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Office of
Fissile Materials Disposition

United States Department of Energy

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Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment

January 1999

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Environmental Assessment

for the

Parallex Project Fuel Manufacture and Shipment

Los Alamos National Laboratory
Los Alamos, New Mexico

Date Prepared: January, 1999
Prepared by: US Department of Energy
Office of Fissile Materials Disposition
Washington, DC

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ACRONYMS AND TERMS

AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada Limited
ALARA	as low as reasonably achievable
ARF	airborne release fraction
ARIES	Advanced Recovery and Integrated Extraction System
CANDU	Canadian Deuterium Uranium
CED	committed effective dose
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
the County	Los Alamos County
CRL	Chalk River Laboratories
DOE	Department of Energy
DOT	Department of Transportation
DR	damage ratio
EA	Environmental Assessment
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FSAR	Final Safety Analysis Report
g	gram
gal.	gallon
HEPA	high-efficiency particulate air
HRCQ	Highway Route Controlled Quantity
in.	inch
kg	kilogram
km	kilometer
L	liter
LANL	Los Alamos National Laboratory
lb	pound
LCFs	latent cancer fatalities
LLW	low-level waste
LPF	leak path factor
m	meter
m^2	square meter
m^3	cubic meter
MACCS	MELCOR Accident Consequence Code System
MAR	material at risk
MEI	maximum exposed individual
mi	mile
mi^2	square mile
mm	millimeter
MOX	mixed oxide
mrem	millirem
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NRU	National Research Universal
O_2	dioxide
oz	ounce
Park	Royal Crest Trailer Park
PC	polychloroprene
PF-4	plutonium facility
Pu	plutonium
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man; dose equivalent
RF	respirable fraction
ROD	Record of Decision
S&D PEIS	Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement
SOPs	Safe Operating Procedures
SST	safe secure transport
SWEIS	Site-Wide Environmental Impact Statement
TA-54	Technical Area 54
TA-55	Technical Area 55
TRANSCOM	Transportation Command
TRU	transuranic
U	uranium
UNH	uranyl nitrate hexahydrate
WIPP	Waste Isolation Pilot Plant

METRIC CONVERSION CHART

To Convert Into Metric			To Convert Out of Metric		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

EXPONENTIAL NOTATION: Many values in the text and tables of the Environmental Assessment are expressed in exponential notation. An exponent is the power to which the expression, or number, is raised. This form of notation is used to conserve space and to focus attention on comparisons of the order of magnitude of the numbers (see examples):

1×10^{4}	=	10,000
1×10^{2}	=	100
1×10^{0}	=	1
1×10^{-2}	=	0.01
1×10^{-4}	=	0.0001

GLOSSARY

burning	To consume in a reactor through fission.
depleted uranium	Uranium whose content of the isotope U-235 is less than 0.7 percent, which is the U-235 content of naturally occurring uranium.
downblend	The addition of uranium dioxide to a *master blend* to achieve a lower plutonium concentration.
fission	The splitting of a heavy atomic nucleus into at least two nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons.
fissile	The ability of a material to be fissioned by slow (thermal) neutrons. Fissile materials include U-235, U-233, Pu-239, and Pu-241.
homogeneity	The extent to which mixing of two powders has occurred.
irradiation	The bombarding of atoms with nuclear particles to change the structure of the nucleus and produce radioactive atoms. Fuel which has been in a reactor is often called "irradiated" because it has been bombarded with neutrons and has become more radioactive.
master blend	A mixture of 10 percent plutonium dioxide and 90 percent uranium dioxide. Typically the first step in a MOX fuel fabrication process.
mixed oxide (MOX)	A mixture of plutonium dioxide and depleted or natural uranium dioxide.
natural uranium	Uranium with a U-235 concentration of approximately 0.7 percent, the average concentration of U-235 in uranium in the natural state.
pit	The core element of a nuclear weapon's primary component.
rem	The special unit of any of the quantities of absorbed radiation expressed as dose equivalent.
rod	A sealed tube of zircaloy designed to contain MOX fuel pellets.
shim pellets	Are added to the ends of fuel rods to obtain the proper fuel pellet stack length. Shim pellets (also called end pellets or backfill pellets) are made of natural uranium dioxide.
sinter	The process to form a homogeneous mass by heating without melting.
weapons-grade	Plutonium in metallic form that was manufactured for weapons applications. Weapons-grade plutonium contains less than 7 percent plutonium 240.
weapons-usable	Plutonium in forms (for example, metals, oxides) that can be readily converted for use in nuclear weapons. Weapons-grade, fuel-grade, and power reactor-grade plutonium are all weapons usable.
zircaloy	Any member of a group of alloys containing mainly zirconium that possess resistance to corrosion and stability over a wide range of temperatures and types of radiation.

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EXECUTIVE SUMMARY

In order to safeguard and manage weapons-usable plutonium that has or may be declared surplus to the United States' defense needs, the Department of Energy (DOE) has decided to implement a program to provide for safe and secure storage of the material, and a strategy that allows for the dispositioning of weapons-usable plutonium, as specified in the Record of Decision for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (S&D PEIS). The Record of Decision (ROD) for the S&D PEIS retained the option of dispositioning some of the surplus plutonium as mixed oxide (MOX) fuel in heavy-water-moderated reactors, such as Canadian Deuterium Uranium (CANDU) reactors, in the event of future multilateral agreement among Russia, Canada, and the United States. The PEIS Record of Decision also explained that DOE would propose to test and demonstrate CANDU MOX fuel, consistent with cooperative efforts with Russia and Canada, and based on appropriate review under the National Environmental Policy Act (NEPA) (42 USC 4371 et seq.). MOX reactor fuel would be made by mixing weapons-grade plutonium dioxide with uranium dioxide and pressing the mixture into dry fuel pellets. These pellets would then be loaded into fuel rods. DOE must test and demonstrate the feasibility of using MOX fuel in CANDU reactors as part of its ongoing mission to evaluate the disposition of surplus weapons-usable fissile materials. The ability to successfully operate heavy-water-moderated CANDU reactors with MOX fuel has not been fully demonstrated.

The Proposed Action is for DOE to fabricate and transport a limited amount of MOX fuel as part of the Parallex Project. This test and demonstration project has been named Parallex (parallel experiment) because of the roles the United States, Russia, and Canada would have in this project—the U.S. and Russia would supply test material to Canada as a neutral third country. The U.S. MOX fuel has been, and additional MOX fuel would be, fabricated at Los Alamos National Laboratory (LANL), New Mexico and transported in one, two, or three shipments in a Department of Transportation approved package container(s) to Canada. At the Canadian border, Atomic Energy of Canada Limited (AECL) would take possession of the fuel and complete its shipment to the test reactor at Chalk River Laboratories in Chalk River, Ontario. The AECL would be responsible for conducting all subsequent fuel performance tests in their National Research Universal (NRU) reactor. The NRU test reactor is the only available reactor specifically redesigned to test MOX fuel performance as related to CANDU reactors. All spent fuel resulting from the tests would be managed under the Canadian spent fuel program.

The Proposed Action would result in the fabrication of additional MOX fuel at LANL and its delivery to the AECL NRU test reactor in Canada. A successful MOX fuel test could lead to the disposition of surplus weapons-grade plutonium from the U.S. and Russia by irradiation in CANDU reactors. The parallel disposition of weapons-grade plutonium would support the American and Russian goals of nuclear materials nonproliferation. Fabrication of the MOX fuel at LANL would generate small amounts of low-level and transuranic radioactive waste, and very small radioactive air emissions. MOX fuel fabrication would not result in adverse health effects in the involved workers or public during normal operations. The shipment(s) of MOX fuel would not adversely affect the environment at LANL or along the transportation routes. During the shipment(s), the truck crew and public would not be adversely affected by the low amount of penetrating radiation from the MOX fuel in the package container(s).

Two hypothetical MOX fuel fabrication and transportation accident scenarios were analyzed that would involve a potential radiation release to the involved workers and public. Another transportation accident scenario not involving a radioactive release was also analyzed. The three accident scenarios would not result in potentially serious risks to the involved workers or public during MOX fuel fabrication and transportation.

It is expected that activities associated with the Proposed Action would not amplify cumulative effects, because the contributions to adverse effects from the Proposed Action would be extremely small.

Under the No Action Alternative, no additional MOX fuel would be fabricated at LANL and no MOX fuel would be shipped to Canada. The existing MOX fuel already made would continue to be stored at LANL until a decision on its use or disposition is made. The AECL would have no source of U.S. MOX fuel and, therefore, would have to delay its testing program at the NRU reactor in parallel with Russian MOX fuel, or if Russian fuel were available, operate the testing program in the absence of U.S. supplied MOX fuel.

1.0 PURPOSE AND NEED

1.1 Introduction

The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.), requires all federal agencies, including the Department of Energy (DOE), to consider the environmental consequences of proposed actions before decisions are made. In complying with NEPA, DOE follows the Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's own NEPA implementing regulations (10 CFR Part 1021). This Environmental Assessment (EA) has been prepared to provide sufficient information so that DOE may determine whether a Finding of No Significant Impact is warranted for the Proposed Action or whether an Environmental Impact Statement (EIS) must be prepared. The assessments of environmental effects presented in this EA are based on reasonable maximum assumptions that tend to overestimate effects. Thus, the actual environmental consequences of the Proposed Action are expected to be less than those presented here.

1.2 Background

The end of the Cold War has created a legacy of surplus weapons-usable fissile materials both in the United States and the former Soviet Union. Further agreements on disarmament may increase the surplus quantities of these materials. The global stockpiles of weapons-usable fissile materials pose a danger to national and international security in the form of potential proliferation of nuclear weapons and the potential for environmental, safety, and health consequences if the materials are not properly safeguarded and managed. In September 1993, President Clinton issued a *Nonproliferation and Export Control Policy* in response to the growing threat of nuclear proliferation. Further, in January 1994, President Clinton and Russia's President Yeltsin issued a *Joint Statement Between the United States and Russia on Nonproliferation of Weapons of Mass Destruction and the Means for Their Delivery*. To demonstrate the United States' commitment to these policies, President Clinton announced on March 1, 1995 that about 224 tons (203 metric tons) of U.S.-origin weapons-usable fissile materials, of which 182 tons (165 metric tons) are highly enriched uranium and 42 tons (38 metric tons) are weapons-usable plutonium, had been declared surplus to the United States' defense needs.

To safeguard and manage this material, DOE has decided to implement a program to provide for safe and secure storage of weapons-usable fissile materials and a strategy for the disposition of surplus weapons-usable plutonium, as specified in the Record of Decision (ROD) for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (S&D PEIS) (DOE 1996a). The fundamental purpose of the program is to maintain a high standard of security and accounting for these fissile materials while in storage, and to ensure the plutonium produced for nuclear weapons and declared excess to national security needs (now or in the future) is never again used for nuclear weapons.

The final S&D PEIS ROD, issued January 14, 1997, established the dual-track strategy to irreversibly dispose of the Nation's surplus plutonium and to reduce from seven to three the number of sites that store nuclear weapons material. The strategy would immobilize some (and potentially all) of the surplus plutonium in glass or ceramic formulations and allow the use of some of the surplus plutonium as MOX fuel in existing domestic commercial reactors. The extent of utilization of either or both of these potential disposition alternatives and the locations for disposition facilities will be determined pursuant to the Surplus Plutonium Disposition EIS (DOE, 1998b), as well as cost analysis and technical and nonproliferation studies.

As explained in the ROD for the S&D PEIS, DOE proposes to engage in a test and demonstration program for CANDU MOX fuel consistent with ongoing and potential future cooperative efforts with Russia and Canada, and based on appropriate NEPA review. The test and demonstration activities would occur at Los Alamos National Laboratory (LANL), New Mexico, and at Chalk River Laboratories (CRL), Ontario, Canada.

Pursuing this approach provides U.S. leadership in working with Russia to implement similar options for reducing Russia's excess plutonium in parallel, Pursuing this approach also sends the strongest possible signal to the world of US determination to reduce stockpiles of surplus weapons-usable plutonium, as quickly as possible, in an irreversible manner. The large-scale disposition of surplus U.S. plutonium would not take place unless there is significant progress on plans for Russian plutonium disposition.

1.3 Purpose and Need for Agency Action

DOE (with the cooperation of the Canadian Government) must demonstrate the feasibility of using MOX fuel in CANDU reactors as part of its ongoing mission to evaluate the disposition of surplus weapons-usable fissile materials. The ability to successfully operate heavy-water-moderated CANDU reactors with MOX fuel has not been fully demonstrated. The possible use of MOX fuel in CANDU reactors needs to be successfully demonstrated to adequately meet the potential disposition agreements in the event that use of these facilities is ultimately agreed upon by the various governments. Therefore, DOE has fabricated, and may, in the future, fabricate a limited amount of MOX fuel and now needs to provide a limited amount of MOX fuel to Canada to facilitate the testing and demonstration of MOX fuel in CANDU reactors. This testing will verify equipment design and resolve related performance issues for potential industrial-scale operation, as well as the process for rendering plutonium dioxide from weapons components.

1.4 Scope of this EA

A "sliding-scale" approach, following the DOE Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements (DOE 1993a), is the basis for effects analysis in this EA. That is, certain aspects of the Proposed Action have a greater potential for creating environmental effects than others; therefore, they are discussed in greater detail in this EA than those aspects of the action that have little potential for effect. For example, implementation of the Proposed Action could slightly increase the accident risk to the motorists along the route from the commercial carrier's truck during transportation of the MOX fuel. The accident risk increase would be negligible when taken as a whole with the many other vehicles on the highway. With regard to this example, the EA, therefore, would present descriptive information on highway transportation only to the extent necessary for effects analysis, and not for every vehicle and motorist along the transportation route.

A "bounding" analysis is often used to assess potential effects. When this approach is used, reasonable maximum assumptions are made regarding the input parameters needed. Such an analysis usually provides an overestimation of potential effects. Any future actions that exceed the assumptions ("bounds") of the effects analysis would not be allowed until an additional NEPA review could be performed and a decision to proceed with that action(s) is made.

This EA focuses on the fabrication and transportation of MOX fuel from LANL to the Canadian border, although, in response to public comments, this EA also discusses impacts in Canada and potential transboundary impacts. The S&D PEIS also discussed use of MOX fuel in CANDU reactors and those discussions, including the response to comments from the Canadian Embassy, are incorporated by reference.

1.5 Public Involvement

DOE provided written notification of this proposed project's NEPA review to the State of New Mexico, all of the states and federally recognized Indian Nations along the proposed shipment routes, the LANL area's four Accord[1] Pueblos (San Ildefonso, Santa Clara, Jemez, and Cochiti Pueblos), the Mescalero Apache Tribe,

[1] Accord refers to the written agreements signed by DOE and the four Pueblos on December 8, 1992, stating the basic understanding and commitments of the parties and describing the general framework for working together. Subsequently, cooperative agreements between each Pueblo and DOE, and between each Pueblo and the

and to over 30 known stakeholders in the Los Alamos County (the County) area. The Preapproval Draft EA was issued on August 18, 1997. It was provided to all of the states and federally recognized Indian Nations along the proposed shipment routes, the four Accord Pueblos, the Mescalero Apache Tribe, and to known stakeholders for their review and comment. The Preapproval Draft EA was also made available to the public for review through placement in the DOE Public Reading Rooms in Los Alamos and Albuquerque, New Mexico and through the World Wide Web (http://www.laao.doe.gov/LAAO/docs/para.pdf). Upon request, the Preapproval Draft EA was provided to all interested parties for their review.

As a result of the public review and comment process for the Preapproval Draft EA, DOE received comments from the State of New Mexico, members of the U.S. and Canadian public, and Canadian and American organizations focused on environmental concerns. DOE considered these comments and modified the final EA as appropriate. Copies of all the comments received are provided in Appendix A of this document together with DOE's responses to questions or stated concerns.

University of California have been signed, which specify further details related to the accord agreements.

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2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action and discusses alternatives considered for enabling DOE to meet its purpose and need for agency action. The No Action alternative is analyzed as a baseline to compare with the consequences of implementing the Proposed Action. Alternatives that were considered but were not analyzed further in this EA are discussed in Section 2.3.

2.1 Description of the Proposed Action

To meet the purpose and need for Agency action, DOE has and proposes to fabricate and transport up to 59.2 lb (26.8 kg) of MOX fuel as part of the Parallex Project. DOE has already fabricated a portion of this MOX fuel at LANL, and DOE proposes to fabricate additional MOX fuel at LANL if needed. This test and demonstration project has been named Parallex (parallel experiment) because of the roles of the United States and Russia in supplying test material. The Parallex Project would be a joint agreement between Russia, Canada, and the U.S. to demonstrate the irradiation[2] of U.S. and Russian MOX fuel in parallel in the Atomic Energy of Canada, Limited (AECL)-owned National Research Universal (NRU) reactor. This international project would use MOX fuel made in the U.S. (specifically LANL [Figure 1]) and Russia (specifically from Bochvar) from surplus weapons-grade plutonium out of both countries' nuclear stockpile.

Research and development of MOX fuels has already been conducted at LANL as part of its ongoing mission relating to the development of energy sources for experiments and research reactors. However, these various MOX fuel forms were not made with weapons-grade plutonium. In contrast, the MOX fuel fabrication process involved in the Parallex Project would use weapons-grade plutonium (in an unclassified form) obtained from decommissioned nuclear weapons. The U.S. would provide up to four types of MOX fuel in varying plutonium percentages for the Parallex Project.

The U.S. MOX fuel for testing and demonstration has and would, in the future, be fabricated at LANL, and would be transported to the Canadian border. At the border the AECL, per prior agreement, would take possession of the fuel. The fuel would remain on the same truck and the AECL would complete the shipment to the reactor site. At Chalk River, Ontario, the MOX fuel would be delivered to CRL for testing in the NRU reactor. Figure 2 shows the general location of the CRL within Ontario, Canada, and North America. The AECL would be responsible for conducting all subsequent tests of the fuel's performance and the function of the reactor. Fueling the NRU reactor with MOX fuel would be part of a feasibility test to determine MOX fuel performance in converted CANDU reactors, should one or more reactors be converted in the future. The NRU test reactor is the only available reactor specifically designed to test MOX fuel performance for CANDU reactors. Positive test results could support subsequent decisions on the dispositioning of surplus weapons-grade plutonium in CANDU reactors. All spent fuel resulting from the tests would be managed under the Canadian spent fuel program.

[2] The irradiation of MOX fuel would reduce the proliferation risk of the plutonium material. Energy would also be produced when the plutonium in MOX fuel is fissioned (burned).

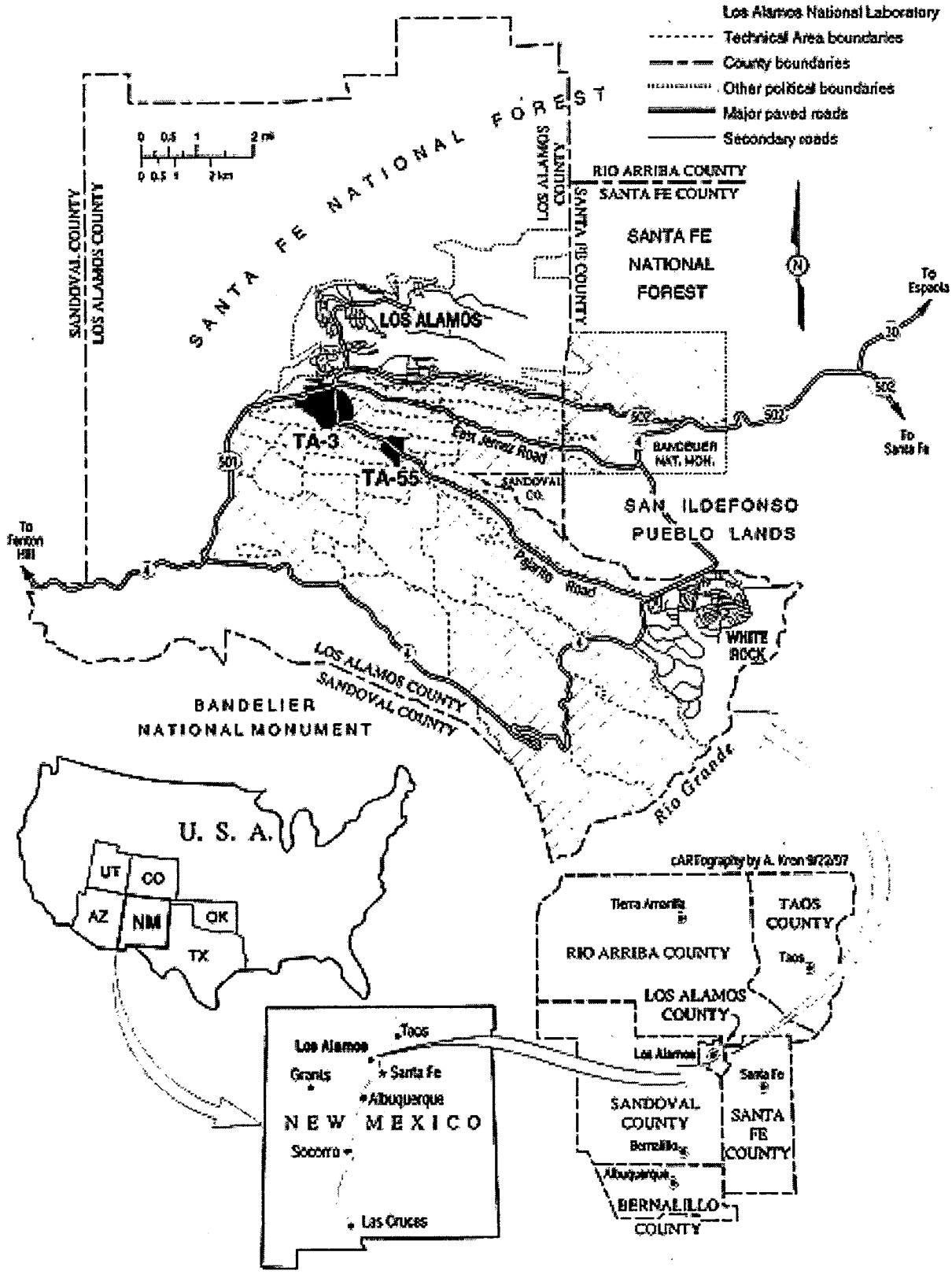

Figure 1. Location of Los Alamos National Laboratory.

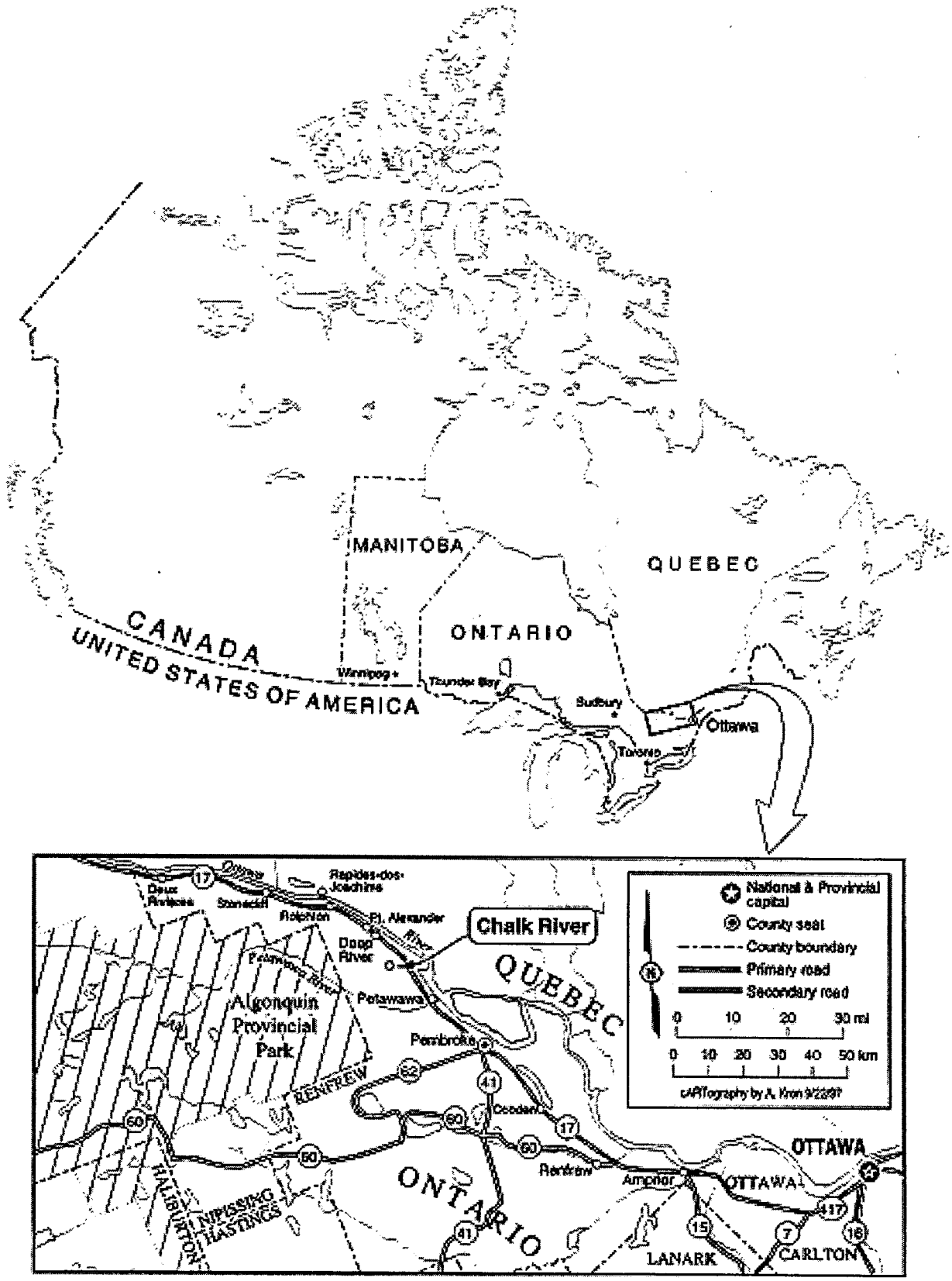

Figure 2. Location of Chalk River in relation to Ontario, Canada.

