
```

```
ACCIDENT
   SEVFRC
     NPOP=1
       NMODE=1
       4.62E-01  3.02E-01  1.76E-01  4.03E-02  1.18E-02  6.47E-03
       5.71E-04  1.13E-04
     NPOP=2
       NMODE=1
       4.35E-01  2.85E-01  2.21E-01  5.06E-02  6.64E-03  1.74E-03
       6.72E-05  5.93E-06
     NPOP=3
       NMODE=1
       5.83E-01  3.82E-01  2.78E-02  6.36E-03  7.42E-04  1.46E-04
       1.13E-05  9.94E-07
RELEASE
   RFRAC
     GROUP=1
       0.00E+00  0.00E+00  0.00E+00  1.00E-02  1.00E-01  1.10E-01
       1.10E-01  1.10E-01
     GROUP=2
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  5.00E-08  5.00E-08
       5.00E-07  5.00E-07
     GROUP=3
       0.00E+00  0.00E+00  0.00E+00  1.00E-08  2.00E-04  2.80E-04
       1.00E-03  1.00E-03
EOF
ISOTOPES  -1 75278     1.00   10.000   1.00   0.00  FRRSNF
        H3GAS  9.99E+02       GAS  10
         FE55  3.64E+02     SOLID   2
         CO60  4.31E+03     SOLID   2
         KR85  1.08E+04       GAS  10
         SR90  1.30E+05     SOLID   2
        RU106  1.05E+03     VOLAT   7
        SB125  2.92E+03     SOLID   2
       TE125M  7.13E+02     SOLID   2
        CS134  1.54E+04     VOLAT   7
        CS137  1.93E+05     VOLAT   7
        CE144  2.40E+02     SOLID   2
        PM147  1.60E+04     SOLID   2
        SM151  9.07E+02     SOLID   2
        EU154  1.20E+04     SOLID   2
        EU155  4.59E+03     SOLID   2
        PU238  1.00E+04     SOLID   2
        PU239  7.30E+02     SOLID   2
        PU240  1.13E+03     SOLID   2
        PU241  1.88E+05     SOLID   2
        AM241  4.26E+03     SOLID   2
        CM244  8.29E+03     SOLID   2
LINK  1 1.54E+02 8.80E+01 1.70E+00 4.70E+02 1.37E-07 R 1
LINK  1 1.77E+01 8.80E+01 5.68E+02 7.80E+02 3.00E-06 S 1
LINK  1 5.40E+00 7.20E+01 2.30E+03 2.80E+03 1.60E-05 U 1
PKGSIZ
         FRRSNF     5.00
EOF
```

_CITY_WITH_RENEWAL_

INCIDENT-FREE SUMMARY
******** **** *******

INCIDENT-FREE POPULATION EXPOSURE IN PERSON-REM

	PASSENGR	CREW	HANDLERS	OFF LINK	ON LINK	STOPS	STORAGE	TOTALS
LINK 1	0.00E+00	2.86E+02	0.00E+00	5.02E-01	7.27E+01	0.00E+00	0.00E+00	3.60E+02
LINK 2	0.00E+00	3.29E+01	0.00E+00	1.68E+01	1.39E+01	0.00E+00	0.00E+00	6.36E+01
LINK 3	0.00E+00	1.23E+01	0.00E+00	5.24E-01	2.29E+01	0.00E+00	0.00E+00	3.57E+01
RURAL	0.00E+00	2.86E+02	0.00E+00	5.02E-01	7.27E+01	0.00E+00	0.00E+00	3.60E+02
SUBURB	0.00E+00	3.29E+01	0.00E+00	1.68E+01	1.39E+01	0.00E+00	0.00E+00	6.36E+01
URBAN	0.00E+00	1.23E+01	0.00E+00	5.24E-01	2.29E+01	0.00E+00	0.00E+00	3.57E+01
TOTALS:	0.00E+00	3.32E+02	0.00E+00	1.78E+01	1.09E+02	0.00E+00	0.00E+00	4.59E+02

MAXIMUM INDIVIDUAL IN-TRANSIT DOSE

LINK 1 3.10E-02 REM
LINK 2 3.10E-02 REM
LINK 3 3.10E-02 REM

_CITY_WITH_RENEWAL_

EXPECTED VALUES OF POPULATION RISK IN PERSON REM

	GROUND	INHALED	RESUSPD	CLOUDSH	*INGESTION	TOTAL
LINK 1	5.01E-01	2.31E-03	9.36E-03	6.66E-06	0.00E+00	5.13E-01
LINK 2	1.68E+02	7.55E-01	3.06E+00	2.67E-03	0.00E+00	1.71E+02
LINK 3	7.12E+01	3.21E-01	1.30E+00	1.18E-03	0.00E+00	7.28E+01
RURAL	5.01E-01	2.31E-03	9.36E-03	6.66E-06	0.00E+00	5.13E-01
SUBURB	1.68E+02	7.55E-01	3.06E+00	2.67E-03	0.00E+00	1.71E+02
URBAN	7.12E+01	3.21E-01	1.30E+00	1.18E-03	0.00E+00	7.28E+01
TOTALS:	2.39E+02	1.08E+00	4.37E+00	3.85E-03	0.00E+00	2.45E+02

* NOTE THAT INGESTION RISK IS A SOCIETAL RISK;
THE USER MAY WISH TO TREAT THIS VALUE SEPARATELY.

_CITY_WITH_RENEWAL_

EXPECTED RISK VALUES - OTHER

LINK	ECON $$	EARLY FATALITY