2.1.1 Manufacture of MOX Fuel and Rods

For the Parallex Project, a Test Plan (Copeland 1996) was developed that provides the basis for DOE to fabricate four types of MOX fuel. Under this Test Plan, MOX fuel with two different plutonium concentrations (1.6 percent and 3.1 percent) would be fabricated, and for each plutonium concentration, two different levels of homogeneity (intermediate and high) would be fabricated. Intermediate homogeneity is defined, for this project, as the homogeneity achieved from the mixing step in the standard fabrication process, whereas high homogeneity would be achieved through the inclusion of an additional mixing step. The amount of fuel to be fabricated for each combination of plutonium concentration and homogeneity level for the U.S. portion of the Parallex Project is shown in Table 2-1.

Table 2-1. Required Material to Complete the LANL Portion of the Parallex Test Plan

Type	Number of Rods	MOX Fuel lb (kg)	Plutonium lb (kg)	Uranium lb (kg)	Oxygen lb (kg)
1.6% Pu Intermediate Homogeneity	14	18.1 (8.2)	0.2 (0.1)	15.7 (7.1)	2.2 (1.0)
1.6% Pu High Homogeneity	14	18.1 (8.2)	0.2 (0.1)	15.7 (7.1)	2.2 (1.0)
3.1% Pu Intermediate Homogeneity	9	11.5 (5.2)	0.2 (0.1)	10.0 (4.5)	1.3 (0.6)
3.1% Pu High Homogeneity	9	11.5 (5.2)	0.2 (0.1)	10.0 (4.5)	1.3 (0.6)
Total	46	59.2 (26.8)	0.84 (0.4)	51.4 (23.2)	7.0 (3.2)

As part of DOE's initial bench-scale fabrication feasibility research and development efforts supporting the proposed Parallex Project, a MOX fuel fabrication process was studied and developed at LANL's plutonium facility (PF-4) located within Technical Area 55 (TA-55). A simplified version of the process is shown in Figure 3. This process was selected for use in the fabrication of the Parallex Project MOX fuel. The first step in the process is the receipt of plutonium dioxide powder, arising from the dismantlement of nuclear weapons at the DOE Pantex Plant near Amarillo, Texas. The plutonium dioxide is put though a thermal treatment process to remove impurities, such as gallium. The treated plutonium dioxide is then combined with uranium dioxide, which in this case was obtained from AECL, to make a master blend. The master blend is defined as having 10 percent plutonium.

After the master blend is made, additional uranium dioxide can be added (in predetermined amounts) in order to achieve the proper plutonium concentrations of 3.1 percent or 1.6 percent as needed in the final blends. The addition of more uranium dioxide is called downblending. These final blends are each then put through a standard mixing procedure, and the result is a powder of intermediate homogeneity. For each plutonium concentration, half of the intermediate homogeneity powder is then put through an additional mixing step to achieve the high homogeneity portion of the test matrix.

Once the proper plutonium concentrations and homogeneities of the powder blends have been achieved, the remainder of the fabrication process is as follows: pressing of the MOX fuel into the proper pellet shape, sintering of the pellets (heating by flame would not be used in this process), grinding of the pellets into the proper final dimensions, and cleaning of the pellets. For this project, process parameters for each of these steps were provided by AECL to meet the specifications of their reactor.

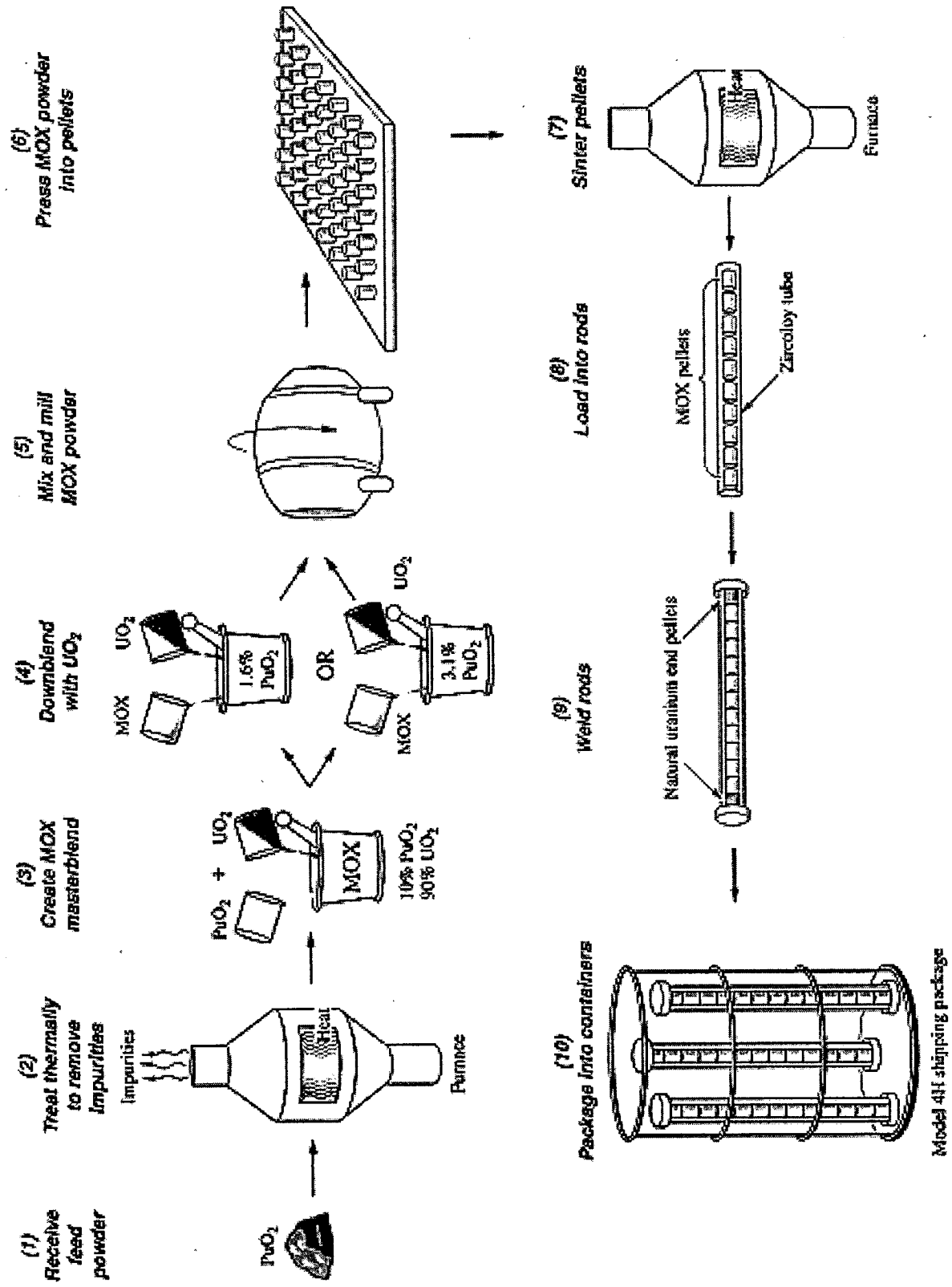

Figure 3. MOX fabrication and packaging.

As part of the bench-scale research and development work already conducted at LANL, three batches of test MOX fuel were produced. From these batches, about 9.2 lb (4.2 kg) of 3.1 percent plutonium fuel was identified as acceptable and meeting the criteria for use in the Parallex Project. A master blend of 11.0 lb (5.0 kg) of MOX powder with 10 percent plutonium and 90 percent depleted uranium was also made that could be used to make most of the remaining amount of fuel needed to complete the test matrix. (Full completion of the test matrix fuel would most likely require an additional batch of master blend to be created.) The existing fabricated MOX fuel pellets and master blend powder are stored in PF-4 awaiting its use in the Parallex Project or another disposition method. For fabrication of the Parallex fuel, this already-created master blend of MOX powder (plus any newly created master blends) would go through the same processing steps as described above so that the resulting fuel powders contain the correct percentages of plutonium and correct homogeneity levels; in turn, these final powder blends would then be pressed into pellets.

After inspection, acceptable pellets would be loaded into zircaloy tubes (also known as rods), and natural uranium dioxide end pellets (also called shim pellets or backfill pellets) would be added, as necessary, to obtain the proper stack length. Endcaps would then be welded onto the loaded rods to create sealed, complete fuel rods. Rod loading and welding capabilities are being developed at LANL specifically for the materials used in this project. These fuel rods would then be leak checked, surveyed for possible contamination, and then stored in PF-4 prior to shipment to CRL.

The MOX fuel fabrication has been and would likely, in the future, be conducted by about a 12-person staff within PF-4. All of the handling and work with the plutonium and uranium that would yet be required would be done inside a series of gloveboxes. A typical glovebox is illustrated in Figure 4. The gloveboxes are sealed and have a self-contained negative pressure ventilation system that is high-efficiency particulate air (HEPA) filtered. Radiological monitors are located in the gloveboxes. The estimated 12-person staff involved in the process would be trained in health and safety requirements and required to follow the written operating procedures for MOX fuel fabrication. The workers would be dressed in personal protective clothing consisting of gloves, overalls, and shoe covers. In addition to the glovebox built-in safety measures, PF-4 is sealed to the outside and is also maintained with a negative air pressure to prevent the escape of airborne contamination. The PF-4 area has its own air ventilation system equipped with radiation monitors, alarms, and HEPA filtration to prevent the escape of contamination into the atmosphere.

On average, the 12 workers directly involved with the plutonium and uranium handling would receive a dose of approximately 355 mrem per year, assuming a year-round routine operation. The anticipated time required to complete the fabrication of any necessary additional fuel rods would be about six months. A limited amount (approximately 170 ft^3 [4.8 m^3]) of low-level radioactive solid waste[3], such as rags and gloves, would be produced from the fabrication process. A small amount, 22 ft^3 (0.62 m^3), of solid transuranic (TRU) waste such as gloves and plastic bags would be produced inside the gloveboxes. Ethanol would be used in the glovebox to clean the MOX fuel pellets before loading into the rods. The ethanol would be applied with a small cloth. No ethanol liquid waste would be produced because the ethanol would evaporate.

2.1.2 Shipping Package Description and Rod Packaging

Approved packaging refers to a container and all accompanying components or materials necessary to perform its containment function. Packages used by DOE for radioactive and hazardous materials shipments are either certified to meet specific performance requirements or built to specifications described in the Department of Transportation (DOT) hazardous materials regulations (49 CFR 100-199). For relatively

[3] Solid waste in this context refers to dry radiological waste and not Resource Conservation and Recovery Act (RCRA) waste.

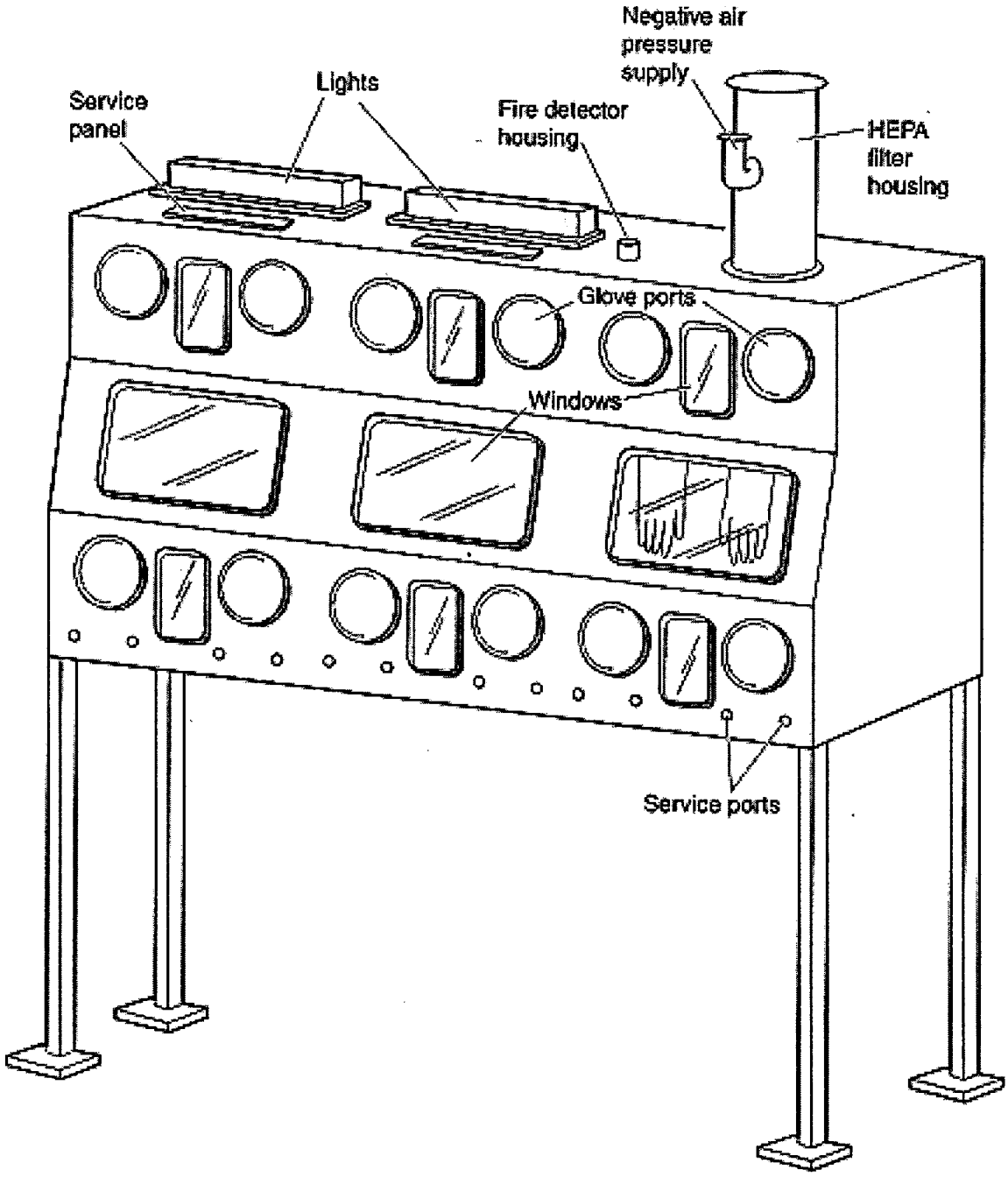

Figure 4. Schematic glovebox design.

low-level radioactive materials, DOT Specification Type A packages are used. For the Parallex Project, a Type B shipping package on a commercial truck would be used to transport the LANL MOX fuel to Canada. Type B packages are designed to retain their contents under both normal conditions of transportation as well as under hypothetical accident conditions. Type B packages are far more robust than Type A packages.

The Type B package used in the shipment(s) would be certified by both the U.S. and Canadian transportation authorities. The Type B shipping package proposed for use was designed and manufactured by Canada. It is known as the Model 4H Enriched Fuel Bundle Shipping Package. The model 4H package has a Certificate of Compliance from the Canadian Atomic Energy Control Board showing that it meets the International Atomic Energy Agency Safety Series 6 requirements. This package also meets DOT Type B specifications. The Model 4H Package can be generally described as a 55-gal. (208-L) metal drum with a sealable lid. Individual storage spaces surrounded by packing material are located in the drum. The Model 4H Package is illustrated in Figure 5. Additional technical information of the Model 4H Package is presented in Appendix B along with a copy of the Canadian shipping package certificate. The U.S. DOT shipping package certificate is also presented in Appendix C.

2.1.3 Transportation of MOX Fuel

When the MOX fuel is identified for shipment, the rods would first be placed inside a Model 4H Package. The rod packaging would be done at the TA-55 facility by workers in personal protection clothing and under the supervision of radiation control technicians. Engineering controls, such as HEPA filtration, and continuous air monitors would be used to protect personnel and the environment. Administrative controls, such as radiation work permits and radiological postings, would also be in place for safety and health protection during the rod packaging. The work area and workers would be monitored for radiation during and after the packaging procedure. At TA-55, the Model 4H Package would be loaded by forklift into a LANL vehicle designed to transport radioactive materials. Such a vehicle is designed to prevent security breaches and loss of material content during transport. Following standard procedure, the LANL vehicle would transport the MOX fuel in the Model 4H Package approximately 2 mi (3.2 km) to the LANL shipping warehouse at TA-3. Because of the low radioactivity per shipping package, no roads along the route would be closed to public access during the MOX fuel transfer to the warehouse.

After arriving at the LANL shipping warehouse, the manifest documents would be processed. Up to two Model 4H Packages would then be loaded with a forklift into a commercial truck. The loading and shipping of radioactive materials would be carried out in accordance with DOT regulations and existing LANL Safe Operating Procedures (SOPs). Once loaded, the truck would then be ready to leave for Canada.

The amount of LANL MOX fuel needed to test in the Parallex Project has been calculated and all of the fuel described in Table 2-1 could be fabricated simultaneously and transported as one shipment. However, this scenario is unlikely due to evolving programmatic decisions, developments, and schedules. For example, from the initial research and development for the Parallex Project, it was determined that approximately 9.2 lb (4.2 kg) of MOX pellets (at 3.1 percent plutonium) was acceptable as fuel for the test irradiation. A programmatic decision was then made to leave open the option that this fuel could be shipped and tested as the lead, or first, test fuel bundle. The fabrication of the complete test matrix (including the full amount of originally planned 3.1 percent plutonium fuel) would follow. This first test fuel could also include additional fuel pellets (up to 2.4 lb [1.1 kg]) to serve as spares, archives, or samples, for a total initial shipment amount of 11.7 lb (5.3 kg). The timing of further project developments could then affect whether the remainder of the fuel could be shipped as a complete package or divided into multiple smaller shipments.

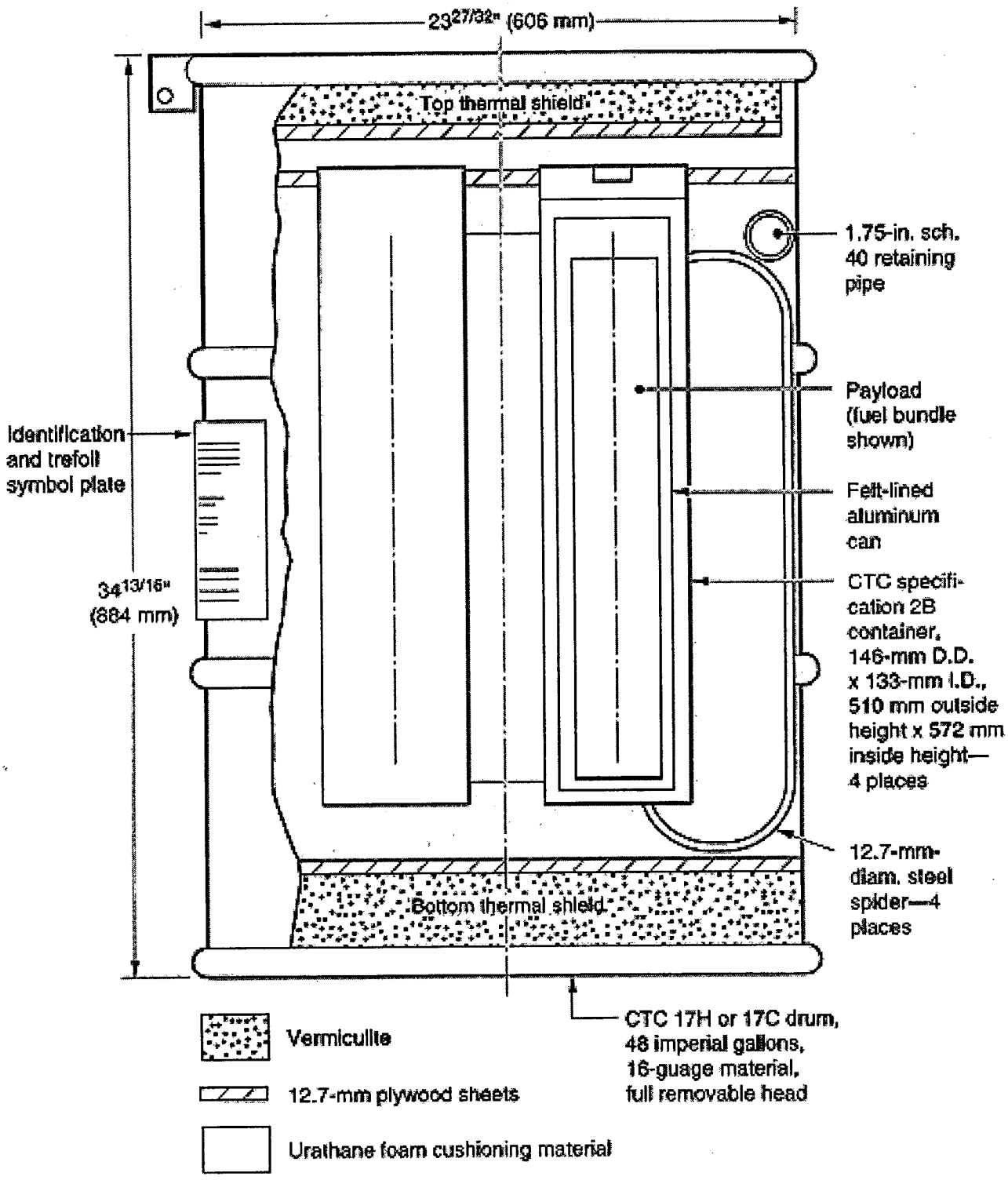

Figure 5. AECL Model 4H shipping package.

For purposes of analysis here, three possible shipment scenarios were developed based on the above uncertainties. Although unlikely, in Scenario 1, all of the MOX material would be transported in a single shipment. This would include the 11.7 lb (5.3 kg) of lead test fuel, plus the entire test matrix quantities. In Scenario 2, the lead test fuel [11.7 lb (5.3 kg)] would be shipped separately, followed by a different shipment of the complete test matrix amounts. Scenario 3 is similar in that the lead test fuel is shipped first, but the test matrix quantities would be further divided into two shipments (one for each plutonium concentration). The specific quantities for each shipment scenario are described in Table 2-2. In all cases, the 6.6 lb (3.0 kg) of natural uranium dioxide shim pellets were divided proportionally between the shipments.

Table 2-2. Material Quantities to be Shipped for Various Shipment Scenarios

Shipment Scenario	Mass of Shim Pellets lb (kg)	Mass of MOX fuel Pellets lb (kg)	Total 3.1% MOX fuel lb (kg)	Total 1.6% MOX fuel lb (kg)	Total Plutonium lb (kg)	Total Uranium lb (kg)	Total Oxygen lb (kg)
1	6.6 (3.0)	71.2 (32.3)	35.1 (15.9)	36.1 (16.4)	1.5 (0.666)	67.1 (30.45)	9.2 (4.18)
2	1.1 (0.5)	11.7 (5.3)	11.7 (5.3)	0 (0)	0.32 (0.146)	11.0 (4.97)	1.5 (0.69)
	5.5 (2.5)	59.5 (27.0)	23.4 (10.6)	36.1 (16.4)	1.2 (0.521)	56.2 (25.48)	7.7 (3.50)
3	1.1 (0.5)	11.7 (5.3)	11.7 (5.3)	0 (0)	0.3 (0.145)	11.0 (4.97)	1.5 (0.69)
	2.2 (1.0)	23.4 (10.6)	23.4 (10.6)	0 (0)	0.6 (0.290)	22.0 (9.94)	3.0 (1.37)
	3.3 (1.5)	36.1 (16.4)	0 (0)	36.1 (16.4)	0.5 (0.231)	34.2 (15.55)	4.7 (2.12)

The above three scenarios were developed in order to provide bounding cases for transportation effect analyses. The single shipment (Scenario 1) provides a bound by having the largest quantity of material to be shipped, and hence the largest possible effects from the actual materials. The three shipments (Scenario 3) provide a different type of bound in that they represent the largest number of shipments, hence the greatest possible effect from the actual transportation.

2.1.4 Transportation Routes

Pursuant to DOT and Nuclear Regulatory Commission (NRC) requirements, the transportation route would principally use interstate highways, minimize bridge crossings, not pass through tunnels, bypass high population areas (where possible), minimize distance and time, minimize public effects, and generally be safe. A commercial truck would be used to transport the MOX fuel because of the Model 4H Package safety features and low radioactivity levels per shipment. The shipment(s) would be transported along interstate highways, whenever possible. Shipment over specific routes, i.e., using interstate bypasses around cities and using the most direct interstate highways, is required for shipments identified by the DOT as Highway Route Control Quantity (HRCQ). HRCQ shipments are regulated under the DOT transportation regulations (49 CFR 397.101). A HRCQ designation is given to radioactive materials (within a single package) that have a radioactivity level (curie) specified in 49 CFR 173.403. More than 7 ounces (200 g) of plutonium per shipment would be required for a Parallex Project shipment to be declared HRCQ. As currently envisioned, not all Parallex Project MOX fuel shipments would be categorized as HRCQ. As an added safety measure, all of the LANL MOX fuel shipments to Canada would follow routes meeting HRCQ requirements. In addition to using interstate highways and bypasses, routing regulations require that the quickest routes must be selected in order to reduce the time the radioactive material is in transit. DOT routing regulations permit appropriate state agencies to designate routes for HRCQ shipments through their state. States granted approval of state-designated alternative routes may request advance notification of the shipment. DOE would also identify the MOX fuel shipments as High Visibility Shipments. A High Visibility Shipment requires, in addition to DOT transportation regulations, a Transportation Plan and a satellite communications relay to a central command center (TRANSCOM). The TRANSCOM system would know the exact location of

a truck in real time during a shipment from LANL to the Canadian border. The system is capable of tracking vehicles all the way to Chalk River.

Seven routes from LANL to the Canadian border that could meet DOT routing requirements were analyzed to present a bounding case for transportation effects. These routes are illustrated in Figure 6. The seven routes each have a separate port of entry into Canada. A computer routing program named HIGHWAY (ORNL 1993) was used to determine the best routes. The HIGHWAY model, developed by Oak Ridge National Laboratory, predicts highway routes for transporting radioactive materials in the United States. The database of the HIGHWAY model calculates routes which maximize the use of the Interstate highway system. The computer model is designed to circumvent urban areas by use of available highway bypasses. These features allow the HIGHWAY code to conform to the DOT transportation routing regulations.

The seven analyzed routes are listed in Table 2-3 and are identified by the name of the city closest to the international border crossing. All routes could meet the DOT transportation routing regulations and, therefore, would be acceptable for transporting the MOX fuel to the Canadian border from Los Alamos. The seven routes vary in distance. Within the U.S., the Pembina, North Dakota route is the shortest to reach the Canadian border, whereas the Watertown, New York route is the longest within the U.S. to reach the border. In comparison, the Detroit, Michigan route is the shortest route overall between Los Alamos and Chalk River. Despite these differences, all seven routes are acceptable for transporting MOX fuel. In the Proposed Action, the MOX fuel would be transported to Canada in up to three shipments. For each shipment, one of the seven routes must be used and the exact route would be chosen by the freight company. A detailed description of each of the seven routes is presented in Section 3.2.2.

Table 2-3. Transportation Routes

Origin	Port of Entry	Destination	Distance to Canadian Border, mi (km)	Total Distance, mi (km)
Los Alamos, NM	Pembina, ND	Chalk River, ON	1,530 (2,462)	2,822 (4,542)
Los Alamos, NM	Sault Ste. Marie, MI	Chalk River, ON	1,959 (3,153)	2,342 (3,769)
Los Alamos, NM	Port Huron, MI [a]	Chalk River, ON	1,755 (2,824)	2,252 (3,624)
Los Alamos, NM	Detroit, MI [b]	Chalk River, ON	1,714 (2,758)	2,217 (3,568)
Los Alamos, NM	Buffalo, NY	Chalk River, ON	1,895 (3,050)	2,271 (3,655)
Los Alamos, NM	Niagara Falls, NY	Chalk River, ON	1,917 (3,085)	2,275 (3,661)
Los Alamos, NM	Watertown, NY	Chalk River, ON	2,126 (3,422)	2,325 (3,742)

a This route will not be used because the Blue Water Bridge is under construction.
b It is unlikely that this route will be used because the Ambassador Bridge is restricted for trucks carrying hazardous materials.

2.2 No Action Alternative

The No Action alternative provides an environmental baseline to compare to the potential effects of the Proposed Action. It must be considered even if DOE is under a court order or legislative command to act [10 CFR 1021.321(c)]. Under this alternative, LANL would continue to store the existing MOX fuel at TA-55. No additional fuel pellets or additional fuel rods would be made for the Parallex Project. The AECL would have no source of U.S. MOX fuel rods and, therefore, would have to delay its testing program at the NRU reactor in parallel with Russian MOX fuel, or if Russian fuel were made available, operate the testing program in the absence of U.S. supplied MOX fuel.

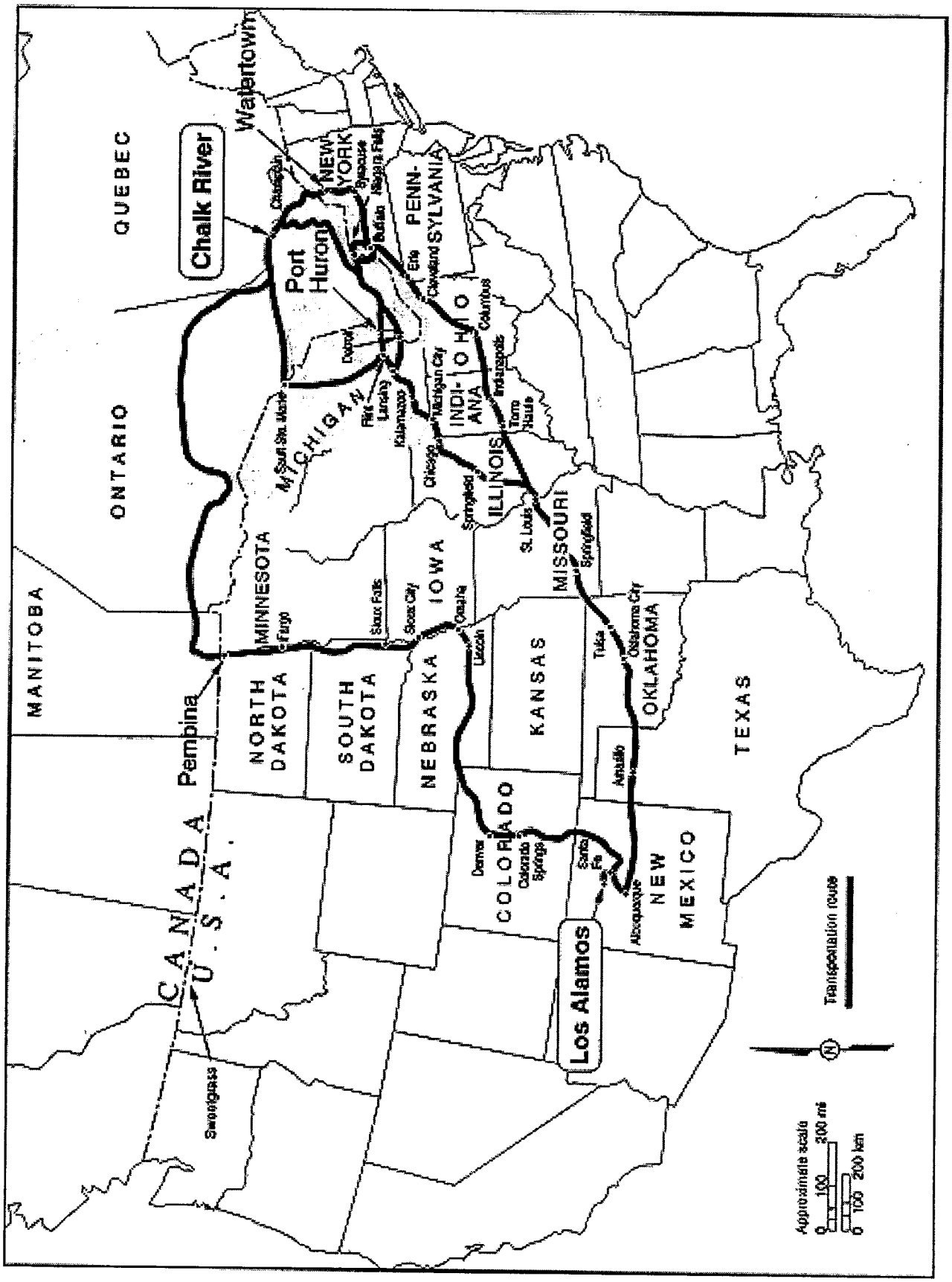

Figure 6. Transportation routes from Los Alamos to Chalk River.

2.3 Alternatives Considered but Dismissed from Further Consideration

Alternatives for producing the MOX fuel at other DOE facilities and using other fabrication technologies were also considered. Additionally three alternatives for transporting the MOX fuel were considered as well: 1) transport by air, 2) transport by rail, and 3) ground shipment by safe secure transport (SST). For the reasons stated below, these alternatives were dismissed from further consideration in this EA.

2.3.1 MOX Fabrication at Other DOE Facilities

Under this alternative, MOX fuel would be fabricated at other DOE facilities and then shipped to CRL. No DOE site other than LANL presently has the ability to fabricate MOX fuel. Furthermore much of the raw materials that would be used in the demonstration are already located at LANL. In addition, the capabilities at LANL were readily available during the timeframe in which DOE needed the work to be conducted. The time required to upgrade other sites to produce MOX fuel would delay the further fabrication and shipment of MOX fuel such that the Parallex Project schedule would not be met. The U.S. MOX fuel would not be tested in the NRU reactor in a timely manner. Therefore, this alternative was dismissed from further analysis.

2.3.2 Other Technologies for MOX Fabrication

This alternative would use other methods such as computer simulation or surrogate fuels to evaluate the MOX fuel fabrication process. The use of computer simulation is not developed to the point where it can be applied to MOX fuel fabrication. The use of surrogate fuels in the Parallex Project would not produce the irradiation data required for verifying reactor performance. The technology and fabrication process developed at LANL from research and development is currently the only reasonable way of fabricating MOX fuel for the Parallex Project. Therefore, this alternative was dismissed from further analysis because it does not meet the purpose and need for MOX fuel fabrication in support of the Parallex Project.

2.3.3 Transport of MOX Fuel by Air

Federal regulations under 10 CFR 71.88 (Air Transport of Plutonium) explicitly prohibit the transportation of plutonium by air or the delivery to a carrier for air transport unless the plutonium is 1) in a medical device, 2) in a form with a specific activity no greater than 0.002 μCi/g, 3) shipped in a single package with no more than a specified quantity, and 4) shipped in a specifically authorized NRC-package with a Certificate of Compliance. Plutonium is a component of MOX fuel. The restrictions imposed for transportation of plutonium by air prohibits this alternative for shipment of the MOX fuel quantities needed for the Parallex Project. In addition, air transport is considered to be more hazardous than ground transport due to the potential for greater distribution of radioactive materials in the event of a major air accident. This alternative was dismissed from further analysis.

2.3.4 Transport of MOX Fuel by Rail

Rail shipment is an allowable mode for the transport of radioactive materials and is regulated by DOT under 49 CFR 174.700. However, there is no direct rail service from Los Alamos, New Mexico. A rail shipment of MOX fuel would be designated as high visibility. This mode of transport would not be feasible because of the high visibility, lack of dedicated rail routes, and long layovers for railcar transfers. Cumulatively, all the complications of rail transport negates use of this transport mode. Therefore, this alternative does not support the purpose and need for agency action and was dismissed from further analysis.

2.3.5 Shipment of MOX Fuel by SST

DOE and DOT require high security in the transportation of special nuclear material, for example, plutonium in the form of metal. Shipments of plutonium and uranium (enriched to greater than 20 percent U-235) in

certain forms are required to be transported by the SST system. Plutonium and uranium dioxides in greater than 13.2-lb (6-kg) and 44-lb (20-kg) quantities, respectively, require shipment by SST. The SST fleet is a DOE owned and operated transportation system and consists of armored tractor-trailers and special escort vehicles. The vehicles are continuously monitored and the couriers operating the escort vehicles and trucks are heavily-armed Federal agents (SNL 1996). The SST system is primarily designed for use in the continental U.S.

The MOX fuel rods do not meet the DOE criteria required for SST use, such as material form and radioactivity level. The added security and expense of the SST system is not needed because the MOX fuel would be in small quantities, would have a negligible radioactive dose to the public, and could not easily be converted into weapons-usable form. The shipment of small quantities of MOX fuel does not justify the use of SSTs. Although this alternative is not analyzed in detail in this EA, the effects from transportation by SST would be similar to commercial truck transportation for radiological and non-radiological effects to the public and crew during both routine and potential accident conditions. For the disposition of MOX fuel as discussed in the S&D PEIS, it is anticipated that SSTs would be used because of the larger quantities of fuel.

2.4 Foreseeable Related and Future Actions

The *Draft Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (SWEIS) (DOE, 1998a) evaluates the consequences of all ongoing operations at LANL including MOX fuel fabrication. The DOE Advisory Council for the SWEIS determined that this EA would meet CEQ requirements for an interim action (40 CFR Part 1506.1), would not affect or be affected by the SWEIS, and would not prejudice the ultimate decision on the SWEIS. DOE therefore determined that the NEPA analysis of the Proposed Action could continue in parallel with the SWEIS process.

In the Surplus Plutonium Disposition Draft EIS (DOE, 1998b), DOE proposes to establish a MOX fuel fabrication facility. The MOX fuel would be used in existing commercial light water reactors in the U.S. Some of the MOX fuel could also be used in CANDU reactors in Canada depending upon negotiation of a future international agreement between Canada, Russia, and the United States. The ROD for this EIS is anticipated to be issued in 1999. The production and shipment of a limited amount of MOX fuel to conduct the Parallex Project is needed before that time frame and would neither affect nor be affected by the analysis, nor would it prejudice the ultimate decision on the EIS. DOE has therefore determined that the Proposed Action would meet CEQ requirements for an interim action (40 CFR Part 1506.1), and therefore, should continue in parallel with the Surplus Plutonium Disposition EIS.

3.0 AFFECTED ENVIRONMENT

Section 3.0 describes the natural and human environment that could be affected by either the Proposed Action or No Action alternative and provides the context for understanding the environmental consequences described in Section 4.0. Environmental resources not likely to be affected are addressed in less detail.

3.1 Potential Environmental Issues

Based on the proposed project description, potential environmental resources that may be affected as a result of implementing the Proposed Action have been considered. Environmental issues were identified and either addressed or not analyzed in detail, depending upon their individual applicability to the Proposed Action. Table 3-1 identifies the subsection where potential environmental issues are discussed or notes why they are not addressed further for this project.

Table 3-1. Potential Environmental Issues

Potential Issue	Applicability	Described In Section
Human Health	Yes	Section 3.3
Air Quality	Yes	Section 3.4
Waste Management	Yes	Section 3.5
Environmental Justice	Yes	Section 3.6
Socioeconomics	NA-no change in employment and socioeconomic conditions.	NA
Ecological Resources/Wetlands/Floodplains	NA-no construction activities, and transportation uses established interstates.	NA
Environmental Restoration	NA-no clean up required.	NA
Aesthetics	NA-no change in aesthetics.	NA
Noise Levels	NA-no noise above normal highway traffic.	NA
Cultural Resources	NA-no construction activities.	NA
Parks, forests, conservation areas, or areas of importance for public recreation	No effects.	NA
Seismology and Geology	NA-no construction activities, buildings meet codes.	NA
Wild Horses and Burros	NA-none present.	NA
Prime Farmland	NA-none present.	NA
Water Quality	NA-none affected.	NA

3.2 Regional Settings

3.2.1 LANL

Four roads convey traffic to and from LANL (see Figure 1). State Road 502 is heavily used by commuter traffic from Santa Fe and Española. State Roads 4 and 502 provide access to LANL for small communities to the west of LANL. East Jemez Road and Pajarito Road are DOE-owned and provide public access to many technical areas at LANL. In addition to private vehicles, DOE and LANL employee and government vehicles contribute extensively to the volume of traffic on each of these roadways.

In 1995, the County had an estimated population of approximately 18,180 (based on the 1990 US census adjusted to July 1, 1995). Two residential and related commercial areas exist in the County. The Los

Alamos townsite has an estimated population of 11,400. The White Rock area, including the residential areas of White Rock and Pajarito Acres, has about 6,800 residents.

PF-4 at TA-55 is centrally located within the LANL core operations complex. It is the only facility of DOE designed to simultaneously handle plutonium and uranium. Active and diverse research and development on the chemical and physical properties of plutonium are conducted at the facility. For protection of the worker, environment, and public, the facility is compartmentalized into laboratories. All plutonium and uranium is handled within a glovebox line that prohibits unprotected contact by the workers. The closed gloveboxes have an air filtration system consisting of HEPA filters and radiation monitors. In addition, the laboratory in which the gloveboxes are stationed has negative air pressure and a secondary air filtration and radiological monitoring system. The facility's air emission stacks are routinely monitored and sampled for control of radiological emissions. The facility is equipped with other engineering controls to contain the plutonium during routine operations and possible accidents.

Detailed descriptions of LANL's physical and socioeconomic environment, its climate, meteorology, hydrology, cultural resources, waste management, floodplains, wetlands, and threatened and endangered species are presented in the SWEIS (DOE 1998a) and the Environmental Surveillance Report (LANL 1997).

3.2.2 Seven Analyzed Routes: General Overview

As discussed in Section 2.1.4, seven routes from LANL to the Canadian border were analyzed. The following routes meet DOT routing requirements; all seven use available interstate highways and city bypasses, where available, to go around high-population areas. DOE anticipates requirements to notify authorities at toll bridges and border crossings. Other interstate highway routes, such as via Sweetgrass, Montana and Champlain, New York were not evaluated because of excessive travel distances.

3.2.2.1 Los Alamos, New Mexico to North Dakota - Canada Border at Pembina

The Canadian border crossing for this route would be near Pembina, North Dakota (population 642) (Rand McNally 1995) as shown in Figure 6. The proposed MOX fuel shipment(s) would be transported by commercial truck (enclosed trailer) from LANL to Santa Fe, New Mexico (population 55,859). The shipment(s) would then be routed north along Interstate Highway 25, past Colorado Springs (population 281,140) toward Denver, Colorado. Denver is the largest city along the LANL-to-Pembina route, with a 1990 population of almost 468,000 people. This portion of the route from Santa Fe to Denver is located in the high plains, just east of the Rocky Mountains.

The shipment(s) would then continue northeast along Interstate Highways 76 and 80 toward the Nebraska cities of Lincoln (population 191,972) and Omaha (population 335,795). This portion of the route in northeastern Colorado and Nebraska is characterized by fairly flat terrain with much lower elevations. This part of the proposed route also parallels sections of the South Platte River and the Platte River.

Once in the Omaha area, the shipment(s) would be routed north along Interstate Highway 29, through western Iowa and eastern South and North Dakota. Between Omaha, Nebraska and Sioux City, Iowa (population 80,505), the route would parallel the course of the Missouri River, located nearby to the west. The route would then continue north, past Sioux Falls, South Dakota (population 100,814), and Fargo, North Dakota (population 74,111). This route essentially follows the high plains northward to the Canadian border.

3.2.2.2 Los Alamos, New Mexico to Michigan - Canada Border at Sault Ste. Marie

The Canadian border crossing for this route would be near Sault Ste. Marie, Michigan (population 15,000) (Rand McNally 1995) as shown in Figure 6. As in the route described above, the proposed MOX fuel shipment(s) would be transported by commercial truck from LANL to Santa Fe, New Mexico (population

55,859). The shipment(s) would then continue southwest along Interstate Highway 25 to Albuquerque, New Mexico (population 384,736). At Albuquerque, the route would continue east into Texas along Interstate Highway 40. Amarillo (population 157,615) is the largest Texas city along this section of the route. Continuing east along Interstate Highway 40 into Oklahoma, the shipment(s) would be routed to Oklahoma City (population 444,719). The shipment(s) would then continue northeast along Interstate Highway 44 through fairly flat terrain, toward Tulsa, Oklahoma (population 367,302) and on to Missouri.

Once in Missouri, the shipment(s) would continue northeast along Interstate Highway 44, past the cities of Springfield (population 140,494) and St. Louis (population 396,685). From St. Louis, the shipments would again be routed northeast, this time along Interstate Highway 55, toward Springfield, Illinois (population 105,227) and Chicago (population 2,783,726).

At Chicago, the largest city along the LANL-to-Port Huron route, the shipment(s) would enter the Great Lakes region of the U.S. From Illinois, the shipment(s) would continue northeast along Interstate Highway 94 past Michigan City, Indiana (population 33,822) and into south-central Michigan past Kalamazoo (population 223,000). The route would then proceed northward along Interstate Highway 69 passing Lansing (population 128,100) and Flint (population 140,100). At Flint, Michigan the shipments would turn north on Interstate Highway 75, past the cities of Saginaw (population 211,946) and Bay City (population 38,700). The route would cross the toll bridge over the Straits of Mackinaw near Mackinaw City (population 875) and continue northward on Interstate Highway 75, ending at the toll bridge crossing the border near Sault Ste. Marie. No specific restrictions for transporting radioactive material are reported for the International Bridge at Sault Ste. Marie.

3.2.2.3 Los Alamos, New Mexico to Michigan - Canada Border at Port Huron

The Canadian border crossing for this route would be near Port Huron, Michigan (population 15,000)(Rand McNally 1995) as shown in Figure 6. The route from LANL to Port Huron follows the Sault Ste. Marie route until Flint, Michigan (population 140,100). At Flint, the shipment(s) would continue east on Interstate Highway 69 to the Blue Water Bridge, which crosses the border near Port Huron. No specific restrictions for transporting radioactive material are reported for the Blue Water Bridge, although traffic delays caused by bridge construction make this route undesirable. Although analyzed in this EA, because of the bridge construction, DOE has decided not to use this route for transport of the Parallex Project MOX fuel to Canada.

3.2.2.4 Los Alamos, New Mexico to Michigan - Canada Border at Detroit

The Canadian border crossing for this route would be near Detroit, Michigan (population 1,016,400)(Rand McNally 1995) as shown in Figure 6. The route from LANL to Detroit follows the Sault Ste. Marie route until Lansing, Michigan (population 128,100). At Lansing, the shipment(s) would be routed east on Interstate Highway 96 to Detroit. The most direct route through Detroit would be to turn east on Interstate Highway 696 and then south on Interstate Highway 75 to the Ambassador Bridge crossing the Detroit Straits into Canada. Several other possible Interstate routes through the Detroit area could be used. The Ambassador Bridge currently does not allow placarded (i.e., carrying hazardous material) vehicles, and could not be used by vehicles carrying more than very small amounts of radioactive materials. However, this EA includes an analysis of this route in case the restrictions change during the program.

3.2.2.5 Los Alamos, New Mexico to New York - Canada Border at Buffalo

The Canadian border crossing for this route would be near Buffalo, New York (population 328,123) (Rand McNally 1995) as shown in Figure 6. The route from LANL to Watertown follows the Port Huron route until St. Louis, Missouri (population 396,685). At St. Louis, the shipment(s) would be routed along Interstate Highway 70 toward Terre Haute, Indiana (population 57,483) and Indianapolis, Indiana. Indianapolis, with a 1990 population of 731,327, is the largest city along the LANL-to-Watertown route.

Continuing along Interstate Highway 70, the shipment(s) would be routed east into central Ohio to Columbus (population 632,910). At Columbus, the route would proceed north along Interstate Highway 71 to Cleveland, Ohio (population 505,616). The shipment(s) would then continue northeast on Interstate 90 along the edge of Lake Erie past Erie, Pennsylvania (population 108,718) to Buffalo, New York (population 328,123). At Buffalo, the shipments would be routed east on Interstate Highway 190 to the Peace Bridge, which crosses the Niagara River into Canada. No Specific restrictions for transporting radioactive materials are reported for the Peace Bridge.

3.2.2.6 Los Alamos, New Mexico to New York - Canada Border at Niagara Falls

The Canadian border crossing for this route would be north of Niagara Falls, New York (population 61,840)(Rand McNally 1995) as shown in Figure 6. The route from LANL to Niagara Falls follows the Buffalo route until the Buffalo (population 328,123) area. Near Buffalo, the shipment(s) would continue on Interstate Highway 90 to Interstate Highway 290, which goes around Buffalo. The shipment(s) would then be routed northwest on Interstate Highway 190, which crosses the Niagara East River twice, and continues past Niagara (population 220,756) and Niagara Falls to the Lewiston Bridge crossing into Canada. No specific restrictions for transporting radioactive material are reported for the Lewiston Bridge.

3.2.2.7 Los Alamos, New Mexico to New York - Canada Border at Watertown

The Canadian border crossing for this route would be near Watertown, New York (population 29,429)(Rand McNally, 1995) as shown in Figure 6. The route from LANL to Watertown follows the Buffalo route until the Buffalo (population 328,123) area. Near Buffalo, the shipment(s) would continue east along Interstate Highway 90 to Syracuse, New York (population 163,860) and then, following Interstate Highway 81, north past Watertown, New York (population 29,429) to the border crossing. No specific restrictions for transporting radioactive or special nuclear material are reported for bridges crossing the St. Lawrence Seaway.

3.3 Human Health

The basic approach used in assessing human health concerns from exposure to radiation is to first identify the affected environments and establish a baseline that represents the effects from current conditions. Changes in this baseline resulting from the fabrication and transportation of MOX fuel are then examined for both normal operations and potential accidents. These changes are discussed in Section 4.1.1.

The normal background radiation that exists day-to-day in the human environment, with little variability, is used as a radiation exposure baseline. A background radiation dose is the exposure received by the public from radiation present in the environment from either natural or manmade sources (e.g., radon and medical X-rays, respectively). Background doses are unrelated to MOX fuel fabrication and transportation activities and are expected to remain constant over time. The four major sources of naturally occurring radiation are cosmic radiation; sources in the earth's crust, known as terrestrial radiation; sources in the human body, known as internal sources; and radon (LANL 1995a) (Table 3-2). The four major sources of manmade radiation are medical radiation procedures, nuclear medicine, consumer products, and other miscellaneous sources (LANL 1995b) (Table 3-2). The average annual radiation dose equivalent to a member of the general population from both natural and manmade background sources is about 360 mrem.

Table 3-2. Average Annual Background Dose

Source - Naturally Occurring	mrem per year
Cosmic	28
Terrestrial	28
Internal	40
Radon	200
Source - Manmade	**mrem per year**
Medical X-Rays	39
Nuclear Medicine	14
Consumer Products	10
Other[a]	2
TOTAL	361

a Includes air travel and weapons test fallout.