```
                        1    0.00E+00   0.00E+00
                        2    0.00E+00   0.00E+00
                        3    0.00E+00   0.00E+00

                    TOTAL    0.00E+00   0.00E+00



                TOTAL EXPOSED POPULATION: INCIDENT-FREE

                       LINK  1  4.19E+02 PERSONS
                       LINK  2  1.61E+04 PERSONS
                       LINK  3  1.99E+04 PERSONS

                         TOTAL  3.64E+04 PERSONS


                TOTAL EXPOSED POPULATION: ACCIDENT
          (PERSONS UNDER PLUME FOOTPRINT FOR A SINGLE ACCIDENT)

                       LINK  1  2.30E+03 PERSONS
                       LINK  2  7.67E+05 PERSONS
                       LINK  3  3.11E+06 PERSONS
EOI
END OF RUN
```

NRC PROPOSES TO AMEND REQUIREMENTS FOR ENVIRONMENTAL REVIEWS OF APPLICATIONS TO RENEW NUCLEAR POWER PLANT OPERATING LICENSES

The Nuclear Regulatory Commission (NRC) is seeking public comment on a proposed amendment to its regulations on the requirements governing environmental reviews of applications to renew operating licenses for nuclear power plants. The requirements were published in the *Federal Register* (61 FR 66537) on December 18, 1996.

The amendment would codify generic analyses of the cumulative environmental impacts associated with transportation operation in the vicinity of a high-level waste repository site and of the environmental impacts associated with the transportation of higher enriched fuel and higher burnup fuel. The requirement that license renewal applicants perform these analyses would be removed from 10 CFR Part 51. Also, this amendment would add the requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term. This requirement was inadvertently omitted from the current rule. The net effect of this action will be to reduce the regulatory burden on licensees without compromising environmental protection.

The Honorable James M. Inhofe, Chairman

Subcommittee on Clean Air, Wetlands, Private

Property and Nuclear Safety

Committee on Environment and Public Works

United States Senate

Washington, DC 20510

Dear Mr. Chairman:

In the near future, the Nuclear Regulatory Commission (NRC) intends to publish in the *Federal Register* the enclosed proposed amendments to the Commission's rule in 10 CFR Part 51, "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses."

The amendment would codify generic analyses of the cumulative environmental impacts associated with transportation operation in the vicinity of a high-level waste repository site and of the environmental impacts associated with the transportation of higher enriched fuel and higher burnup fuel. The requirement that license renewal applicants perform these analyses would be removed from 10 CFR Part 51. Additionally, this amendment would add the requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term. This requirement was inadvertently omitted from the current rule. The net effect of this action will be to reduce the regulatory burden on licensees without compromising environmental protection.

Sincerely,

Dennis K. Rathbun, Director

Office of Congressional Affairs

Enclosure:

Federal Register Notice

cc: Senator Bob Graham

The Honorable James M. Inhofe, Chairman

Subcommittee on Clean Air, Wetlands, Private

Property and Nuclear Safety

Committee on Environment and Public Works

United States Senate

Washington, DC 20510

Dear Mr. Chairman:

In the near future, the Nuclear Regulatory Commission (NRC) intends to publish in the *Federal Register* the enclosed proposed amendments to the Commission's rule in 10 CFR Part 51, "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses."

The amendment would codify generic analyses of the cumulative environmental impacts associated with transportation operation in the vicinity of a high-level waste repository site and of the environmental impacts associated with the transportation of higher enriched fuel and higher burnup fuel. The requirement that license renewal applicants perform these analyses would be removed from 10 CFR Part 51. Additionally, this amendment would add the requirement to address local traffic impacts attributable to continued operation of the plant during the license renewal term. This requirement was inadvertently omitted from the current rule. The net effect of this action will be to reduce the regulatory burden on licensees without compromising environmental protection.

Sincerely,

Dennis K. Rathbun, Director

Office of Congressional Affairs

Enclosure: *Federal Register* Notice

cc: Senator Bob Graham

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The Honorable Dan Schaefer, Chairman

Subcommittee on Energy and Power

Committee on Commerce

United States House of Representatives

Washington, DC 20515

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Enclosure:

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cc: Representative Ralph Hall

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