3.3.1 MOX Fuel Fabrication

A comprehensive explanation of exposures, doses and dose calculation methods, health effects due to radiation, and LANL's radiological program can be found in the annual environmental surveillance report (LANL 1997). Although most plutonium and uranium isotopes are alpha-particle emitters, the nature of the working environment, i.e. hot cells, gloveboxes, other protective enclosures, ventilation systems, and personnel protective measures, prevents internal (or "inside the body") exposure to the alpha particles. These protective measures would be in place for the MOX fuel fabrication workers. The predominant source of personnel radiation exposure in these facilities is external radiation exposure, such as X-rays, gamma rays, or neutrons that accompany the alpha or beta particles emitted by the plutonium and uranium isotopes. External radiation exposure is also "penetrating radiation" because, unlike alpha or beta particles, this radiation penetrates clothing and skin and reaches the internal organs. Shielding barriers between penetrating radiation sources and MOX fuel fabrication workers are used to reduce the dose.

Exposure to penetrating radiation, routinely measured by personal dosimetry badges, is reported as the effective dose equivalent (EDE) in units of rems for the period during which the dosimeter was worn. Penetrating exposure is used in this EA as the unit of comparison for human health effects of routine and accident events for the Proposed Action.

Exposure to radiation may increase the MOX fuel worker's chance of developing fatal cancer. DOE has adopted the NRC's recommended risk conversion factors that express radiation doses in terms of risk of excess cancer fatalities. These risk factors are 400 cancer fatalities per million person-roentgen equivalent man (person-rem) for workers and 500 cancer fatalities per million person-rem for the general population (NRC 1991a). The EDE to individuals in the general public, also referred to as doses, from natural background sources has been estimated in order to provide a basis of comparison with doses resulting from LANL operations.

Members of the public living near LANL can potentially receive doses due to radioactive emissions from LANL. The Environmental Protection Agency (EPA) limits doses received by members of the public through airborne releases to 10 mrem annually (EPA 1992). The DOE limits doses received by members of the public, taking all exposure pathways into consideration, to as low as reasonably achievable (ALARA) and not more than 100 mrem annually (DOE 1993b).

LANL personnel, such as the MOX fuel fabrication workers, who may be exposed to radiation are included in the health physics monitoring program. Whole-body doses to all individuals working in DOE facilities are limited according to the ALARA concept and are kept within the 2,000 mrem per year administrative control level specified by DOE (DOE 1994a). Additionally, the laboratory standards supplement the LANL Radiological Control Manual by encouraging further reduction of the administrative control levels for personnel exposures during operations at LANL. For example, processes at TA-55 have ALARA levels set below the DOE level. MOX fuel workers wear appropriate anticontamination clothing, including smocks, shoe covers, and rubber gloves as needed when working with radioactive material.

A small quantity of MOX fuel that can be used for the Parallex Project has been fabricated in PF-4 at TA-55. During the production of the fuel, the involved workers were protected from direct plutonium and uranium contact by gloveboxes and personal protective clothing. Safe Operating Procedures (SOPs) developed for the fabrication and worker health and safety were followed. Six months were required to train the MOX fuel fabrication technicians, set up the equipment, start up the process, and fabricate the 11.7 lb (5.3 kg) of MOX fuel. The average involved worker dose for the MOX fuel made for research and development purposes was 355 mrem per year. This is well below the DOE administrative control level of 2,000 mrem (2 rem) per year.

3.3.2 MOX Fuel Transportation

Commercial carriers are required to transport radioactive materials in accordance with DOT regulations (49 CFR 179), NRC regulations (10 CFR 71), and all applicable DOE Orders. For shipments that require real-time tracking for security purposes, a TRANSCOM (transportation computerized satellite tracking system) linked truck is used that involves a tamper-proof satellite relay system located within the vehicle. A transportation plan detailing the shipment material(s) and associated requirements is developed and written by DOE. The commercial carrier contracted for radioactive TRANSCOM shipments is required to follow the DOE transportation plan. For overland transport, in conformity with DOT routing regulations for HRCQ shipments of radioactive material, interstate highways and interstate bypasses are the required method of travel whenever possible (49 CFR 397.101). Responsibility for each shipment would transfer from DOE to AECL at the border.

In the U.S., more than 42,700 miles of interstate highways are open to traffic. The network of interstate highways serves virtually all of the nation's large urban areas and all states but Alaska. Fatality and injury rates are much lower for interstate travel than for travel on other highways or by rail as shown in Table 3-3. In 1993, a nation-wide fleet of 10,636 freight trucks traveled a total of 593,262,000 mi (954,770,000 km) on existing U.S. highways (NSC 1994).

Table 3-3. Urban Fatality and Injury Rates per 100 Million Person Miles* in 1994

Type of transport	Fatalities	Injuries
Interstates	0.39	38.1
Other Highways	0.81	134.7
Urban Rail	1.11	80.7

(from: Cox and Love 1996)

* A person mile is one person traveling one mile in a vehicle, whether passenger or driver.

Most commercial transportation routes between major cities are along interstate highways within the U.S. with the use of local access routes being required for pick-up and delivery point transportation. For transportation analysis, the routes are divided by the transportation computer model known as RADTRAN into route-segments according to population density. In general, three population density zones are defined by the HIGHWAY routing code (ORNL 1993). The zones correspond to mean population densities for rural, suburban, and urban areas and are expressed as persons per square mile or square kilometer (ORNL 1993).

Rural is defined as 0 to 66 people per square kilometer, suburban is defined as 67 to 1,670 people per square kilometer, and urban is defined as greater than 1,670 people per square kilometer. In Table 3-4 the actual population for each proposed potential route-segment is expressed using a weighted population number.

Table 3-4. Travel Summary: Potential Shipping Routes

Border Crossing	Distance in US (km)	Percentage in Zones			Population Density (persons/km²)			Affected Population (US)	Distance in Canada (km)
		Rural	Suburban	Urban	Rural	Suburban	Urban		
Pembina	2,462	91.9	7.0	1.0	4.8	389.9	5398.9	207,000	2,080
Sault Ste. Marie	3,153	78.3	20.1	1.6	9.8	296.3	2174.8	515,000	617
Port Huron	2,824	77.6	20.6	1.8	9.8	308.7	2163.3	498,000	800
Detroit	2,758	77.2	20.1	2.7	9.4	335.7	2288.1	602,000	810
Buffalo	3,050	77.7	20.3	2.0	10.4	316.2	2175.9	565,000	605
Niagara Falls	3,085	77.1	20.8	2.1	10.4	325.2	2126.1	594,000	576
Water-town	3,422	75.7	22.5	1.8	11.4	298.7	2105.0	614,000	324

DOE's hazardous material (radioactive and nonradioactive) shipments are small compared to the large shipment volume from non-DOE hazardous material transport activities. DOT estimates that approximately 4 billion tons of regulated hazardous materials are transported each year and that approximately 500,000 movements of hazardous materials occur each day. Two percent of the annual hazardous materials shipments represents approximately 2 million annual shipments of radioactive materials involving about 2.8 million packages (DOE 1995a).

In comparison, DOE ships about 6,200 radioactive packages (commercial and classified) annually among its sites. DOE's annual shipments of radioactive packages represent less than 0.3 percent of all radioactive shipments in the United States, and less than 0.006 percent of all hazardous material shipments. DOE's unclassified radioactive and other hazardous materials are transported by commercial carrier (truck, rail, or air carriers) while abiding by all applicable DOE and federal transportation regulations (DOE 1995a).

In addition, there are nonradiological risks of highway travel. These risks are caused by air pollution or by highway accidents and do not involve a radiological release. Millions of miles are driven by cars and trucks on the U.S. highways every year. The risk of a highway accident increases with the number of highway miles traveled by a vehicle. In 1993, for example, 10,636 freight trucks traveled 593,262,000 mi (954,770,000 km). For the same year, there were 4.64 truck accidents per 1,000,000 vehicle miles (NSC 1994).

3.4 Air Quality

LANL and the County are remote from major metropolitan areas and major sources of industrial pollution. In 1996, air quality at LANL was much better than ambient air quality standards set by the EPA and the New Mexico Environment Department (LANL 1997). Information on nonradioactive air emissions is summarized in the LANL annual Environmental Surveillance Report (LANL 1997). Radioactive and nonradioactive air emissions from LANL operations are in compliance with the Clean Air Act (including National Emissions Standards for Hazardous Air Pollutants [NESHAPs]) and the New Mexico Air Quality Control Act.

3.5 Waste Management

LANL personnel operate an on-site radioactive management and disposal site (Area G) at Technical Area 54 (TA-54) for low-level radioactive waste (LLW). In 1996, LANL operations generated 162,790 ft^3 (4,609.8 m^3) of solid LLW. LLW may be disposed of on-site or shipped off-site to commercial disposal facilities or other DOE sites.

Some LANL operations generate TRU wastes. Personnel place these materials in containers such as specially designed 55-gallon drums. The containers are sealed and certified to Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (DOE 1991). Containers are then transported to TA-54, Area G, where they are currently placed on asphalt pads in air-supported structures. The stacking array allows drums to be individually inspected and the storage areas are monitored. TRU wastes are being stored pending shipment to WIPP for disposal. In 1996, LANL operations generated 3,291.3 ft^3 (93.2 m^3) of solid TRU waste. This amounted to a substantial decrease from the 7,080 ft^3 (200 m^3) generated in 1990.

3.6 Environmental Justice

Under Presidential Executive Order 12898 of February 11, 1994:

"1-101. *Agency Responsibilities.* To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands" (EO 1994).

DOE is in the process of finalizing procedures for implementing the Executive Order. The manner in which environmental issues should be addressed in an EA is expected to be addressed in the procedures. In December 1997, the Council on Environmental Quality (CEQ) released guidance on environmental justice (CEQ, 1997). The analysis performed in this EA is generally in conformance with the CEQ guidance.

Minority populations, as categorized by the U.S. Bureau of the Census, are considered to be all people of color, exclusive of white non-Hispanics. Minorities include individuals classified as Black (African-American); American Indian, Eskimo, or Aleut; Asian or Pacific Islander; persons of Hispanic origin; and other non-white persons. Within a 10-mi (16-km) radius of LANL, 14 percent of the 18,115 persons are of minority status including Hispanics and Native Americans. The principal population centers located within a 50-mi (80-km) radius of LANL are Santa Fe, Española, and the Pojoaque Valley. These areas have an approximate total population of 214,727 people. Fourteen pueblos and Native American reservations are located within a 50-mi (80-km) radius of LANL. The populations of the four Accord Pueblos are as follows: San Ildefonso Pueblo has a population of 1,499; Santa Clara Pueblo has a population of about 3,000; Cochiti Pueblo has 1,342 people; and Jemez Pueblo has a population of about 1,750 (Commerce 1991). Minority individuals account for 65 percent of the general population of 133,028 living 10 to 30 mi (16 to 48 km) from LANL. Within a 50-mi (80-km) radius of LANL, minority individuals account for 54 percent of the population of 214,727.

Low-income is defined as an annual household income of less than 15,000 dollars[4]. As reported in the 1990 Census, 581 households (about 2 percent) within 10 mi (16 km) of LANL were classified as low-income households. However, the number of low-income households increases sharply beyond the 10-mi (16-km) radius. In the 10- to 30-mi (16- to 48-km) radius of LANL, 12,995 households (23 percent) were low-income. Within a 50-mi (80-km) radius of LANL, 18,519 households (24 percent) were categorized as low-income households (DOE 1995b).

Both minority and low-income populations are likely to be present along portions of the seven analyzed transportation routes. Tables 3-5, 3-6, and 3-7 were generated using state-level data from a recent study of poverty in the U.S. and from the 1990 census (Baugher and Lamison-White 1996; U.S. Census Data 1990).

Table 3-5. Environmental Justice Population Summary: Los Alamos to North Dakota - Canada Border

State	% of Population Living in Poverty in 1995†	% Minority Population (Non-whites and Persons of Hispanic origin‡)
New Mexico (NM)	25.3	62.3
Colorado (CO)	8.8	24.4
Nebraska (NE)	9.6	8.9
Iowa (IA)	12.2	4.4
South Dakota (SD)	14.5	9.2
North Dakota (ND)	12	6.0

† As used in Baugher and Lamison-White (1996) "Poverty status is defined by a set of money income thresholds that vary by family size and composition. Families or individuals with income below their appropriate poverty thresholds are classified as poor".

‡ Minority population figures, as defined for this chart, are taken from the following 1990 US Census Tables: Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; Other Races; and Persons of Hispanic Origin.

[4] Poverty thresholds vary by size of family and number of related children under 18 years of age. In 1989, 14,990 dollars was the official poverty threshold for a family of five persons. Poverty thresholds in 1989 dollars range from 8,076 dollars per year for a family of two to 25,480 dollars for a family of nine persons or more (Census 1997).

Table 3-6. Environmental Justice Population Summary: Los Alamos to Michigan - Canada Border

State	% of Population Living in Poverty in 1995†	% Minority Population (Non-whites and persons of Hispanic origin‡)
New Mexico (NM)	25.3	62.3
Texas (TX)	17.4	50.0
Oklahoma (OK)	17.1	20.4
Missouri (MO)	9.4	13.5
Illinois (IL)	12.4	29.3
Indiana (IN)	9.6	11.1
Michigan (MI)	12.2	18.6

† As used in Baugher and Lamison-White (1996) "Poverty status is defined by a set of money income thresholds that vary by family size and composition. Families or individuals with income below their appropriate poverty thresholds are classified as poor".

‡ Minority population figures, as defined for this chart, are taken from the following 1990 US Census Tables: Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; Other Races; and Persons of Hispanic Origin.

Table 3-7. Environmental Justice Population Summary: Los Alamos to New York - Canada Border

State	% of Population Living in Poverty in 1995†	% Minority Population (Non-whites and persons of Hispanic origin‡)
New Mexico (NM)	25.3	62.3
Texas (TX)	17.4	50.0
Oklahoma (OK)	17.1	20.4
Missouri (MO)	9.4	13.5
Illinois (IL)	12.4	29.3
Indiana (IN)	9.6	11.1
Ohio (OH)	11.5	13.4
Pennsylvania (PA)	12.2	13.3
New York (NY)	16.5	37.5

† As used in Baugher and Lamison-White (1996) "Poverty status is defined by a set of money income thresholds that vary by family size and composition. Families or individuals with income below their appropriate poverty thresholds are classified as poor".

‡ Minority population figures, as defined for this chart, are taken from the following 1990 US Census Tables: Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; Other Races; and Persons of Hispanic Origin.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Proposed Action

This section evaluates the environmental effects of the Proposed Action. Each applicable resource in Section 3.0 is evaluated in Section 4.0 for potential environmental consequences. The impacts of potential accidents are described in Section 5.0.

4.1.1 Human Health

The effect on human health from MOX fuel fabrication would come from the penetrating radiation environment within PF-4. Noninvolved workers, those performing other jobs as well as the usual PF-4 building personnel, would not be expected to receive a dose from the proposed operation. MOX fuel fabrication is not expected to measurably increase the airborne radioactive material emissions from PF-4 associated with routine operations; therefore, no effects to the public are expected. The shipment(s) of MOX fuel to the Canadian border in specially designed package containers in a commercial truck is not expected to increase the penetrating radiation dose to the public above background levels. No effects to the public are expected from transportation.

4.1.1.1 MOX Fuel Fabrication

Estimates of long-term or chronic human health risk from the radiation environment are made based upon currently accepted radiation risk models (ICRP 1991). These risk estimates show the ultimate effects of radiation on humans, namely, an estimate of the added cancer fatalities in the exposed population. Human health risk is determined by converting the estimated dose into the probability of contracting a fatal cancer. The dose-to-risk conversion factor used for estimating cancer deaths was four latent cancer fatalities (LCFs) per 10,000 person-rem dose (4.0×10^{-4} cancer deaths per person-rem) for exposed workers (NRC 1991a, DOE 1993a). The health risk to an exposed individual is best expressed as the added probability of that individual developing a fatal cancer. As the probability approaches 1.0, the chances of development of a fatal cancer increase. As probability decreases, the chances of development of a fatal cancer similarly decrease. For exposed populations, the probability is more meaningful when it is considered as the number of additional cancer deaths. If the probability is less than 1.0, no additional cancer deaths are expected. If it exceeds 1.0, then additional cancer deaths are likely to occur.

No excess fatal cancers would be expected from penetrating radiation exposures associated with MOX fuel production used in the Parallex Project at LANL. The 12 involved workers exposed to penetrating radiation during total MOX fuel fabrication for the Parallex Project (including both that for the fuel that already exists and for the additional amounts of fuel pins yet to be manufactured) are estimated to receive a maximum dose of 661 mrem (0.661 rem) per year at work. The assumed dose used in this analysis, 661 mrem, is a "conservative" estimate meaning that it leads to an overestimate of ultimate health risk. The MOX fuel fabrication required to complete the test matrix would not be a year-long process, and the assumed total dose was derived as 95 percent of the maximum dose average for two workers in operations that are known to be similar to the Proposed Action. The 95 percent dose is defined here as a dose which is expected to be exceeded no more than 5 percent of the time as based on real data from similar operations. The 95 percent maximum dose is multiplied by the dose-to-risk conversion factor of 4×10^{-4} cancer deaths per person-rem resulting in a risk estimate of 2.6 in 10,000 (2.6×10^{-4}) per worker, which means that the probability of an individual worker developing a fatal cancer from MOX fuel fabrication is slightly above one chance in ten thousand. For comparison, the 661 mrem estimated dose is well below the DOE administrative control level of 2,000 mrem (2 rem) per year. The DOE regulatory annual dose limit for workers is 5,000 mrem (5 rem) per year (DOE 1996b), which corresponds to an individual annual risk of LCF of 2 in 1,000 (2.0×10^{-3}).

If all 12 Parallex Project workers were exposed to 661 mrem, it would result in a collective dose of 7.9 person-rem per year. Using the dose-to-risk conversion factor (4×10^{-4} cancer deaths per person-rem), the calculated risk of annual excess fatalities for the worker population is 3.2×10^{-3} (Table 4-1). This is less than 1.0, defined earlier in this section as the probability below which no additional cancer deaths are expected. Therefore, no excess cancer deaths of workers are expected from radiation exposures associated with routine operations of MOX fuel fabrication at LANL.

Table 4-1. Summary of Estimated Radiation Dose and Risk of Cancer Deaths to Worker Populations

Activity	Individual Dose (rem)	Worker Population	Person-rem (annual)	Risk of Excess Cancer Fatalities
Parallex MOX fuel fabrication	0.661 (661)	12	7.9	3.2×10^{-3} per year

Operations would be analyzed, planned, and managed to ensure that worker exposures are kept as low as reasonably achievable. Based upon this information and the calculated risk, no excess cancer fatalities are expected and workers engaged in this proposed project are not expected to incur any harmful health effects from radiation exposures they receive during normal operations.

4.1.1.2 MOX Fuel Transportation

No changes to the existing highway infrastructure would be required to allow passage of the MOX fuel shipment(s), nor would the roads need to be closed. The normal traffic flow along the seven analyzed MOX fuel transportation routes would not be expected to change with the added presence of one to three commercial truck(s).

A transportation analysis of the proposed shipment(s) of MOX fuel was performed using the RADTRAN 4 computer model developed and maintained by Sandia National Laboratories in Albuquerque, New Mexico. The analysis considered the following elements: mode of transportation, curies of material, proximity dose rates (transport index), type of packaging, and potentially affected populations. Transportation health risks were estimated for normal (incident-free) transportation radiological dose rates, and nonradiological accident effects (i.e., highway collision fatalities). The RADTRAN 4 computer model is discussed in detail in Appendix D.

The shipment(s) of MOX fuel by commercial truck from LANL to the Canadian border would not be expected to adversely affect the health of the public along the proposed routes. The incident-free dose is the radiological exposure received by the public while the shipment(s) are transported along the routes. Assuming, as an upper bound, all of the MOX fuel is transported in a single shipment, the incident-free doses to the public from each proposed route would be below 1×10^{-4} person-rem . The doses are summarized in Table 4-2. The shipment(s) of the MOX fuel along any of the seven routes would result in a negligible radiological dose to the public.

Similarly, the shipment(s) of MOX fuel by commercial truck from LANL to the Canadian border along the proposed routes would not be expected to adversely affect the health of the truck crew. If all the MOX fuel is transported in a single shipment, the radiological exposure received by the truck crew would be below 1×10^{-4} person-rem. The doses are also summarized in Table 4-2. The truck crew would receive a negligible radiological dose from the shipment(s) of the MOX fuel along any of the seven routes. More information on these doses is provided in Appendix D

Table 4-2. Radiological Incident-Free Doses to the Public and Truck Crew during Single Shipment

Border Crossing	Dose to the U.S. Public (Person-rem)	Dose to the U.S. Truck Crew (Person-rem)
Pembina, ND	5.4×10^{-5}	1.2×10^{-5}
Sault Ste. Marie, MI	6.9×10^{-5}	1.5×10^{-5}
Port Huron, MI	6.1×10^{-5}	1.3×10^{-5}
Detroit, MI	6.0×10^{-5}	1.3×10^{-5}
Buffalo, NY	6.6×10^{-5}	1.4×10^{-5}
Niagara Falls, NY	6.7×10^{-5}	1.5×10^{-5}
Watertown, NY	7.3×10^{-5}	1.6×10^{-5}

By using the single MOX fuel shipment as an upper bound, the risk of excess LCFs can be estimated for the total combined radiological dose to the public and truck crew for each proposed transportation route. As shown in Table 4-3, the estimated number of LCFs would be very small (much less than 1.0). Therefore, no adverse health effects to the public and truck crew would be expected from any scenario involving the shipment of MOX fuel across the U.S.

Table 4-3. Risk of Cancer Fatalities for Single Shipment for All Routes

Border Crossing	Total U.S. Dose (Person-rem)	Exposed U.S. Population LCFs
Pembina, ND	6.5×10^{-5}	3.2×10^{-8}
Sault Ste. Marie, MI	8.3×10^{-5}	4.1×10^{-8}
Port Huron, MI	7.5×10^{-5}	3.6×10^{-8}
Detroit, MI	7.3×10^{-5}	3.5×10^{-8}
Buffalo, NY	8.1×10^{-5}	3.9×10^{-8}
Niagara Falls, NY	8.2×10^{-5}	4.0×10^{-8}
Watertown, NY	8.9×10^{-5}	4.3×10^{-8}

4.1.2 Air Quality

Air emission from the fabrication of MOX fuel pellets and rods for the Parallex Project would be a very small percentage of the overall LANL annual air emissions. The MOX fuel pellets and rods would be made inside sealed gloveboxes that have negative pressure and a primary air system fitted with HEPA filtration. Laboratories in PF-4 are also equipped with a separate HEPA filtered air system and use negative air pressure to prevent the escape of radioactive contaminants. Plutonium dioxide and uranium dioxide powders that become airborne inside a glovebox would be captured by the glovebox HEPA filtration system. In the event of a glovebox failure airborne particles would be captured by the PF-4 building HEPA filters. The filters would prevent any measurable release of particles into the atmosphere. Glovebox HEPA filters are replaced on an as-needed basis depending on glovebox use and dust generation. PF-4 HEPA filters are replaced on a quarterly basis or a shorter period if needed. The used filters are treated and disposed of as radioactive waste. Any release of radioactive particles outside of gloveboxes would trigger alarms. Radiological control technicians would respond to the alarms and contain the situation. No MOX fuel powder particles would be expected to be released from PF-4 into the environment. In addition to continuous radiation monitoring in the facility, the air emission stacks are continuously monitored and sampled for radioactivity.

No change to the air quality along the route(s) to Canada would be expected since the MOX fuel would be sealed in rods and package container(s) during transportation. No measurable radioactive particles would be released into the air. A commercial truck carrying MOX fuel would be one out of thousands of trucks on the road at any one time. The overall contribution of nonradiological air pollutants from a single vehicle to the air quality within a given airshed would be immeasurable.

4.1.3 Waste Management

LANL has established processes to manage radioactive liquid and solid wastes. Only solid waste would be generated from the Parallex Project MOX fuel fabrication. The LLW and TRU waste would consist of gloves, tape, plastic bags, booties, metal pieces, and rags. The waste produced from the MOX fuel process would be within the normal values of waste production for LANL. The estimated small quantities of solid LLW (169.9 ft^3/4.8 m^3) and TRU waste (21.95 ft^3/0.62 m^3) are well below the LANL yearly (1996) generation of LLW (162,790 ft^3/4,609.8 m^3) and TRU waste (3,291.3 ft^3/93.2 m^3). The LLW and TRU waste would be characterized by the generators before packaging. The wastes would be packaged following the LLW Acceptance Criteria and the WIPP Waste Acceptance Criteria before being transported to TA-54 for disposal (LLW) or storage (TRU waste). LLW would be packaged in specially designed cardboard boxes. The TRU waste would be stored in special 55-gal. drums. The LLW would be buried at the TA-54 disposal site. The TRU waste would be stored awaiting shipment to WIPP. No mixed waste, hazardous waste, or additional nonhazardous solid waste would be generated from MOX fuel fabrication. The sanitary wastewater production at PF-4 would not measurably increase. No radioactive or hazardous waste would be generated during the shipment of MOX fuel to the Canadian border.

4.1.4 Environmental Justice

No disproportionally high and adverse human health or environmental effects on minority and low-income populations adjacent to LANL would be expected if the Proposed Action to fabricate additional MOX fuel rods for use in the Parallex Project is implemented since there would be no anticipated measurable effects to the public from this action during both normal operations and accident conditions (the impacts of potential accidents are described in Section 5.0).

Although populations that are subject to environmental justice considerations are likely to be present along the transportation routes, there would be no disproportionally high and adverse health effects to any population expected from the transportation events as part of the Proposed Action. Transportation accidents are random occurrences that could potentially affect the population around the accident site. However, the random nature of these accidents precludes any intentional disproportionate effect to minority or low-income populations. Also, as described in Sections 4.1.1.2 and 5.2, there would be no anticipated measurable effects to the public from transport of MOX fuel, therefore, no disproportionate effects are possible.

4.2 No Action Alternative

This section evaluates the environmental effects of the No Action alternative. Each resource identified and not dismissed in Section 3.0 is discussed in this section.

4.2.1 Human Health

Under this alternative, no additional MOX fuel would be fabricated at LANL for the Parallex Project. However, it is likely that TA-55 workers would be involved with work on other plutonium processes. There would be little change to human health effects compared to normal TA-55 operations. No MOX fuel rods would be shipped to Canada. No shipment activities would mean that there would be no additional risk to the transport crew and members of the public along the route from routine radiological and accident exposures. There would be no change in the potential radioactive, chemical, biological, physical, or environmental hazards that could affect human health at LANL or along the proposed shipment routes under

this alternative. MOX fuel pellets and master blend of plutonium dioxide would continue to be stored at LANL until some other use or disposition was determined. Storage of these materials would result in the continuation of minor additional radiation exposure to the LANL workers involved in material handling and management.

4.2.2 Air Quality

There would be no further fabrication of MOX fuel at LANL for the Parallex Project. No change to the air emissions from the routine operations in PF-4 at TA-55 would be expected. Therefore, the air quality at TA-55 and the surrounding areas would not change from the routine operation baseline.

4.2.3 Waste Management

No additional fabrication of MOX fuel and rods would take place at LANL for the Parallex Project. Therefore, no additional wastes would be generated and managed at LANL under this alternative. There would be no change to the normal waste operations of LANL.

4.2.4 Environmental Justice

No disproportionate adverse effects on low-income, minority, or Native American populations are known to occur with the storage of MOX fuel at LANL. Therefore, no disproportionally high adverse human health or environmental effects to populations subject to environmental justice concerns are anticipated under the No Action alternative. No disproportionate adverse effects on low-income, minority, or Native American populations would occur along the transportation corridors because Parallex Project MOX fuel would not be transported. No disproportionate adverse effects on low-income, minority, or Native American populations would occur due to potential accidents during storage of MOX fuel since the impacts of storage accidents are unlikely to be greater than the impacts of the MOX fuel processing accident evaluated in Section 5.1 of this EA. That accident would produce a negligible dose and no fatalities at offsite locations.

4.3 Comparison of Alternatives

The following summary table (Table 4-4) compares the two alternatives presented in this EA and the expected consequences under each alternative. The Proposed Action would fabricate MOX fuel and result in the shipment(s) of MOX fuel from LANL, New Mexico to Canada without any negative effects to the transportation environment and human health. The No Action alternative would result in no MOX fuel fabrication or shipment(s) to Canada.

Table 4-4. Summary of the Potential Effects of the Proposed Action and the No Action Alternative

Factor	Proposed Action	No Action
Human Health (normal operations)	No anticipated excess fatal cancers would be expected from MOX fuel fabrication and transportation.	No change from current conditions
Human Health (accidents)	No anticipated excess fatal cancers would be expected from MOX fuel fabrication and transportation accidents.	No change from current conditions
Transportation	Transport of radioactive materials from LANL to the Canadian border would have negligible environmental consequences.	No change from current conditions
Air Quality	Negligible emissions from MOX fuel fabrication would have no impact to air quality.	No change from current conditions
Waste Management	Negligible amounts of LLW and TRU waste would have no impact on the waste management infrastructure.	No change from current conditions

4.4 Cumulative Effects

Cumulative effects on the environment result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7). Potential radiation exposures to workers would be maintained below ALARA guidelines. MOX fuel and rod fabrication at LANL would contribute a negligible increase to the air emissions and waste generation from routine LANL operations. The small solid waste volumes generated from the fabrication of MOX fuel and rods would not be expected to affect or exceed the capacity of the waste disposal facilities at LANL or WIPP; nor would air emissions be expected to affect the air quality at LANL. The shipment(s) of MOX fuel to CRL would be very small in size and numbers. The required number of highway road miles to CRL for the shipment(s) is very small compared to the millions of miles traveled yearly by commercial trucks. Because the contributions to adverse effects from the Proposed Action would be extremely small, it is expected that activities associated with the Proposed Action would not exacerbate cumulative effects. The cumulative impacts of operations at LANL, including MOX fuel fabrication, are evaluated in detail in the *Draft Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (DOE, 1998).

4.5 Operations in Canada

The NRU reactor at CRL began operation in 1957. The reactor uses heavy water as both moderator and coolant and operates at 125 MW using a 20 percent enrichment (percent uranium-235) fuel. The reactor core contains ninety fuel sites and eight reactor loops and thirty isotope irradiation sites. One of the isotope irradiation sites will be used to irradiate the Parallex Project MOX fuel. The reactor currently contains approximately 45.9 oz (1,300 g) of plutonium that was created during normal operation. The amount of U.S. plutonium added to the reactor for the Parallex Project would be less than 5.64 oz (160 g).

The NRU reactor at CRL is operated under a license granted by the Atomic Energy Control Board (AECB). In May 1996, Atomic Energy of Canada Limited (AECL), owner of the Laboratories, revised and updated their Facility Authorization (AECL 1996) document which was submitted to AECB for approval. As part of the approval process, AECB prepared a Screening Report (AECB 1996a) in accordance with the Canadian Environmental Assessment Act and issued a license renewal (AECB 1997a) in August 1997.

The Environmental Screening Report states the following about normal operations at CRL:

- Environmental monitoring is conducted by AECL staff independent of facility managers. This monitoring is to provide a quantitative record of radioactivity in the environment, verify compliance with regulatory limits, and Derived Release Limit (DRL) models and assumptions.

- The monitoring results show that radioactivity levels in the environment have generally remained constant or have been decreasing over the past ten years.

- AECL routinely monitors airborne discharges to the environment from CRL which may potentially contain significant quantities of radioactive material. The most significant radionuclides released as airborne emissions are argon-41, iodine-131, and tritium. The average and maximum weekly airborne releases from the site are provided to the AECB in annual reports on Radiological Monitoring Results for CRL and Whiteshell Laboratories. These annual reports show that the average weekly airborne releases from all facilities and activities on site summed for each radionuclide during the period 1992 to 1995 were less that one percent of the DRLs. The

> The Derived Release Limits (DCLs) are calculated limits on releases under normal operation conditions which take into account the various pathways for transfer of radioactive materials through the environment to humans.

airborne effluent monitoring results for the last ten years (1986 to 1995) shows that releases of the most significant radionuclides are decreasing.

- Ambient tritium concentrations are monitored at CRL at eleven locations at or within the site boundary. Based on the concentrations of tritium in the air, the calculated maximum potential annual dose at the CRL boundary due to tritium inhalation and air immersion (skin adsorption) is 0.006 percent of the current public dose limit.

- Radioactive liquid emissions from the site are monitored to measure conformance with the DRLs. The results of the on-going surface water monitoring program indicate that liquid releases of tritium from the CRL site have not resulted in significant contamination of surface waters. Concentrations of tritium at monitored sites are well below the Canadian drinking water quality guidelines. For a yearly consumption of 185 gal (700 L), the resulting dose would be a very small fraction of the public dose limit (<0.0001 percent).

- The most significant radionuclides released as liquid effluents are cesium-137, phosphorus-32, and tritium. The average and maximum monthly liquid releases from the site are provided to the AECB in the annual report on Radiological Monitoring Results for CRL and Whiteshell Laboratories. This report shows that the average monthly liquid releases from all facilities and activities on site summed for each radionuclide during the period 1992 to 1995 were less that 0.15 percent of the DRLs. The results of the surface water monitoring program indicate that the concentration of tritium, cobalt-60, and strontium-90 have remained well below the Canadian drinking water quality guidelines.

- All solid radioactive waste generated at CRL is stored in the Waste Management Areas at CRL. The quantities of solid radioactive waste processed and stored are provided to the AECB for each year in the annual reports of the CRL waste management areas, and the Waste Management Treatment Center.

AECL has taken steps to facilitate the testing of U.S. MOX fuel in the NRU reactor at CRL. AECL has obtained an import license for MOX fuel test shipments from the United States. The current import license is for 83.8 lbs (38 kg) of depleted uranium, 2.29 lbs (1.04 kg) of plutonium, and 6.6 lbs (3 kg) of natural uranium (AECB 1996b). This Parallex EA analyzes the shipment of approximately 67.1 lbs (30.45 kg) of uranium, 1.5 lbs (0.666 kg) of plutonium, and 6.6 lbs (3 kg) of natural uranium (Table 2-2). Although, the amounts of plutonium and depleted uranium listed in the import license are greater than the amounts analyzed in this EA, material shipments would be limited to the amounts listed in this EA. Significant changes in the amounts of material shipped would not be allowed without additional NEPA review.

Extra physical protection measures will be taken in accordance with the Physical Security Regulations for Category I materials. AECL believes that an environmental assessment will not be required for the Parallex shipments based on the use of the Type B (AECL Model 4H) shipping container. AECL also believes that the Parallex test is within the existing license for the CRL facility and therefore, no test-specific environmental assessment will be required to conduct the tests (AECB1997b).

It is extremely unlikely that there would be environmental impacts in the United States because of the conduct of MOX fuel testing at CRL in Canada. This is based upon the fact that the environmental impacts at the site boundary of CRL are very low and the nearest United States border is approximately 120 mi (193 km) from CRL. It is also extremely unlikely that there would be environmental impacts in Canada as a result the proposed action for both normal operations and accidents in the United States. This is based upon the fact that the environmental impacts at the site boundary of LANL are very low and the nearest Canadian border is approximately 900 mi (1,450 km) from LANL. It is extremely unlikely that transboundary effects would occur due to transportation accidents, because accidents that result in the release of plutonium would be extremely unlikely.

If DOE selects CANDU reactors for the plutonium disposition program, implementation would be subject to Canadian federal and provincial policies and regulations. These would include detailed, satisfactory assessments of health, safety and environmental aspects before issuance of an AECB operating license for the use of MOX fuel. The public reviews included in the AECB assessment process are likely to focus on issues such as the safe and secure transportation of MOX fuel from the international border as well as matters specific to the reactor site (Canadian Embassy, 1996).

5.0 ACCIDENT ANALYSIS

Abnormal events or accidents are hypothetical incidents that are not a planned part of routine operations. This EA evaluates three hypothetical accident scenarios (see Appendix D) that have a reasonable probability of occurrence and are provided as the bounding cases that could be associated with the fabrication and transportation of MOX fuel and rods under the Proposed Action and that could affect workers, the public, and the environment. One accident scenario occurs during MOX fuel and rod fabrication and the other two accident scenarios occur during fuel shipment(s). The potential accident scenarios for the transportation of the MOX fuel from LANL to the Canadian border were developed using the RADTRAN 4 computer model.

The three accident scenarios developed are expected to be bounding. The scenarios are bounding in that their estimated likelihood of occurrence range to "extremely unlikely" (i.e., to once every million years [10^{-6} per year]). The scenarios represent the upper bounds, which means that other credible accidents would pose less serious risks. Table 5-1 shows the qualitative classification of likelihood. The analysis of the three accidents resulted in low consequences for each accident. The involved worker and public radiation exposure was low, as was the calculated LCFs.

Table 5-1. Qualitative Likelihood Classification

Descriptive Word	Estimated Annual Likelihood of Occurrence	Description
Anticipated	$10^{-1} \geq p > 10^{-2}$	Incidents that may occur several times.
Unlikely	$10^{-2} \geq p > 10^{-4}$	Accidents that are not anticipated to occur.
Extremely Unlikely	$10^{-4} \geq p > 10^{-6}$	Accidents that would probably not occur.
Beyond Extremely Unlikely	$10^{-6} \geq p$	All other accidents.

Source: DOE 1994b

5.1 MOX Fuel Fabrication Fire

This accident scenario occurs during MOX fuel and rod fabrication in the PF-4 plutonium processing laboratory of TA-55. The fire is occurs adjacent to a granulation glovebox where the pellets are screened through a sieve. Nearby LLW boxes filled with combustible materials are ignited by generation of internal heat or a spilled flammable liquid. The laboratory is unattended, at first, and the fire spreads to the rubber gloves of the adjacent glovebox. Workers then enter the laboratory unaware of the fire and are exposed to plutonium dioxide by breathing airborne particulates produced by the fire. Depending on the particle size, the inhaled plutonium dioxide would settle in different parts of the respiratory tract. The inhalation of a large amount of plutonium dioxide in a short time period would be characterized as an acute exposure. The health effect from an acute exposure would be radio pneumonitis, which is the inflammation of the lungs with pneumonia-like symptoms. A large amount (1.0 μCi or greater) of plutonium dioxide would have to be inhaled to give the large dose required to cause radio pneumonitis. Radio pneumonitis has been observed in experimental animals but never in a human. The inhalation of a small amount (much less than 1.0 μCi) of plutonium dioxide would be characterized as a chronic exposure. The health effect from a chronic exposure would be the possible development of respiratory cancer decades after the exposure. A chronic exposure is analyzed in this accident scenario. Under this scenario the material at risk is the plutonium dioxide in the glovebox. The likelihood of this accident occurring was calculated to be between one in 100 and one in 10,000 years (10^{-2} to 10^{-4}) and categorized as "unlikely." "Unlikely" is defined in Table 5-1. An accident consequence computer code was used to estimate the radiological dose to involved workers at 1.8×10^{3} mrem. If all 12 workers were exposed to this dose, this would result in a total worker dose of 21.6 person-rem with a risk of LCF of 8.6×10^{-3}.

A radiation dose of 3.14×10^{-5} mrem was estimated for the maximally exposed public located at the Royal Crest Trailer Park (Park), which is a privately owned mobile home park situated about 2,953 ft (900 m) north of PF-4. The low level of released material within PF-4 and mitigation of the release by the two-stage HEPA filtration system result in a negligible dose to residents at the Royal Crest Trailer Park and no LCFs within the offsite population. Analytical details regarding this accident are provided in Appendix D.

5.2 MOX Fuel Transportation Accidents

The transportation accident model assigns accident probabilities to a set of accident categories. Eight accident-severity categories defined in the NRC's *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 (NRC, 1977), were used. The least severe categories represent low magnitudes of crush force, accident-impact velocity, fire duration, and/or puncture-impact speed. The most severe category represents a large crush force, long fire duration, and/or high puncture-impact speed. The fraction of material released and material aerosolized, and the fraction of material that is respirable (particles smaller than 10 microns), was assigned based on accident categories. Conditional probabilities, (i.e., given an accident, the probability of that accident being in a severity category) are assigned to each accident severity category. Because all shipments will use the previously described Type B containers, even severe accidents release, at the most, a portion of the material being transported.

Traffic accident fatality rates are estimated from published accident data described in Table 3-3. Note that fatalities due to traffic accidents are much more likely than fatalities due to exposure to radioactive material, due to the protection provided by Type B packages. Table 5-2 lists the public radiological accident risks based on the assigned probabilities and consequences, and the traffic accident risk based on 3 round-trip shipments. Since the amount of material shipped does not vary, the radiological accident risk is independent of the number of shipments.

Table 5-2. Accident-related Risks for Each of the Candidate Routes

Border Crossing	Radiological Accident LCF	Non-Radiological Accident Fatality
Pembina, ND	1.4×10^{-12}	3.6×10^{-5}
Sault Ste. Marie, MI	1.6×10^{-12}	4.6×10^{-5}
Port Huron, MI	1.4×10^{-12}	4.1×10^{-5}
Detroit, MI	1.5×10^{-12}	4.0×10^{-5}
Buffalo, NY	1.6×10^{-12}	4.5×10^{-5}
Niagara Falls, NY	1.6×10^{-12}	4.5×10^{-5}
Watertown, NY	1.7×10^{-12}	5.0×10^{-5}

An accident scenario could occur anywhere along the transportation corridors, and could have transboundary effects on Canadian populations. No early fatalities are expected for any shipment configuration by any route. The maximum potential accident consequence (50-year population dose) for the single-shipment configuration is 1.2 H 10^{3} person-rem committed effective dose (CED) for an urban link of a proposed route. The probability of this accident consequence occurring is very low (8.1 H 10^{-13}). The expected number of excess LCFs from breathing plutonium dioxide particles is less than one in a million (6.0 H 10^{-7}) for the maximum estimated population dose. For this accident scenario, an individual standing outdoors and within a few meters of the accident would receive a maximum first-year dose of 5.8 H 10^{-2} mrem from breathing plutonium dioxide. The population and individual doses are very small; no LCFs from an accident would be expected from the shipment(s) of MOX fuel by any of the proposed routes. The probability of such a

severe accident occurring and adversely affecting the public is extremely unlikely. Appendix D provides more information on transportation risk and consequence analysis.

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6.0 AGENCIES CONSULTED

The following U.S. and Canadian agencies were contacted during the preparation of this analysis regarding the MOX fuel and rod shipment(s) to Canada for the Parallex Project:

- Atomic Energy of Canada Limited, Mississauga, Ontario, Canada L5K1B2
- Canadian Atomic Energy Control Board, Ottawa, Canada K1P5S9
- U.S. Department of Transportation, Washington, D.C. 20590
- U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

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APPENDIX A. COMMENT RESPONSE

A.1 Summary of Comments Received on the Preliminary Draft EA

As shown on pages A-2 through A-39, DOE received 40 comment documents from regulatory agencies, public interest groups and individual citizens during the comment period. The documents are not numbered sequentially for clerical reasons; all unique comment documents received by DOE are presented in this appendix. Twenty six of the documents received are letters or faxes, and 14 are electronic mail (e-mail). Six of the documents were submitted from addresses in the United States, 32 were submitted from addresses in Canada, and 2 documents did not have identifiable addresses.

As shown in Table A-1, approximately 150 comments were received. Thirty-nine of the comments are on the technical accuracy of the EA, with 19 of these comments relating to transportation issues. Eleven comments questioned the relationship of MOX fuel and the Parallex Project to the U.S. Government's nonproliferation policy. Nine comments questioned whether the EA meets NEPA requirements, and whether a EIS should be prepared. Seven commentors expressed a preference for an alternative, with most supporting the no action alternative. Six comments recommended that the scope of the EA be broadened to include other issues. Two requests for a copy of the EA were received, and three comments expressed views that are unrelated to the proposed action. The remaining 75 comments are related to Canadian issues and concerns.

Table A-1. Comments Received on the Preliminary Draft EA

Comment Category	Number of Comments
Comments on Scope of EA	6
Comments on NEPA adequacy	9
Comments on Nonproliferation Policy	11
Preference for Alternatives	7
Comments on the Technical Accuracy of the EA[a]	39
Comments on Canadian Issues	75
Requesting Copy of EA	2
Other	3
TOTAL	152

a Nineteen of these comments are on transportation issues.

A.2 Summary of DOE Responses

Table A-2 shows DOE's responses to the comments received during the comment period on the preliminary draft Parallex Project EA. As shown in Table A-2, seventy unique responses were prepared by DOE to address the comments received. Most of the comments received by DOE did not require changes to the EA. Although the Canadian issues are outside the scope of the Parallex Project EA, Section 4.5 (Operations in Canada) was added to address these concerns.

A.3 Comments Received During the Public Comment Period on the Surplus Plutonium Disposition Draft EIS

DOE received additional comments on the Parallex Project during the comment period for the Surplus Plutonium Disposition EIS (DOE, 1998b) that ended on September 16, 1998. Although these comments were submitted to DOE outside the comment period for the Parallex EA, they are summarized below, and have been considered to the extent possible in preparing the final Parallex EA. These comments are related to four issues:

- Opposition to transporting MOX fuel through Michigan,
- Support for transporting MOX fuel through Michigan,
- Impacts of the Parallex Project in Canada, and
- Extension of the comment period for the Parallex EA.

In response to the comments on transportation routes, and upon additional investigation DOE has modified the final EA. DOE has determined that the route that crosses the U.S. - Canada border near Port Huron, Michigan will not be used to avoid undesirable traffic congestion caused by the continued renovation of the Blue Water Bridge. DOE has added four other shipping routes for consideration; one crossing the border near Sault Ste. Marie, Michigan; one crossing near Detroit, Michigan; one crossing near Buffalo, New York; and one crossing near Niagara, New York. It is unlikely that the Detroit route would be used due to hazardous material restrictions on the Ambassador Bridge. Revised analyses in this Final EA still show that risks to persons along any of the transportation routes, and to the truck crew, would be small. Operations in Canada are discussed to the extent possible in Section 4.5 of this EA.

Document 01

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MARK E. WEIDLER
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September 18, 1997

Dean Triebel
U.S. Department of Energy
Los Alamos Area Office
528 35th Street
MS-A316
Los Alamos, N.M. 87544

Dear Mr. Triebel:

RE: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PARALLEX PROJECT FUEL MANUFACTURE AND SHIPMENT; LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NEW MEXICO; PREPARED BY U.S. DEPARTMENT OF ENERGY, LOS ALAMOS AREA OFFICE; AUGUST 18, 1997

The following transmits New Mexico Environment Department (NMED) staff comments concerning the above-referenced Predecisional Draft Environmental Assessment (PDEA).

1 1. Page 5, Section 2.1: TA-3 is highlighted in Figure 1, however, there is no mention of TA-3 in the text. What is the purpose of TA-3 and why is it highlighted?

2 2. Page 23, Section 3.3.2: The sentence in this section reads, *"Responsibility for each shipment would transfer from the US government to the Canadian Government at the border."* How would this be accomplished?

3 3. Page 3, Section 4.1.2: The paragraph states, *"HEPA filters are regularly replaced..."* How often is "regularly"? Do the HEPA filters undergo testing to meet certain requirements?

4 4. Page 3, Section 4.1.3: The U.S. Department of Energy (DOE) must meet requirements of 40 CFR 61, Subpart H, specifically Section 61.93.

5 5. 20NMAC.72.202E requires that "applications for permits shall be filed prior to the commencement of the construction, modification or installation. Regardless of the anticipated commencement date, no construction, modification or installation shall begin prior to issuance of the permit." There is no mention of whether or not this facility has been included in the current air quality permit for Los Alamos National Laboratory (LANL). If it has not, then it must be included in the permit before commencement of construction.

6 6. It should be noted that the proposed shipments include relatively small amounts of Mox Fuel: a total of 59.2 pounds will be shipped to Canada over the life of this project. The text in Section

6 2.1.2. states that a "Type A" package will be used for shipping Mox fuel. This package appears substantially similar to a 55-gallon drum with top and bottom thermal shields and interior packing. The text explains that this type of container is typically used for "relatively low-level radioactive materials." DOE's Los Alamos Office should explain the rationale behind this choice. Mox fuel contains significant quantities of plutonium and uranium and should therefore require more protective packaging.

7 Too many citizens in our State have been sensitized to such issues by the prospect of radioactive waste shipments to the Waste Isolation Pilot Plant (WIPP) should provide ample reason for caution in this case. The comparison is apt to be made between the Mox fuel shipments and the planned WIPP shipments. In the case of WIPP shipments the wastes are planned to include, among other radionuclides, plutonium and uranium isotopes at much lower levels than in the Mox shipments. The Type A drums of TRU waste comprising WIPP shipments will be transported in Trupact II containers that have been subjected to extremely rigorous tests. DOE should also explain its proposed use of commercial trucks in shipping this material.

We appreciate the opportunity to comment on this document. Please let us know if you have any questions.

Sincerely,

Gedi Cibas, Ph.D
Environmental Impact Review Coordinator

NMED File No. 1122ER

Document 02

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We make Indiana a cleaner, healthier place to live

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Indianapolis, Indiana [illegible]
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Environmental Helpline 1-800-[illegible]

November 7, 1997

Mr. G. Thomas Todd
Area Manager
Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

Dear Mr. Todd:

Thank you for informing us of the proposal to ship mixed oxide fuel pellets through northwestern Indiana. A copy of the proposal that you provided for our review has been sent to Mr. Roger Andrews of the State Emergency Management Agency, who offered to coordinate distribution of the document to other affected agencies. The Indiana Department of Environmental Management (IDEM) is primarily interested in the date, time and route of shipment. It would also be necessary to have a copy of the contingency plan that you would be using, along with critical contacts and phone numbers. This information should be sent to the attention of Mr. Bruce Palin, Assistant Commissioner for the Office of Solid and Hazardous Waste Management at IDEM.

1 The lead state agency concerned with the movement of radioactive materials within the state is the Department of Health. The State Emergency Management Agency and the State Police would also play primary roles. Our agency would also get involved should a spill or release occur. The following is a list of contacts for these agencies:

Indiana Department of Health	Rex Bowser	317/233-7153
Indiana State Police	Steve King	317/232-8246
State Emergency Management Agency	Roger Andrews	317/233-4996
Indiana Dept. of Environmental Mgt.	Chuck Phipps	318/233-7745

Should you have any questions regarding this matter, please contact Thomas Linson of the Office of Solid and Hazardous Waste Management at 317/233-2192.

Sincerely,

John M. Hamilton
Commissioner

JMH:tel

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Document 03

STATE OF ILLINOIS
WASHINGTON OFFICE
444 NORTH CAPITOL STREET, N.W.
SUITE 240
WASHINGTON, D.C. 20001

JIM EDGAR
Governor

(202) 624-7760

November 3, 1997

Mr. Dean Triebel, MS-A316
US Department of Energy
Los Alamos Area Office
528 35th Street
Los Alamos, NM 87544

Dear Mr. Triebel:

The U.S. Department of Energy (DOE) is proposing to fabricate and ship mixed oxide nuclear fuel pellets from Los Alamos, New Mexico, to Chalk River, Canada. In accordance with NEPA requirements, DOE has prepared a draft Environmental Assessment (EA) to describe the potential environmental consequences of this fabrication and shipment. Illinois Department of Nuclear Safety (IDNS) staff have reviewed this EA for issues of concern to Illinois and have provided the following comments:

We recognize that mixed oxide nuclear (MOX) fuel is an experimental type of fuel containing plutonium as well as uranium and that this fuel is non-irradiated (i.e., not yet used in a nuclear reactor). In our view, the level of hazard is similar to that of common uranium fuel and far less than spent nuclear fuel. Both of these fuels are shipped across Illinois on a routine basis without incident. We do not disagree with DOE's assessment that the health and safety impacts of the proposed action are extremely small.

1 However, because of the public's indiscriminate association of plutonium in any form with the hazards of weapons grade plutonium, MOX fuel is sometimes perceived as extremely dangerous. As a result of the increased level of public interest and publicity this shipment is likely to generate, we consider it prudent to advise DOE to choose a shipment route which passes through low population areas whenever possible. Of DOE's three proposed routes, we consider the Port Huron route to be least acceptable to Illinois, since it passes through Chicago. One suggestion might be to modify the Port Huron route to bypass Chicago. This could be accomplished by crossing southern Illinois to Indianapolis and then Lansing.

If you have any questions about these comments, please call Richard Allen with the Illinois Department of Nuclear Safety at (217) 782-1332.

Sincerely,

Paul Doucette
Legislative Assistant

cc: Thomas W. Ortciger, IDNS
Rich Allen, IDNS

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Document 04

STAND of Amarillo, Inc.

September 24, 1997

Dean Trichel
U.S. Department of Energy
Los Alamos National Laboratory
528 35th Street
Los Alamos, NM 87544

Dear Mr. Triebel:

These are STAND (Sodiers Texans Against Nuclear Dumping) of Amarillo's comments on the U.S. Department of Energy's (DOE) predecisional draft Environmental Assessment (EA) for the Parallex Project Fuel Manufacture and Shipment (PFFMS). The PFFMS is actually a Mixed Oxide (MOX) fuel fabrication and transport project, the first steps for irradiating MOX fuel in the National Research Universal (NRU) reactor owned by Atomic Energy of Canada, Limited (AECL). The purpose of the project is to use MOX fuel made in the United States and Russia from excess weapons-grade plutonium for both countries' nuclear stockpile.

1 STAND of Amarillo requests that DOE select the "no-action" alternative and not proceed with this project. The PFFMS is incompatible with the ongoing Surplus Plutonium Disposition Environmental Impact Statement (SPDEIS); it inadequately addresses potential environmental impacts and cumulative impacts at Los Alamos National Laboratory (LANL); and it provides insufficient accident analyses.

Relationship of PFFMS to Other NEPA Documents

2 In the May 16, 1997 Notice of Intent for the SPDEIS, DOE identified immobilizing all surplus weapons grade plutonium as a reasonable alternative for plutonium disposition. Selection of the full immobilization alternative would preclude the use of MOX fuel as a disposition option. Any action taken on the MOX option could limit the choice of reasonable alternatives in the SPDEIS.

The Record of Decision (ROD) for the Storage and Disposition of Fissile Materials Programmatic Impact Statement (S&D PEIS) does allow for the CANDU test and demonstration project. However, it does not mandate it, stating that the CANDU program should be, "consistent with ongoing and potential future cooperative efforts with Russia and Canada." Since these ongoing efforts are not identified in the EA, DOE has provided no evidence that it must proceed at this time.

Insufficient Environmental and Safety Analyses

3 The PFFMS-EA is completely disconnected from existing realities at LANL and functions to mislead the public. The EA does not acknowledge that safety problems have been so rampant at LANL that a complete shutdown of one facility has occurred, and operations have been slowed down elsewhere. The EA also fails to mention that in the recent settlement of a lawsuit brought by Concerned Citizens for Nuclear Safety, LANL was found to be in non-compliance with the Clean Air Act. For the PFFMS-EA to be a legally sufficient and scientifically credible document, DOE must analyze and present existing conditions at LANL and place this proposed action within that context. This is especially important since LANL has no site-wide EIS to support the PFFMS-EA.

4 DOE should also address the concerns raised by the October 3, 1996 *Petition of the Nuclear Control Institute, Natural Resources Defense Council, and Greenpeace for Leave to Intervene and Request for Hearing*. The petition was submitted to the Nuclear Regulatory Commission and specifically focused on the same CANDU proposed test program found in the PFFMS-EA. DOE does not even acknowledge that the proposed action has been challenged.

(806) 355-2622 7105 W. 34th Ave. Suite E - Amarillo, TX 79109 FAX (806) 355-2839

Insufficient Accident Analyses

5 The PFFMS-EA does not fully assess the risks of an accident. In both the MOX fuel fabrication fire accident and the MOX fuel transportation accident scenarios, DOE only identifies plutonium oxide as an air-borne hazard. Is the uranium oxide that is present in much greater amounts (97% of the MOX fuel pin) considered a hazard by DOE? DOE must analyze the risk of breathing air contaminated with uranium oxide and plutonium oxide, not just plutonium oxide.

6 The PFFMS-EA also fails to analyze the risk of an accident at the reactor site, and the potential environmental and human health impacts of such an accident. As long as a possibility exists that the test could fail, DOE is obligated to assess the impacts of a failed test. If one impact is a reactor accident, this could affect the United States as well as Canada. The failure of the Canadian government to conduct any environmental assessment on the proposed action should not be compounded by DOE's failure to recognize that the consequences of nuclear accidents do not follow political boundaries. For the scope of the PFFMS-EA to be sufficient, DOE must analyze the risk and consequences of a reactor accident and solicit input on this issue from Candian citizens. .

Additional Questions and Comments

7 • What are the criteria for determining success or failure of using MOX fuel from weapons grade plutonium in the CANDU research reactor?

8 • What is the composition of the three existing batches of MOX test fuel? How does the test fuel that met specifications for the CANDU test differ from the test fuel that did not meet specifications? The EA states that "9.2 pounds of [fuel with] 3.1 percent plutonium was identified as acceptable and meeting the criteria for the Parallex project." Yet, DOE never lists the criteria--or the document under which the criteria is defined--for the MOX fuel in CANDU reactors. DOE should define this criteria.

9 • What other "impurities" other than gallium are in the weapons-grade plutonium and what are the potential effects of having these impurities in amounts exceeding specifications?

10 • How safe and secure will this shipment be? The S&D PEIS ROD states that "strict security and safeguards would be employed in the fabrication and transport of MOX fuel to CANDU reactors, as well as domestic reactors." Yet DOE is proposing to ship this MOX in a commercial vehicle and not in Safe Secure Transports (SST's). What are the specific differences between the SST's and commercial vehicles?

11 • What are the full effects of the No-Action alternative? DOE states that "storage of these materials would result in minor human health effects to workers involved in LANL material handling and management requirements." What exactly are these minor effects that workers can expect during normal operations?

Thank you for this opportunity to comment.

Sincerely,

Don Moniak
Program Director
STAND of Amarillo

Document 05

NUCLEAR CONTROL INSTITUTE

September 17, 1997

Mr. Dean Triebel
Los Alamos National Laboratory
528 35th Street
Los Alamos, NM 87544

NCI Comments on the Draft EA for the Parallex Project

Dear Mr. Triebel:

We are writing to comments on the predecisional draft *Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment* ["draft EA"]. We believe DOE should cancel the planned export and test irradiation of CANDU MOX fuel. Even from the perspective of a "dual-track" approach to disposition, the experiment is ill-conceived, unnecessary and dangerous.

1 The CANDU MOX experiments are unnecessary. Ontario Hydro recently announced that for safety and management reasons it will shut down several of its CANDU reactors, including the Bruce A reactors designated for the full-scale use of MOX fuel.[1] It appears that neither Ontario Hydro nor the Canadian government has proposed alternative CANDU reactors for the MOX disposition mission. There is no point in proceeding with demonstration of CANDU MOX fuel if the designated Canadian reactors will not be available to use it. In NEPA terms, the desirability of the "no action" alternative is enhanced considerably. Not even a very slight probability of transportation accidents resulting in plutonium exposure and human health hazards is justified if the Parallex Program cannot proceed due to the unavailability of Ontario Hydro's CANDU reactors.

2 The CANDU MOX experiments are premature. The final PEIS and Record of Decision both treat the CANDU disposition option as a secondary option, rather than a preferred alternative. The Final PEIS stated that "[a]ll of Canadian CANDU reactors would be retained in the event a multilateral agreement is made among Russia, Canada, and the United States to implement this."[2] To date, it appears that little if any substantive progress has been made toward such an agreement. To our knowledge, Russia has not even agreed to fabricate small amounts of MOX for test irradiation in Canada as part of the Parallex program. The Record of Decision noted other major barriers to a three-government agreement:

2 > Disposition of Russian plutonium in CANDU reactors ... would require resolving additional transportation issues and additional questions relating to the likely Russian desire for compensation for the energy value of the plutonium.[3]

Given that CANDUs are only an option in case of a three-way agreement—an agreement whose successful conclusion is not on the horizon—it is premature to proceed with test irradiation of CANDU MOX at this time or in the foreseeable future.

3 The CANDU MOX experiments would undermine U.S. non-proliferation policy. This proposed export must be examined not simply as an isolated experiment involving a small amount of plutonium, but in the larger context of what to do with surplus U.S. and Russian weapons plutonium and how to stop the further spread of nuclear weapons. There is a special danger in demonstrating the feasibility of using MOX fuel in CANDU reactors. As the draft EA stated, "[t]he ability to successfully reengineer and operate heavy-water-moderated CANDU reactors with MOX fuel cycles has never been demonstrated on any industrial scale."[4] The Parallex Project is undoubtedly being watched carefully by other countries interested in potential plutonium use options. CANDU reactors are operated in the Republic of Korea, India, Romania and Argentina. Each of these countries at some point had an active program to develop nuclear weapons. In India and Pakistan, nuclear weapons have been constructed and, in the case of India, tested.[5] Neither nation is a party to the Nuclear Non-Proliferation Treaty, and neither maintains full-scope safeguards on all its nuclear facilities.

4 Pakistan imported its Kanupp CANDU reactor from Canada. This reactor is under safeguards, but Pakistan is currently constructing a heavy-water-moderated plutonium production reactor at Khushab which is not subject to safeguards.[6] China recently concluded an agreement with Canada to purchase two CANDU reactors. China may be interested in developing a plutonium fuel cycle, and it has been the primary source of

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[1] Ray Silver, "Hydro Says Older Units' Return Depends on Future Economics," *Nucleonics Week*, August 21, 1997, p. 8.

[2] U.S. DOE, Office of Fissile Materials Disposition, *Storage and Disposition of Weapon-Usable Fissile Materials Final Programmatic Environmental Impact Statement*, Volume I, December 1996, p. 2-9.

Strategies for stopping the spread and removing the threat of nuclear arms.

Paul C. Leventhal, President, Peter C. Stockton, Board Chairman, Thomas A. Hayes, Jeffrey Kimmey, Maureen Thayer, Regal Reinsch, Dr. Theodore B. Taylor
BOARD OF DIRECTORS

[3] U.S. Department of Energy, *Record of Decision for the Storage and Disposition of Weapon-Usable Fissile Materials Final PEIS*, January 14, 1997, p. 15.

[4] Draft EA, p. xiii.

[5] In fact, India acquired the plutonium used in its 1974 nuclear test explosion through the use of the CIRUS research reactor and a consignment of heavy water supplied by Canada and the United States respectively. Senator Abraham Ribicoff, "State Department Position on Indian Nuclear Explosion," *Congressional Record*, July 28, 1976, p. S11790.

[6] Mark Hibbs, "China May Continue NPD Exports to Pakistan After U.S. Certification," *NuclearFuel*, August 18, 1997, p. 1.

nuclear technology for Pakistan.[7] The significance of a U.S. initiative to develop
4 plutonium MOX fuel for use in CANDU reactors would not be lost on either Pakistan or China.

India today operates five unsafeguarded CANDU reactors which are "considered to be part of the country's potential nuclear-weapons production infrastructure."[8] It has been reported, moreover, that South Korea still "would be very interested in obtaining plutonium fuels."[9] Should the feasibility of CANDU MOX fuel be demonstrated in Parallex, and should Canada proceed to implement plans actually to burn 50 tons of plutonium,
5 non-Canadian CANDU operators are likely to seize on this as a precedent to justify their own use of plutonium. The likely result would be reprocessing of CANDU fuel in these nations to recover plutonium for MOX fuel, leading to the further stockpiling and use of weapons-usable plutonium in civilian nuclear power programs around the world—a development that would run counter to U.S. Government policy to "not encourage the civil use of plutonium" and "to seek to eliminate where possible the accumulation of stockpiles of highly enriched uranium or plutonium..."[10]

Thank you for your consideration of these views, which we are also forwarding to Secretary of Energy Peña and NRC Chairman Jackson.

Sincerely,

Paul Leventhal
President

Steven Dolley
Research Director

cc: Federico Peña, Secretary of Energy
Shirley Jackson, Chairman, Nuclear Regulatory Commission

[7] A CIA report concluded in June that China is Pakistan's "primary source of nuclear related equipment and technology..." Quoted in Tim Weiner, "China is Top Supplier to Nations Seeking Powerful, Banned Arms," *New York Times*, July 3, 1997, p. A10.

[8] Leonard Spector, *Nuclear Ambitions*, 1990, p. 220.

[9] Mark Hibbs, "CANDU MOX Fabrication Costs are Unfavorable, Germans Say," *NuclearFuel*, September 11, 1996, p. 8.

[10] The White House, Office of the Press Secretary, "Fact Sheet: Nonproliferation and Export Control Policy," September 27, 1993.

Document 06

From: Dave Taylor <ccc@web.net>
To: LAAO.LAAO WPO(Winbel)
Date: 9/21/97 1:20pm
Subject: Re: MOX fuel shipment

> > From: Dave Taylor
> Concerned Citizens of Manitoba
> c/o 674 Riverwood Ave. > Winnipeg, Manitoba
> To: Mr. D. Tawbet
> U.S. Department of Energy
> Los Alamos National Laboratory
> > Date: September 19, 1997
> > Subject: EIS for the Parallex Project Fuel Manufacture and
> Shipment (DOE/EA-1216)
> > Dear Mr. Tawbet
> I apologize for the lateness of this e-mail, I had some technical problems. I would like to take this opportunity to comment on the proposed shipment of mixed oxide (MOX) fuel from the Los Alamos National Laboratory
> to the Chalk River Laboratories of Atomic Energy of Canada, Ltd.
> (AECL).

1 > > Concerned Citizens of Manitoba is a group of approx. 400 citizens who have been opposed to AECL's disposal concept for nuclear waste. We have also monitored its Pinawa laboratories and have discovered many instances of neglect and pollution of the surrounding area.
> We have a continuing problem with the shroud of secrecy which surrounds this crown corporation and have called for open and transparent dealings with the public on nuclear issues in this province and throughout Canada. For the last 15 years we have been meeting on a monthly basis to research and document the behaviour of AECL.

2 We are on one of the proposed transportation routes and feel that there are inadequate safety precautions in case of an accident. Firefighters from the volunteer fire departments en route are not trained to deal with radioactive materials. We have also had experience with the City of Winnipeg Fire Department which is qualified only to cordon off an area of radioactive pollution and await the arrival of a geiger counter from another agency. This was proven several years back in a test scenario demonstrated by our organization.

3 Winnipeg is also a nuclear-free zone and shipments would not be allowed in the city due to this policy.

4 December and later winter months are extremely dangerous on our roads due to extremely icy conditions and the proximity of highways to the rock of the Canadian shield. Many of our highways through this province and Northwestern Ontario are single lane in many places.

5 All shipments of radioactive materials by AECL are confidential as of 1996, and the public will not have the opportunity to voice their opinion on this important subject. Unlike the U.S. no environmental assessment has been established for this country.

6 We are also concerned about the actual process itself because the Plutonium will not be burned up as stated in much of the literature on the subject. Most of it will wind up as high-level radioactive waste for which there is no solution in Canada at this time. We feel this is extremely irresponsible.

7 We encourage you to demand the same opportunities for Canadian public input into this process as your own citizens have.

Sincerely,
Dave Taylor

CC: LAAO.snmp("snp@web.net")

Document 07

From: Rosalie Bertell <100062.1200@compuserve.com>
To: Don Trivisa <dtrivisa@doe.CarLgov>
Date: 96/07 11:49am
Subject: MOX Fuel

Dear Mr. Trivisa,

1 I would like to express concern about the manufacture of MOX fuel and its=

testing at Chalk River Canada. As President of the International Institute of Concern for Public Health in Toronto, I have been working for years to=

make human health assessment an explicit part of the Canadian Environmental Assessment Process. This is not an area now adequately covered in the US=

2 Environmental Assessment process. I would ask that you request the Canadian govt, especially since with the MOX project the plutonium and liquid effluence from the reactors are important potential human health hazards.=

This exhibits, that it is important for Canadians to conduct an Environmental Assessment, which includes as far as possible, an Environmental Health Assessment.

We have three major problems with current radiation protection standards = in both the US and Canada:

3 1. Neither country has legislated the ICRP recommendations for maximum permissible exposure for members of the public, lowering it from = 5 mSv to 1 mSv per year, as proposed in 1990.

2. The risk factor officially used in the US and Canada to estimate the expected number of cancer deaths attributable to the radiation released does to the public, may well be too low by a factor of four.

3. The number of deaths per hundred Person Sieverts which the radiation protection standards assume are "acceptable" to the public for the benefits of the industry are much higher than the public finds "tolerable" from the radiological industry. This radiation protection assumption needs legal challenging.

4 In addition to these basic problems, Ontario nuclear reactors are currently of borderline acceptability for emergency preparedness and have been seriously misinterpreted over the past twenty years. Ontario Hydro has arrears and a large debt, and cannot afford to undertake an experimental program with potential problems, such as the proposed MOX program.

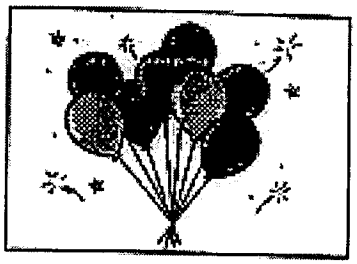
For all of these reasons, we ask that you not transfer the MOX fuel to Chalk River at this time.

Dr. Rosalie Bertell
International Institute of Concern for Public Health
718-384 Queens Quay West
Toronto On M5J 1B6 CANADA
Tel: 1-416-260-0575
Fax: 1-416-260-3484

cc: Kristen Dalby <cnp@web.net>

Document 08

L'Hôpital de Montréal pour Enfants
The Montreal Children's Hospital



FACSIMILE TRANSMITTAL SHEET
TÉLÉCOPIEUR FEUILLE DE TRANSMISSION

DATE: 16 - Sept. 1997 MCH/HME FAX # (514) 934-4337
DEPT PSYCHIATRIE /PSYCHIATRIE
PSYCHOLOGY /PSYCHOLOGIE

FROM/DE Dr C. Bouvakis TEL:
DEPT: BUDGET 9, EXPT CONTROL

TO/A: Mr Jean Trivisa
US Department of Energy TEL:
FAX #: 505 - 665 - 4972 # PAGES: 2
PLACE/LIEU:
CITY/VILLE:

SHORT MESSAGE/COURT MESSAGE:
Please See Attached Two Pages

TIME/HEURE:

2300 TUPPER, MONTRÉAL QUÉBEC H3H 1P3
PSYCHIATRY (IE): 4018 STE CATHERINE W (8), WESTMOUNT PQ H3Z 1P3
PSYCHOLOGY (IE) TEL: 934-4449

I am writing to you because I am concerned about the Parallex Project and the conversion of plutonium extracted from weapons into a reactor fuel ("MOX") which is going to be transported from Los Alamos to Chalk River, Ontario for testing in an experimental reactor. I understand that the testing may be followed by large quantities of plutonium MOX fuel being imported to Canada over the next 20-30 years for use in Canada nuclear reactors.

1 In the preliminary environmental assessment prepared by your department, I believe that the possible scenario of a traffic accident was envisaged whereby plutonium oxide particles would be released into the atmosphere and inhaled by members of the public. Also specific security arrangements other than a satellite tracking system for the trucks are not discussed leaving open the possibility of theft of plutonium fuel by armed gangs with disastrous environmental consequence and health related effects.

2 In Canada seven Candu reactors are listed for shut-down because of management and safety-related problems and some of these reactors had been selected for the use of MOX fuel. This brings into question the judgement and wisdom of the responsible officials.

3 In my opinion your department should complete a comprehensive environmental assessment to take into account the dangers referred to above.

4 In addition, to my knowledge, no such assessment has been undertaken by the Canadian Government who would be responsible for the plutonium fuel after it crosses the border into Canada. I understand that no discussion has taken place in Parliament and the Canadian population have not had the opportunity to comment on this project. In fact for the U.S. authorities to approve it under such conditions would lead to a powerful public opposition in Canada.

I believe that your department should request the Canadian Government to direct a comprehensive environmental assessment in parallel with your own. Our health and the health of generations to come is at stake.

5

Thanking you for your attention,

C.B.

Document 09

F A X

UFCW / TUAC

300-61 International Blvd., Rexdale, Ontario, M9W 6K4
TEL / TÉL: (416) 675-1104 FAX / TÉLÉCOPIEUR: (416) 675-6919

TO / À: Mr. Dean Triebel

SENDER / ÉMETTEUR-TRICE: Mr. Thomas Kukovica

DATE: September 18, 1997

MESSAGE:

TOTAL PAGES / NOMBRE DE PAGES: 3

OPERATOR / OPÉRATRICE: Anny Kukovica

DESTINATION FAX #: (505) 665-4872

UNITED FOOD AND COMMERCIAL WORKERS INTERNATIONAL UNION, CLC, AFL-CIO
UNION INTERNATIONALE DES TRAVAILLEURS ET TRAVAILLEUSES DE L'ALIMENTATION ET DU COMMERCE, CTC, AFL-CIO

UFCW TUAC

September 18, 1997

VIA FAX

Mr. Dean Triebel
U.S. Department of Energy
528 35th Street
Los Alamos NM 87544
USA

Mr. Triebel,

On behalf of the more than 200,000 Canadians who are members of the United Food and Commercial Workers Union, I urge you to ensure that any sale of plutonium to Canada is conducted in a totally responsible manner and only if adequate security and environmental assessments and safeguards are put in place, by both the U.S. and Canadian governments.

1 As you are no doubt aware, seven CANDU reactors are now slated for shutdown due to safety concerns. It is therefore even more imperative that you re-consider the wisdom of the "Parallex Project" which we understand is to test the feasibility of the large-scale importation and fabrication of weapons-grade plutonium into reactor fuel ("MOX").

2 If this importation is allowed to proceed, at minimum, safeguards must require complete environmental assessments in Canada, as well as the United States, and full-safe security plans for the transport and use of this material to avoid costly and irreparable damage to the Canadian people and environment.

.../2

Thomas Kukovica
Deputy National Vice-President
and Canadian Director
Vice-président national adjoint
et directeur canadien

Douglas W. Dority
International Secretary
Secrétaire internationale

Joseph C. Tabolsky
International Executive Vice-President
Vice-président international exécutif

National Office / Bureau national
300-61 International Boulevard
Rexdale, Ontario M9W 6K4
(416) 675-1104 • Fax / Télécopieur : (416) 675-6919

Document 10

From: Norman Rubin <NormanRubin@nextcity.com>
To: LANL:LAAO WPO(airtebel)
Date: 9/13/97 3:47pm
Subject: Comments on DOE's preliminary EA for "Parallex"

Dean Tirebel
U.S. Department of Energy
Fax:505-665-4872
Tel: 505-665-6353 e-mail: dtirebel@doe.lanl.gov,

To the U.S. Department of Energy:

I am writing on behalf of Energy Probe concerning the "Parallex Project", which involves the fabrication of weapons-grade plutonium into reactor fuel ("MOX") at Los Alamos, and transport of said fuel to Chalk River, Ontario, for testing in an experimental reactor. We understand that the "test burn" is a precursor for the possible eventual large-scale importation of plutonium MOX fuel for use in CANDU nuclear reactors over a period of two or three decades. In particular, we refer to the preliminary Environmental Assessment prepared by the U.S. Department of Energy on the Parallex Project.

Energy Probe is the largest of Canada's environmental groups that focuses on energy and nuclear issues, and has taken a decades-long interest in issues concerning nuclear energy and nuclear weapons proliferation. We also corresponded with the Department of Energy (June 8, 1996) in response to the Draft PEIS on the Storage and Disposition of Weapons-Usable Fissile Materials.

1 In that correspondence, we cautioned the U.S. Department of Energy not to assume that official Canadian Government approval of "the CANDU Reactor Alternative" is based on either full assessment of the program's potential impacts, or full public discussion in Canada of those potential impacts. We call attention to your response to our comments (Final PEIS, Comment Response Document, Volume IV, Part A, pp. 3-1186 through 3-202). In that response you state:

"... In addition, according to the Canadian Government, implementation of the CANDU Reactor Alternative would be subject to Canadian Federal and Provincial policies and regulations and would require health, safety, and environmental assessments before issuance of a Canadian license. (See the letter from the Canadian Embassy in Washington, DC, dated June 4, 1996, reproduced in this CRD.)"

In that letter, signed by Brian Morrisey, the Embassy's Minister-Counsellor, Economic and Trade Policy, the final paragraph reads as follows:

2 "If the DOE selects Ontario Hydro CANDU reactors for the plutonium disposition program, implementation would be subject to Canadian federal and provincial policies and regulations. These would include detailed, satisfactory assessments of health, safety, and environmental aspects before issuance of an Atomic Energy Control Board (AECB) operating license to Ontario Hydro for the use of MOX fuel. We expect that the public reviews included in the AECB assessment process would focus on issues such as the safe and secure transportation of MOX fuel from the international boundary as well as reasons specific to the reactor site."=20

3 We do not believe that the promised "public reviews" will approach the level of democratic public scrutiny that this paragraph would suggest to a U.S. (or indeed a Canadian) reader. Indeed, past AECB "public reviews" on important licensing decisions have generally been completed in the course of an hour or two, giving five or ten minutes for the presentation of each independent analysis, followed (usually immediately) by the decision of the Board. In the case of the Parallex Project, including the proposed December shipment of MOX fuel to Chalk River, Ontario, we do not believe that even this level of "public review" has taken place or is anticipated. We believe that common decency in international relations, concern for the environment of a neighbouring state, the U.S. National Environmental Protection Act (NEPA), and the Presidential Executive Order requiring your Department to implement the principles of environmental justice in your review process, all require that Canadians must be accorded the right to a meaningful public review and assessment before the proposed shipment for the Parallex Project can proceed.

4 As you know, one of the credible scenarios described in the preliminary Environmental Assessment prepared by the U.S. Department of Energy on the Parallex Project involves a traffic accident resulting in the release of plutonium oxide particles to the atmosphere and subsequent inhalation of such particles by members of the public. That scenario has not been taken seriously, or publicly reviewed, in Canada. We believe a full-scale environmental assessment process must be initiated so that the details of this analysis can be critically scrutinized and alternative scenarios studied.

5 It is noteworthy that the preliminary EA does not specifically discuss security measures or armed guards for the transport of plutonium fuel, other than to describe a tamper-proof on-board satellite tracking system for the trucks. However, it is apparent that any attempt to hijack the shipments by force of arms could have both direct and indirect environmental consequences, and is, we believe, just as credible as the other accident scenarios discussed in the EA. Such scenarios must be included in a comprehensive environmental assessment.

6 Furthermore, we note that most credible assessments of the security requirements of shipments of weapons-plutonium MOX (including notably that of the U.S. National Academy of Sciences) suggest that they be handled to "The Stored (Nuclear) Weapons Standard". It would appear that the proposed shipment would not meet that standard, in part because it does not anticipate the use of safe secure transport (SST) vehicles for the MOX export. Full discussion of this issue must be included in a comprehensive environmental assessment.

7 We are also concerned that the largest impact of this "test of feasibility" has not been assessed adequately at all, on either side of the border between our countries. Specifically, we believe that there is a crucial non-proliferation danger even in merely demonstrating the feasibility of using MOX fuel in CANDU reactors. CANDU reactors are operated in India, Pakistan, South Korea, Romania and Argentina, each of which have or have had an active program to develop nuclear weapons. China is about to buy two CANDU reactors. Non-Canadian CANDU operators can be expected to seize on this demonstration in Canada as a precedent to justify their own use of plutonium. The likely result is the further spread of weapons-usable plutonium in civilian nuclear power programs around the world. More than a decade ago, the U.S. government intervened to prevent the same Canadian agency, AECL, from sharing plutonium-use technology with the South Korean nuclear establishment, on legitimate anti-proliferation grounds. If even moderately successful, the proposed test of feasibility -- whether or not full-scale implementation follows -- will give comfort and encouragement to precisely those forces within South Korea (and other CANDU client states) that still wish to proceed towards full plutonium use.

8 In Canada, seven CANDU reactors are slated for shutdown due to a poor "safety culture", manifested in sub-standard practices, sloppy management and a huge backlog of safety-related maintenance problems. The reactors to be shut down include the Bruce A reactors which were selected by AECL as the best candidates for eventual use of MOX fuel. This calls into question the judgment of AECL officials, the wisdom of consigning MOX fuel to AECL without any independent oversight, and the reliability of Ontario Hydro and AECL to fulfill the terms of any proposed plutonium disposition agreement. (Indeed, we believe that the same "safety culture" problems most likely apply as much to AECL as to Ontario Hydro.) We therefore believe that this test is at least premature, and is likely to prove useless, as it will not lead to successful disposition even if the test succeeds.

9 As stated in the EA, "environmental assessment of activities conducted in Canada would be the responsibility of the Canadian government". However, there has been no environmental assessment process initiated in Canada. In fact, there has been no public process of any kind to involve the Canadian parliament or the Canadian population in approving, disapproving, or otherwise commenting on this project. For U.S. authorities to approve the project under such circumstances would inevitably lead to strong public opposition within Canada, as well as violating the spirit and (we believe) the letter of U.S. law. We urge the DOE to request the Canadian government to conduct an environmental assessment in parallel with your own.

cc. Prime Minister Jean Chrétien, fax: 613-941-6900

Norman Rubin
Senior Consultant, Ontario Energy Research Association
Director of Nuclear Research and Senior Policy Analyst, Energy Probe
225 Brunswick Avenue, Toronto, Ontario M5S 2M6 Canada
Check out Energy Probe's home page at:
http://www.nextcity.com/EnergyProbe.

Document 11

From: Campaign for Nuclear Phaseout <cnp@web.ave>
To: LAAO.LAAD.WPO(dirtribal)
Date: 9/17/97 4:53pm
Subject: Comments on DoE Parallex Environmental Assessment

September 17, 1997

Mr. Dean Tribbal
United States Department of Energy
528 35th Street
Los Alamos
New Mexico, USA
87322

via fax (505) 665-4872 and e-mail dirtribal@doe.fed.gov

Re: Parallex Environmental Assessment

Dear Mr. Tribbal,

The Campaign for Nuclear Phaseout, a Canada-wide coalition supported by over 300 public interest groups, is opposed the importation of weapons plutonium from the United States to Canada and its use in Canadian nuclear reactors.

The question of what to do with "excess" plutonium from nuclear warheads poses one of the most perplexing hazardous waste and international security dilemmas of our time. However, the transportation and use of plutonium fuel in Canada will only compound the problem. The surest way to meet disarmament and non-proliferation objectives is to ensure the safe and secure storage of the existing plutonium stockpiles, and to halt all production and separation of plutonium in the future.

1 It is unacceptable for the Parallex project to be considered, let alone proceed, without proper public consultation in Canada. As stated in the Parallex Environmental Assessment, "activities conducted in Canada would be the responsibility of the Canadian government" (section 2.1, Description of the Proposed Action). To date, the only opportunity Canadians have had to comment has been through the current US environmental assessment process. Although the DoE's Environmental Assessment stops at the border, any accident resulting in plutonium dispersal into the environment is unlikely to similarly respect national boundaries.

2 The transportation of plutonium fuel poses a serious potential health and safety risk. If even a small amount of plutonium were to be dispersed into the environment there could be disastrous consequences. The Nobel prize-winning organization, International Physicians for the Prevention of Nuclear War, has estimated that 37 micrograms of inhalable plutonium-239 in the lungs would be sufficient to cause cancer in an adult human being. (Plutonium: Deadly Gold of the Nuclear Age, International Physicians Press, 1982, p. 146).

3 One accident scenario in the Parallex Environmental Assessment describes "an event which leads to the MOX fuel package container breaking open, igniting, and releasing plutonium dioxide particles into the air, with the public assumed to be near enough to the accident to breathe air contaminated with plutonium dioxide." (Section 5.2(f))

4 While the Parallex Environmental Assessment admits that a traffic accident could potentially release plutonium dioxide into the air, federal government scientists in Canada have failed to acknowledge this possibility, stating in recent media reports that "there is virtually no scenario under which the pellets could be converted into dust capable of being inhaled." ("Trial burn of reactor fuel irks activists", Canadian Press, September 12, 1997. See also "Nuclear Jitters: A controversial plutonium plan is under fire", MacLean's Magazine, September 22, 1997, p. 50). Clearly, potential safety risks are not being taken seriously by the Canadian agencies which would be responsible for the transportation and use of plutonium fuel in Canada. Moreover, the Parallex assessment downplays risk factors as well as international recommendations on maximum permissible exposures.

5 In conjunction with your review of the project, we urge you to take into account the fact that one of the main proponents of the plutonium fuel plan in Canada, Ontario Hydro, has been forced to shut down seven CANDU reactors due to sub-standard safety practices and maintenance problems. The reactors to be shut down include five Bruce A reactors which were selected by Atomic Energy of Canada Limited as the best candidates for use of plutonium fuel. Seen from the perspective of many Canadians, the plutonium fuel initiative would only serve to prop up Canada's declining and safety-scandal ridden nuclear industry.

6 A Presidential Executive Order requires the Department of Energy to implement the principles of environmental justice in its review process (Section 3-3). The Parallex Environmental Assessment notes that the DoE is in the process of finalizing procedures for the implementation of the Executive Order. While there is no stated requirement for a similar analysis of political impacts outside its borders, the United States has a moral obligation to consider the negative impacts of its actions as countries that it claims as allies. This should particularly be the case when the activities which follow from approval of the Parallex assessment will fundamentally change Canada's status with respect to nuclear weapons materials on its soil.

7 The weapons plutonium fuel initiative will not turn "swords into ploughshares", as its proponents claim. Instead, it will help to entrench a North American plutonium economy. Plutonium production worldwide is increasing and new weapons of nuclear mass destruction continue to be developed. The weapons plutonium fuel proposal does nothing to halt these trends.

8 The Canadian government and nuclear industry's rationale for accepting weapons plutonium fuel, has more to do with attempting to sustain an inherently non-sustainable industry than it does with any notion of transforming swords into ploughshares. The United States Department of Energy should not engage in a process which has nothing to do with safeguarding weapons plutonium and everything to do with shoring up the prospects of a flagging industry.

9 We are calling upon the governments of Canada and the United States to immediately take this proposal off the table before Canada is locked into an irreversible decision.

Sincerely,

Kristen Dorling
National Coordinator
Campaign for Nuclear Phaseout

cc: The Honourable Jean Chrétien, Prime Minister of Canada
William J. Clinton, President of the United States

Campaign for Nuclear Phaseout
Campagne contre l'expansion du nucléaire
412-1 Nicholas St.
Ottawa, Ontario, K1N 7B7
Canada

Tel: (613) 789-3834
Fax: (613) 241-2202 e-mail: cnp@web.ave

Document 11 (duplicate)

Campaign for Nuclear Phaseout / Campagne contre l'expansion du nucléaire
413-1 Aux Nicholas St., Ottawa, Ontario K1N 7B7 Tel: (613) 789-3654 Fax: (613) 843-2267 e-mail: cnp@web.ca

Fax/Télécopie

Date: September 17, 1997
Pages: 3 + 4

To: Dean Treibel, Department of Energy, Los Alamos
Tel:
Fax: 505-665-4872

From: Kristen Osding

Comment

Letter and related documentation on Parallex Environmental Assessment follow.

Campaign for Nuclear Phaseout / Campagne contre l'expansion du nucléaire
413-1 Aux Nicholas St., Ottawa, Ontario K1N 7B7 Tel: (613) 789-3654 Fax: (613) 843-2267 cnp@web.ca

September 17, 1997

Mr. Dean Treibel
United States Department of Energy
528 35th Street
Los Alamos
New Mexico, USA
87523

via fax (505) 665-4872 and
e-mail dtreibel@doe.lanl.gov

Re: Parallex Environmental Assessment

Dear Mr. Treibel,

The Campaign for Nuclear Phaseout, a Canada-wide coalition supported by over 300 public interest groups, is opposed the importation of weapons plutonium from the United States to Canada and its use in Canadian nuclear reactors.

The question of what to do with "excess" plutonium from nuclear warheads poses one of the most perplexing hazardous waste and international security dilemmas of our time. However, the transportation and use of plutonium fuel in Canada will only compound the problem. The surest way to meet disarmament and non-proliferation objectives is to ensure the safe and secure storage of the existing plutonium stockpiles, and to halt all production and separation of plutonium in the future.

It is unacceptable for the Parallex project to be considered, let alone proceed, without proper public consultation in Canada. As stated in the Parallex Environmental Assessment, "activities conducted in Canada would be the responsibility of the Canadian government" (section 2.1, Description of the Proposed Action). To date, the only opportunity Canadians have had to comment has been through the current US environmental assessment process. Although the DoE's Environmental Assessment stops at the border, any accident resulting in plutonium dispersal into the environment is unlikely to similarly respect national boundaries.

The transportation of plutonium fuel poses a serious potential health and safety risk. If even a small amount of plutonium were to be dispersed into the environment there could be disastrous consequences. The Nobel-prize-winning organization, International Physicians for the Prevention of Nuclear War, has estimated that 27 micrograms of insoluble plutonium-239 in the lungs would be sufficient to cause cancer in an adult human being. (*Plutonium: Deadly Gold of the Nuclear Age*, International Physicians Press, 1992, p. 148).

One accident scenario in the Parallex Environmental Assessment describes "an event which leads to the MOX fuel package container breaking open, igniting, and releasing plutonium dioxide particles into the air. ... The public is assumed to be near enough to the accident to breathe air contaminated with plutonium dioxide." (Section 5.20)

4 While the Parallex Environmental Assessment admits that a traffic accident could potentially release plutonium dioxide into the air, federal government scientists in Canada have failed to acknowledge this possibility, stating in recent media reports that "there is virtually no scenario under which the pellets could be converted into dust capable of being inhaled." ("Trial burn of reactor fuel irks activists", Canadian Press, September 12, 1997. See also "Nuclear Waste: A controversial plutonium plan is under fire", *MacLean's Magazine*, September 22, 1997, p. 68). Clearly, potential safety risks are not being taken seriously by the Canadian agencies which would be responsible for the transportation and use of plutonium fuel in Canada. Moreover, the Parallex assessment downplays risk factors as well as international recommendations on maximum permissible exposures.

5 In conjunction with your review of the project, we urge you to take into account the fact that one of the main proponents of the plutonium fuel plan in Canada, Ontario Hydro, has been forced to shut down seven CANDU reactors due to sub-standard safety practices and maintenance problems. The reactors to be shut down include the Bruce A reactors which were selected by Atomic Energy of Canada Limited as the best candidates for use of plutonium fuel. From the perspective of many Canadians, the plutonium fuel initiative would only serve to prop up Canada's declining and safety-scandal ridden nuclear industry.

6 A Presidential Executive Order requires the Department of Energy to implement the principles of environmental justice in its review process (Section 3-6). The Parallex Environmental Assessment notes that the DoE is in the process of finalizing procedures for the implementation of the Executive Order. While there is no stated requirement for a similar analysis of political impacts outside its borders, the United States has a moral obligation to consider the negative impacts of its actions on countries that it claims as allies. This should particularly be the case when the activities which follow from approval of the Parallex assessment will fundamentally change Canada's status with respect to nuclear weapons materials on its soil.

7 The weapons plutonium fuel initiative will not turn "swords into ploughshares", as its proponents claim. Instead, it will help to entrench a North American plutonium economy. Plutonium production worldwide is increasing and new weapons of nuclear mass destruction continue to be developed. The weapons plutonium fuel proposal does nothing to halt these trends.

8 The Canadian government and nuclear industry's rationale for accepting weapons plutonium fuel, has more to do with attempting to sustain an inherently non-sustainable industry than it does with any notion of transforming swords into ploughshares. The United States Department of Energy should not engage in a process which has nothing to do with safeguarding weapons plutonium and everything to do with shoring up the prospects of a flagging industry.

9 We are calling upon the governments of Canada and the United States to immediately take this proposal off the table before Canada is locked into an irreversible decision.

Sincerely,

Robert Collins
National Coordinator

cc. The Honourable Jean Chrétien, Prime Minister of Canada
William J. Clinton, President of the United States

Campaign for Nuclear Phaseout / Campagne contre l'expansion du nucléaire
412-1 rue Nicholas Street, Ottawa, Ontario K1N 7B7 Tel: (613) 789-0181 Fax: (613) 789-2033

Press Clippings / Coupures de presse

Publication: KW THE RECORD, Kitchener, Ontario

Date: FRIDAY, September 12, 1997

OTTAWA

Trial burn of reactor fuel irks activists

An anti-nuclear activists are upset over the plan to burn plutonium-based fuel from the United States in Canada for a test to determine how well the fuel functions in Candu reactors.

The test is expected to take place in December at the Atomic Energy of Canada lab at Chalk River, Ont.

A U.S. environmental assessment, which considers most "painstaking to approved as requirement the plutonium fuel be shipped by truck from Los Alamos, N.M., to the Canadian border.

"The [U.S.] government literally stops at the border," said Kristin Collins of the Campaign for Nuclear Phaseout at a news conference Thursday.

Collins said that if the test proceeds, Canada "may find itself committed to the large-scale import of plutonium from Cold War-era nuclear weapons for reactors for disposal in Canada reactors.

Canada has agreed in principle to burn a plutonium-enriched fuel called MOX fuel (MOX) in Canada reactors in order to help reduce plutonium stockpiled in Russia and the U.S.

The stockpiles are considered a security problem because they could fall into the hands of terrorists and be used to make nuclear weapons.

Canada heavy-water reactors can be adapted more readily to burning plutonium than the light-water reactors used in Russia and the United States.

The federal government has promised a full environmental assessment if there is a formal proposal to burn MOX fuel on a large scale.

Officials for the MOX project at Atomic Energy of Canada said there is no need for an environmental assessment of the test because the amounts of plutonium involved are small.

The test would involve 3 kg of plutonium fuel, with other material.

Federal authorities say plutonium is a health hazard if inhaled but there is virtually no scenario under which the pellets could be converted to dust capable

Environment

Nuclear jitters

A controversial plutonium plan is under fire

Maclean's Magazine September 22, 1997 p. 68

Document 12

From: Sierra Club of Canada <sierra@web.net>
To: LAAO.LAAO WPO(dtriebel)
Date: 9/17/97 2:39am
Subject: Commentary on Parallex Environmental Assessment

September 16, 1997

Mr. Dean Triebel
Department of Energy
528 35th Street
Los Alamos
New Mexico, USA
87522

via fax: (505) 665-4872 and e-mail: dtriebel@doe.lanl.gov

Dear Mr. Triebel:

1 I am writing in connection with the U.S. Department of Energy environmental review of the ground shipment of plutonium fuel across U.S. highways and into Canada (the Parallex environmental assessment). Our government is not holding any public review, but Canadians by a large majority do not want to be in the business of burning plutonium in CANDU reactors.

2 Clearly, there is a need to render the plutonium unusable for military purposes, but burning it in Canadian reactors, and creating long-lived nuclear wastes here is not the answer. Moreover, trafficking in plutonium runs the risk of increasing, not lessening security concerns. We would essentially be creating a plutonium economy. We favour the vitrification of the material on-site. We believe that vitrification is the most economical as well as safe, secure and environmentally appropriate way to proceed.

Yours sincerely,

Elizabeth May
Executive Director
Sierra Club of Canada

Sierra Club of Canada
412-1 Nicholas St.
Ottawa, Ontario, Canada K1N 7B7
Tel: (613) 241-4611
Fax: (613) 241-2292 sierra@web.net

Document 12 (duplicate)

Sierra Club of Canada

September 14, 1997

Mr. Dean Triebel
Department of Energy
528 35th Street
Los Alamos
New Mexico, USA
87522

via fax: (505) 665-4872 and
e-mail: dtriebel@doe.lanl.gov.

Dear Mr. Triebel

1 I am writing in connection with the U.S. Department of Energy environmental review of the ground shipment of plutonium fuel across U.S. highways and into Canada (the Parallex environmental assessment). Our government is not holding any public review, but Canadians by a large *majority* do not want to be in the business of burning plutonium in CANDU reactors.

2 Clearly, there is a need to render the plutonium unusable for military purposes, but burning it in Canadian reactors, and creating long-lived nuclear wastes here is not the answer. Moreover, trafficking in plutonium runs the risk of increasing, not lessening security concerns. We would essentially be creating a plutonium economy. We favour the vitrification of the material on-site. We believe that vitrification is the most economical as well as safe, secure and environmentally appropriate way to proceed.

Yours sincerely,

Elizabeth May
Executive Director

412 1 nor Norfolk St., Ottawa, Ontario K1N 7B7 Tel: (613) 241-4621 Fax: (613) 241-2181 sierra@web.ca

Document 13

From: Anne Aslakson <canadavow@pathcom.com>
To: LAAO,LAAO WPO(Internet)
Date: 9/16/97 1:00pm
Subject: MOX shipment to Canada

Canadian Voice of Women for Peace
736 Bathurst Street
Toronto, Ontario
M5S 2R4
Tel. (416)537-8343
Fax:(416)531-6214 e-mail: vow@interlog.com

September 16, 1997

Dan Triebel
U.S. Department of Energy e-mail: dtriebel@doe.lanl.gov

To the U. S. Department of Energy,

RE: Parallex Project: MOX fuel shipment to Canada

On behalf of Canadian Voice of Women for Peace (VOW) , I am writing to strongly oppose the proposed shipment of weapons-grade plutonium to Chalk River, Ontario, in the form of MOX fuel, for a "test-burn".

1 As Canadians, we regret that our only opportunity for input to the U.S. Environmental Assessment, an assessment that stops, quite literally, at the U.S./Canadian border. Given the potential environmental, health, safety, security, and economic ramifications of this proposed project, we find it alarming that there has been NO public process of any kind involving the Canadian people or the Canadian government.

2 Public confidence in CANDU reactors is at an all time low in Canada, following highly critical internal and external reports of Ontario Hydro and the subsequent closing of Bruce reactors. There is widespread and well-informed opposition to nuclear power in Canada, and people, including our own, are calling for a federal inquiry into the fundamental assumptions of the nuclear industry. Ontario Hydro's lack of compliance with the letter and spirit of Canadian and international regulatory requirements also give us cause for concern. In addition, there has been no final report from the
FARROE panel looking into the disposal of high-level nuclear waste, and, as of now, there is no solution to this grave and intractable problem. The waste from the MOX plutonium project is intended to be dealt with by a Canadian spent fuel program that does not exist. We are amazed that the
U.S. Government would even consider the proposal at a time when so many questions remain unanswered.

3 We also feel that the U.S. Environmental Assessment process is inadequate.
As our colleague, Dr. Rosalie Bertell, points out, human health assessment is not an explicit part of the Environmental Assessment process. Moreover, current radiation standards in both countries are unacceptably lax. Security issues are not specifically discussed, and scenarios of possible accidents are not developed.

For all these reasons, we urge you not to proceed with the MOX test burn at
Chalk River,

Yours sincerely, Dr. Anne Aslakson for Canadian Voice of Women for Peace

Document 14

From: Gadsby, Bob <GadsbyR@aecl.ca>
To: Triebel, Dean [LANL] <dtriebel@doe.lanl.gov>
Date: 8/28/97 10:26am
Subject: LANL: Draft EA for Parallex

Dean,

1 Please send a copy of the pre-decisional draft "Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment" to me at the following address:

>R. D. Gadsby
>Director
MOX Project
>Atomic Energy of Canada Limited
>2251 Speakman Drive
>Mississauga, Ontario
>Canada L5K1B2

phone: (905) 823-9040 fax: (905) 403-7319
E-Mail: GadsbyR@aecl.ca

Thanks,
Bob Gadsby

Document 15

From: "ecoverst@umoncton.ca"
To: LA/OA/AD WPO(Internet)
Date: 9/15/97 10:36am
Subject: Mox

To the US Department of energy,

1 I want to express my concerns about the Parallex Project. Your government conducted a EA on the project but the Canadian government didn't, so that means the populations of Canada don't know what's going on. As an act of responsability and partnership, I would like you to ask the Canadian government to do same as you did, which is to involve the populations in the decision process.
sincerly yours,

Marco Morency, président Écoverstie, the ecologist group of Université de Moncton, Moncton, N.-B.

Écoverstie
http://www.umoncton.ca/ecoverstie
Tél & Fax: (506) 856-4095
057 PAC. CUM, Moncton, N.-B., E1A 3E9
"LA VAGUE VERTE"

Document 16

From: Bill Robinson <plough@watserv1.uwaterloo.ca>
To: LAAO.LAAO WPO(dtriebel)
Date: 9/15/97 1:30pm
Subject: MOX experiment

Dear Mr. Triebel,

I am writing on behalf of Project Ploughshares to urge the U.S. government to cancel the planned test use of MOX fuel in Canada.

1 As the Nuclear Control Institute has written, "This proposed export must be examined not simply as an isolated experiment involving a small amount of plutonium, but in the larger context of what to do with surplus U.S. and Russian weapons plutonium and how to stop the further spread of nuclear weapons."

2 In this respect, it would be a serious mistake to encourage the use of plutonium as a reactor fuel. There is, in addition, "a special danger in demonstrating the feasibility of using MOX fuel in CANDU reactors.... Non-Canadian CANDU operators can be expected to seize on this demonstration in Canada as a precedent to justify their own use of plutonium. The likely result is the further spread of weapons-usable plutonium in civilian nuclear power programs around the world."

3 Project Ploughshares urges both the U.S. and Canadian governments to reject the CANDU MOX proposal in favour of direct disposal of plutonium in glassified waste.

Thank you for your attention,

Bill Robinson, Project Ploughshares,
Conrad Grebel College, Waterloo, Ontario, Canada N2L 3G6
Phone: 519 888-6541 x264 Fax: 519 885-0806
E-mail: plough@watserv1.uwaterloo.ca http://watserv1.uwaterloo.ca/~plough

Project Ploughshares is a member of the Canadian Network to Abolish Nuclear Weapons (http://watserv1.uwaterloo.ca/~plough/cnanw/cnanw.html)

CC: LAAO.smtp("pm@pm.gc.ca")

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Document 18

From: Ole Hendrickson <ole@web.net>
To: LAAO,LAAO WPO(distribution)
Date: 9/17/97 3:45pm
Subject: MOX fuel shipment

From: Ole Hendrickson
Concerned Citizens of Renfrew County and Area
P.O. Box 661
Pembroke, Ontario K8A 7M5 Canada
To: Mr. D. Trivelpiece
U.S. Department of Energy
Los Alamos National Laboratory
Date: September 17, 1997
Subject: EIS for the Parallex Project Fuel Manufacture and Shipment (DOE/EA-1216)

Dear Mr. Trivelpiece:

Thank you for the opportunity to comment on the proposed shipment of mixed oxide (MOX) fuel from the Los Alamos National Laboratory to the Chalk River Laboratories of Atomic Energy of Canada, Ltd. (AECL).

Concerned Citizens of Renfrew County and Area (CCRCA) has over 200 members living in Renfrew County, Ontario and neighboring Pontiac County, Quebec. CCRCA promotes the responsible management and reduction of radioactive wastes and effluents from AECL's Chalk River Laboratories, which are located in the northwestern part of Renfrew County.

CCRCA has circulated a petition opposing the testing of MOX fuel at AECL. This petition has been signed by nearly 4000 citizens, and was submitted to the House of Commons in Ottawa in May 1997. We are continuing this petition campaign.

Although those who signed our petition may have done so for a variety of reasons, I believe that much of our concern can be attributed to an absence of means for members of the public to obtain information and express views on projects and activities at AECL such as the proposed MOX fuel test.

1 It is worth noting that the U.S. government is on the verge of approving the shipment of weapons-grade plutonium to a foreign nation in the absence of publicly available evidence that the receiving nation has in place proper measures to safeguard the plutonium and the waste products it may generate. Even if the U.S. has received confidential assurances that such measures are in place, this sets a disturbing precedent.

2 Canada has much less experience with environmental assessment than does the U.S. The Canadian Environmental Assessment Act was passed in 1992. Major new projects announced since 1992 for AECL/Chalk River have been given support by the federal government following either a minimum level of environmental screening (e.g., two new reactors and an extraction facility for fabricated targets of highly-enriched uranium for medical isotope production) or no environmental assessment whatever (e.g., a permanent disposal facility for all Canada's low-level radioactive wastes).

3 Many of our members and other local residents are aware of the considerable involvement of the Chalk River Laboratories in weapons manufacture, which has included many past shipments to the U.S. of plutonium and plutonium-containing fuel rods. In light of this history, one might think that participation of Chalk River Laboratories in melting plutonium unavailable for weapons use might be welcomed by groups such as ours. But approval for any activity such as the proposed MOX fuel test, whatever its merits, will never come in the absence of credible and consistent mechanisms for informing the public and allowing public participation in the assessment process.

4 Given that this test has often been labelled as a "test burn" of plutonium, it is understandable that many local residents believe that plutonium is about to be oxidized and released into the air that we breathe. Although technically speaking the "fuel burn" is beyond the scope of your assessment of the manufacture and shipment of MOX fuel, you may appreciate that the fear and unease associated with this ballet has represents a significant negative impact on the lives of residents of Renfrew and Pontiac Counties. We recommend that you consider a more comprehensive environmental assessment, if only to address this issue.

5 Another source of confusion is the rationale for the proposed MOX fuel test. AECL operated plants for plutonium extraction at Chalk River during the 1950s, has large amounts of plutonium extraction wastes in storage, and recently refurbished its mixed fuel fabrication plant - well in advance of the announcement of the proposed MOX fuel shipment from Los Alamos. The performance of mixed oxide fuels in the NRU reactor should already be quite well understood.

6 The NRU reactor, although similar to CANDU reactors, is by no means identical to them. What purpose will be served by this highly controversial test of weapons-derived MOX fuel? Is this merely a public relations exercise?

6 Are plans already in place to proclaim the test results as a total success, giving added impetus to those in the nuclear industry who support the routine use of plutonium-uranium fuel mixtures?

We hope that these issues will be considered before a final decision is made to approve the proposed MOX fuel shipment. Given the absence of mechanisms for public consultation in Canada, we would again like to express our appreciation for the opportunity you have provided to share our concerns.

Yours sincerely,
Ole Hendrickson, Ph.D.
Researcher, CCRCA

cc: LAAO,smtp("cnpcons@web.net")

Document 19

From: U. Franklin <franklin@chass.utoronto.ca>
To: Dan Tisdale <dtisdale@doe.tisd.gov>
Date: 9/16/97 11:01AM
Subject: MOX fuel testing in Chalk River,

Dear Mr. Tisdale, My friend and colleague, Dr.Rosalie Bertell, sent me a copy of her letter to you regarding the proposal of a test burn of Mox fuel in a Candu reactor. I am writing to you in support of her submission and her request NOT to process at this time with a test.

1 In addition to the points she raised, I would like to draw you attention to two other aspects of the plutoign.
One is the current state of safety and reliability of reactors in Canada and the technical and managerial competence of Ontario Hydro. Your organisation should study in detail the external and internal technical reports on Ontario Hydro's Nuclear division and the Canadian public's responses to the revelations; in this context, do not overlook Hydro's lack of compliance with the letter and the spirit of
Canadian and international regulatory requirements.

2 The second aspect relates to the chemical composition of weapons-usable plutonium. As first stated earlier this year by the Nuclear Information and Resources Service in Washington DC, the presence of Gallium and other trace elements, specific to boats derived Plutonium, poses environmental problems not previously considered in scientific studies such as the inquiry by the US Academy of Science. I would urge you to address and resolve publicly both the question of the dependability of the receiving organization and the exact components of the plutonium component of the MOX fuel before contemplating tests in
Canada.
May I also remind you that there is widespread and well informed opposition in Canada to nuclear power in general and the MOX opposition in particular.
Together with my associates of the Canadian Voice of Women for Peace, I have been for many years part of this movement, (I am also a former Board
Member of the National Research Council of Canada and hold degrees in experimental physics and in engineering.)
Yours sincerely
Prof. Ursula M.Franklin Ph.D. D.Sc.

Ursula M. Franklin, C.C. FRSC
Massey College
University of Toronto
4 Devonshire Place
Toronto, ON CANADA M5S 2E1
Tel: (416) 978-4539
Fax: (416) 978-1758
Email: franklin@chass.utoronto.ca

Document 20

From: Joan F Davis <jdavis@totalnet>
To: LAAO.LAAO WPO(oldest)
Date: 9/15/97 9:28am
Subject: Transport of Plutonium

I am expressing concerns of many Canadians about the possible future use of U.S. stocks of Plutonium as fuel for the nuclear power plants of
Ontario. We are firmly against any such sale.

1 We are also seriously concerned about the environmental impact and the security measures that would be necessary in the case of any transport of nuclear fuel along public routes leading to the Canadian border.

I personally doubt any possibility of a 100% security warranty covering the various phases of the above project.

Sincerely,

John F Davis, M.A.
498 Beaumont Ave East.
St-Bruno, Quebec, Canada

cc: LAAO.smip(smip@uwo.ca)

Document 21

From: Peter Shepherd <sip@web.net>
To: LAAO.area("drtebel@doe.lanl.gov")
Date: 9/17/97 7:31am
Subject: Parallex Project

To the U.S. Department of Energy:

1 I am writing concerning the "Parallex Project". The project initially involves the fabrication and transport of MOX fuel from Los Alamos to Chalk River for a "test burn". There are numerous aspects of the project which raise issues of public safety and environmental protection. It is crucial that this project be subjected to a full scale environmental assessment process. Further, I would urge the Department of Energy to request that the Canadian government conduct a parallel assessment of the project for the following reasons.

In the preliminary Environmental Assessment of the Parallex Project by the U.S. DoE are described credible scenarios involving traffic accidents and hijacking of shipments by force. Traffic accidents could result in the release of particles and have harmful effects on human health. Attempts at hijacking the shipments could also have potentially negative environmental impacts. Thus, as both of these would have major environmental consequences, the Parallex project clearly warrants a full-scale environmental impact assessment to address such scenarios.

2 There are serious questions generally about the "safety culture" of the CANDU system, or lack thereof. There is evidence of sub-standard practices, sloppy management and a huge backlog of safety-related maintenance problems. These issues of safety also need to be dealt with in the context of the choice of reactors as candidates for possible use of MOX fuel. The extremely poor financial state of the utility brought on by uncontrolled nuclear expansion is also a major concern that will continue to affect safety planning.

3 In addition, the twinning of CANDU and MOX technologies will almost inevitably lead to lateral weapons proliferation into unstable states, especially as the IAEA's failure to quickly discover Iraq's recent attempt shows, and "latent proliferation" of nuclear plants as military targets as well.

4 It should be clear that these are crucial matters of public policy. Environmental assessment of activities conducted in Canada are, of course, the "responsibility of the Canadian government". As there has been no public process of any kind to involve the Canadian parliament or the Canadian population in approving, disapproving, or otherwise commenting on this project, I urge the DOE to request the Canadian government to conduct an environmental assessment in parallel with your own.

Yours sincerely,

Peter Shepherd
Member of the Energy Working Group,
Science for Peace
11 King's College Circle,
University of Toronto,
Ontario, Canada,
M5S 3H7

cc to the Hon. Jean Chretien, Prime Minister of Canada
Hon. Tony Ianno, M.P. Trinity-Spadina

Document 22

From: Irene Kock <nucaware@web.net>
To: LAAO.LAAO-WPO(dtriebel)
Date: 9/17/97 8:15am
Subject: parallex project E.A. comments

Nuclear Awareness Project
P.O. Box 104, 34 Church St.
Uxbridge, Ontario L9P 1M6 Canada
905-852-0571 (phone/fax) nucaware@web.net (e-mail)

September 17, 1997

Mr. Dean Triebel
U.S. Department of Energy
Los Alamos National Laboratory
528 35th Street
Los Alamos, New Mexico
87544 USA
BY E-MAIL ONLY --> dtriebel@doe.lanl.gov
RE: Parallex Project Environmental Assessment (DOE/EA-1216)

Dear Mr. Triebel,
Thank you for sending me a copy of the Predecisional Draft Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment. I would like to provide you with the following comments on behalf of Nuclear Awareness Project, a citizens environment organization based in Ontario, Canada. I have reviewed the Environmental Assessment document on the Parallex Project and understand that you are willing to consider comments on the proposal from Canadians.

1 The Executive Summary (page xiii) notes: "A successful MOX fuel test could lead to the disposition of surplus weapons-grade plutonium from the U.S. and Russia by irradiation in CANDU reactors in Canada." Your Environmental Assessment predicts that one outcome of the Parallex Project may be the large-scale use of plutonium/MOX fuel in Canada. You should be aware that, if it goes ahead at all, it could very likely happen without any public review by Canadian citizens. Nuclear Awareness Project, and many other organizations and citizens, have requested that a full environmental assessment, including public hearings, be carried out on the proposal for large-scale use of plutonium/MOX fuel in CANDU reactors; but the government has refused to guarantee such a public process.
We request that the U.S. Department of Energy cancel the Parallex Project because of the Canadian government's refusal to conduct a full environmental assessment, with public hearings before an independent panel under the Canadian Environmental Assessment Act, on the plutonium/MOX fuel proposal (including the testing of fuel at Chalk River Nuclear Labs under the Parallex Project). In our view, there is no point in even testing the plutonium/MOX fuel prior to the completion of an environmental assessment in Canada on the large-scale import of MOX fuel.
Two other factors also point to the need to cancel the Parallex Project:

2 1) How will Ontario Hydro be able to fulfil its commitment to use plutonium/MOX fuel at the Bruce Nuclear Power Development given that it has just announced the indefinite shutdown of the remaining reactors at the Bruce "A" Nuclear Station, and given that the Bruce "B" reactors may not have more than another 15 year of use left in them, due to requirements for expensive pressure tube replacement? This does not factor in the impending changes to the electricity market in Ontario, which could see the entire nuclear division of Ontario Hydro phased out much sooner, due to its inability to compete with other electricity sources.

3 2) Why is the Parallex Project proceeding, given that Russia seems determined to use plutonium/MOX fuel in its own reactors, and is currently developing that capability? (See the July 1997 issue of Nuclear Engineering International for details.) The Record of Decision by the U.S. Energy Secretary on the matter of plutonium disposition made it clear that the CANDU-MOX option would only proceed if a three-way U.S./Russian/Canadian agreement could be achieved. Why is the test proceeding in the absence of any such agreement with Russia? Doesn't this situation make a U.S. plutonium/MOX test unnecessary, given that the CANDU option won't be used by the U.S. in the absence of agreement for Russia to use CANDUs too?
In summary, Nuclear Awareness Project urges the U.S. Department of Energy to select the "no action" alternative

with respect to the Parallex Project for three main reasons: the Canadian government refuses to guarantee a full environmental assessment on the plutonium/MOX fuel option for CANDU; Ontario Hydro's nuclear reactors may not be available due to technical and market factors; and, lack of the required agreement with Russia.

Please keep me informed of all Department of Energy activities related to the Parallex Project and plutonium/MOX fuel "disposition". Thank you for considering our comments on this important matter.

Sincerely,

Irene Koch

Document 23

Fax— (303) 965- 4872

Dear Tribal,
Environmental Assessment of Mox fuel to Canada,
U.S. Dept. of Energy (DOE),
Los Alamos,
New Mexico, USA.

Dear Sir:

I understand you are doing an Environmental Assessment re shipping mixed oxide fuel to Chalk River, Ontario.

1 Unfortunately, we do not have procedures or regulations in Canada for the environmental assessment of the transport of such dangerous products. Our politicians have been making deals secretly without discussion in the public or debate in the Parliament.

2 Security could be a very great problem as shipments of this highly toxic fuel with travel through the densely populated areas of Ontario. A spill or accident could be terribly damaging to the environment as well.

3 Canadian public opinion is opposed to such shipments without careful environmental assessment.

4 If this MOX fuel is burnt in Chalk River or other Candu Reactors, the resulting chemical residue will contain 3.5 times more plutonium than spent Candu fuel—a danger to Canadian citizens! (See—National Academy of Science, Committee on International Security and Arms Control, Management and Disposition of Excess Weapons Plutonium-Reactor Related Options, National Academy Press, 1995, p.252, Table 8-1)

It would be helpful for the DOE to delay its decision regarding US shipments until the Canadian Government undertakes appropriate environmental assessment on our side of the border.

Yours truly,
W R Adamson
W. R. Adamson,
805 Acadia Dr.,
Saskatoon, Sask.
S7H 3W2
Sept. 15, 1997.

Document 24

C/o 1002 - 15 St. South
Lethbridge, Alberta
Canada T1K 1V3

September 15, 1997

Dean Triebel
U.S. Department of Energy
Los Alamos, New Mexico

Dear Mr. Triebel,

We, the undersigned Canadians living in Southern Alberta, are writing with regard to the Parallex Environmental Assessment on the fabrication and transport of nuclear weapons plutonium in the United States. We are strongly opposed to the plan to import plutonium to Canada later this year for a "test burn" at a nuclear reactor in Chalk River, Ontario.

1 Canadian citizens have had no opportunity to comment on this project except through the US environmental assessment process. This is unacceptable.

2 Also, the transportation of plutonium fuel poses a serious potential health and safety risk. Plutonium is one of the most carcinogenic substances known. If even a small amount were to be dispersed into the environment, there would be disastrous consequences. International Physicians for the Prevention of Nuclear War, (winner of the 1985 Nobel Peace Prize), estimates that just 27 micrograms of insoluble plutonium-239 in the lungs would be sufficient to cause cancer in an adult person. At this rate, 600 grams of plutonium is theoretically enough to kill about three quarters of the population in Canada. Yet Canadian communities along the three possible transportation routes from the US border to Chalk River have received no information from the Canadian government about the planned shipment of this plutonium and the hazards involved.

3 We are also concerned about the potential effect of security measures for the plutonium fuel transportation on Canadian civil liberties. Because the proposed plan requires shipping nuclear weapons-usable plutonium over enormous distances, it increases the likelihood that this material could fall into the hands of terrorists. Indeed, the US National Academy of Sciences has stated that shipments of plutonium fuel will require security measures equivalent to those needed for transport of nuclear weapons. Indeed, both the Harvard Law School and the United Kingdom Royal Commission on Environmental Pollution have stated that the security measures and civil liberties implications of using plutonium as an article of commerce are a serious concern.

4 Early this year, 171 international peace, environmental, and medical organizations condemned the U.S. decision to allow the use of plutonium fuel in commercial nuclear

.../2

4 reactors. There is grave concern that this plan will not turn swords into ploughshares, but will only create an international commerce in plutonium that would mean an ongoing supply of plutonium derived from military and civilian sources will find its way into countries around the world.

5 We are also concerned about the sub-standard safety practices and maintenance problems at Canadian CANDU reactors, which have necessitated the shut-down of seven reactors, including the Bruce A reactors that were designated by Atomic Energy of Canada to be the best candidates for using MOX fuel from dismantled nuclear weapons.

In Canada, a recent independent study that was funded by Atomic Energy of Canada Limited and Ontario Hydro recommends that the plutonium fuel initiative "be consigned to oblivion" (Franklin Griffiths, 'MOX Experience: The Disposition of Excess Russian and US Weapons Plutonium in Canada', 1997).

6 The Canadian Government's support for the MOX fuel proposal is not based on any democratic process and it poses hazards both for international security and for the health and safety of Canadians and Americans alike. We call upon the governments of the United States and Canada to stop the planned shipment of plutonium fuel to Canada for test burning, and to take the MOX fuel proposal off the table before Canada is locked into an irreversible decision.

Sincerely yours,

cc: Prime Minister Chretien

Anne E. Williams
1002 - 15 St. South
Lethbridge, AB T1K1V3

Kay MacLeod
Lethbridge AB

Alice Harper
Lethbridge AB

Deborah Berg
Lethbridge, AB

Ann Weinstein
Lethbridge

Fran Hiebreckt
Lethbridge AB

Diana M. Williams
Lethbridge, Alberta

Pat Williams
Lethbridge, AB

J. H. Woods
1039 16th St. S.
Lethbridge, AB
T1K 1X3

Sylvia Campbell
Lethbridge AB

Jasmina Bertoldi
Lethbridge, AB

Document 25

Harry G. Kalish
24 SUMMIT CIRCLE, WESTMOUNT, QC, H3Y 1B3

Phone: (514) 939-3336
Fax: (514) 939-3331

September 15, 1997

U.S. Department of Energy
MR. BEAN TRIEBEL

Fax: 505/665-4872
Tel.: 505/665-6353

Dear Mr. Triebel,

RE: PLUTONIUM

1. I understand that plutonium presents
   A THREAT TO HUMAN LIFE:
   a) A few milligrams (about the size of a grain of salt) inhaled, burns and destroys lung tissue and causes death in months.
   b) A few thousands of a milligram (an invisible spec) inhaled, causes lung cancer.
2. Less than 10 pounds of plutonium can easily be made into an atomic bomb.
3. Made into atomic fuel rods and burnt in a nuclear power station, it forms a variety of highly radioactive substances, many with a half life of thousands of years.

DANGERS

1. Accident in transport, spilling plutonium on the ground and in the air.
2. Hijacking of plutonium shipment by nations or terrorists who seek world domination, or "simply" by extortionists.
3. Accidents in nuclear power stations — Chernobyl?!
4. Disposal of dangerous radioactive product after the fuel bundles of power stations are exhausted.

AM I CORRECT?

For the sake of North Americans, for the good of all humanity world-wide, is there anything **YOU CAN DO?**

Sincerely,

Harry G. Kalish

HGK/cg

cc: Elizabeth May, Executive Director/Sierra Club of Canada
Prime Minister Jean Chrétien, House of Commons
Dr. Gordon Edwards

Document 26

FAX : This is page one (1) of three (3) pages:

From: Walter L. Robbins 613-634-3824
796 Hillside Drive
Kingston, Ontario K7M 5Y8
Canada
September 1[illegible], 1997

To: Mr. Dan Trichel
U.S. Department of Energy
Los Alamos National Laboratory
528 35th St.
Los Alamos, New Mexico
U.S.A. 87544

re: Predecisional Draft, EIS for the Parallex Project Fuel Manufacture and Shipment (DOE/EA-1216)

Mr. Dan Trichel
U.S. Department of Energy
Los Alamos National Laboratory
528 35th St.
Los Alamos, New Mexico, 87544
U.S.A.

Dear Mr. Trichel:

Following are my comments on the August 18, 1997 predecisional draft of the Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment, (DOE/EA-1216). These comments are being offered under the understanding that you are willing to entertain submissions from reviewers in Canada.

1 I appreciate the importance of the efforts of the United States Government to attempt to deal effectively with the surplus weapons plutonium now residing in various DOE facilities. However, speaking as an American as well as a Canadian citizen, I strongly object to the involvement of Canada in this effort. Canada has attempted (not always completely successfully) to maintain a neutral position as regards fissionable material for nuclear weapons. Canada's position on this policy issue has to be as consistent as possible, to be credible. A Canadian program that involves U.S. (or any other countries' nuclear weapons material) would violate that basic Canadian principle.

2 Frankly, Parallex is a non-starter, or to use the EIS jargon, the "no action" alternative must be invoked here. I am well aware of the fact that Atomic Energy of Canada, Ltd., (AECL) lobbied aggressively for this project (as early as 1994) at meetings held at the Canadian Embassy in Washington. But it does not follow from that (inappropriate) effort, that Parallex should proceed.

It is quite clear that the frame of reference of your EIS is restricted to the Parallex project alone and does not attempt to assess the consequences of the project's outcome to the future policies of the U.S. Government regarding the use of MOX fuel in CANDU reactors. In that regard, the analysis discourages extrapolation to outcomes and tends to force the reviewer into a narrow consideration of the Parallex processes. In essence, your EIS ignores the larger questions surrounding the potential transportation and use of significant quantities of surplus plutonium in Canada.

3 Rightly, your EIS stops at the Canadian border. Environmental impacts in Canada are the business of Canadian authorities. However, to my knowledge, no such environmental impact study has been initiated by the Government of Canada for this project. That is an issue that must be addressed in Canada.

4 The EIS maintains that "DOE must test and demonstrate the feasibility of burning MOX fuel in CANDU reactors as part of its ongoing mission to evaluate the disposition of surplus weapons-grade fissile materials. The ability to successfully reengineer and operate heavy-water- moderated CANDU reactors with MOX fuel cycles has never been demonstrated on any industrial scale."

Would the use of a refurbished reactor at AECL's Chalk River facility really be suitable for such a demonstration on an industrial scale? Would not the only conclusive evidence be obtained from a full-scale operating, CANDU reactor? Obviously, in the light of my comments above, I am not suggesting such a course of action. I am simply questioning the EIS assumptions that the Chalk River experiments would fulfill the stated objectives of the project.

5 Furthermore, I assume that Parallex project management is aware of the recent developments regarding CANDU reactors in Ontario. Would the U.S. Government really proceed with an experiment of this nature, given the knowledge of the serious management problems at Ontario Hydro and the upcoming

Document 27

Dan Tichler
U.S. Department of Energy

To the U.S. Department of Energy:

1 It has recently come to my attention that the "Parallex Project" is a precursor to exporting plutonium for use in CANDU nuclear reactors. At this time no environmental assessment process has been started in Canada dealing with this problem. To approve the project, without due consideration by the Canadian government and particularly, the Canadian public who are the ones to suffer if a nuclear fuel accident or other nuclear related event were to occur, stands as an affront to the so called "best neighbours" policy. I am opposed to the importation of plutonium to Canada for use in Canadian reactors or for disposal. I urge you to formally approach the Canadian government to start an environmental assessment in parallel with your own. I suspect that Canadians in large numbers will be opposed. If given a chance to consider this issue.

Leonard Prupas

Leonard Prupas
Vanier College
821 St. Croix Blvd.
St. Laurent, Quebec
Canada

5 removal of seven CANDU reactors from service? CANDU reactors have also been experiencing some significant technical problems.

6 Given the understanding that the EIS provisions only apply to the U.S., I must make another assumption re Canada, regarding health and safety. The EIS recognizes some degree of risk to the American public in Parallex, even though the risk is deemed minimal by DOE. That being the case, it is safe to assume that whatever risk is possible in the U.S., is also possible in Canada, especially in handling and transportation of the nuclear materials. In my opinion, Canadians should bear no risk (zero tolerance) at all from such a venture, and the only way that is possible, is through the use of your "no action" alternative.

7 As for the spent fuel aspects of Parallex, the EIS states that "All spent fuel resulting from the tests would be disposed of in Canada under the Canadian spent fuel program." Such statements must be removed from the EIS. Environmental and other major policy implications abound from such deceptively simple declarations! The Canadian spent fuel program (the underground burial option) has been the subject of a protracted and contentious federal environmental scrutiny.

8 It is more than a little ironic that DOE, Los Alamos, would be moving ahead with Parallex to deal with surplus weapons plutonium, at a time when substantial progress is being made at your facility (and in a number of other countries) on the technology for accelerator transmutation of nuclear waste (ATW). Your own scientists in the ADTT Project Office, Los Alamos, have pointed out, in many studies and papers, that transmutation systems would "burn" plutonium quite efficiently and in a very high degree of completeness. They make a point of saying that the weapons plutonium stockpile could be totally destroyed by these methods.

9 Finally, you may recall the strong negative reaction of Canadians during 1985-86, when your Department attempted to identify potential nuclear waste repository sites in northern states near the border. The Government of Canada was forced by the public to request that no such facilities be placed in watersheds draining into Canada. If Parallex proceeds, and it looks to plans for a major effort, I predict that considerable consternation and turmoil will result. For the sake of harmony between two great nations, I sincerely hope that your organization has the wisdom not to set such a scenario into motion now.

September 11, 1997

Submitted by: Walter L. Robbins

750 Hillside Drive, Kingston, Ontario, Canada, K7M-5Y. email: wrobbins@istar.ca

Walter Robbins has been involved with nuclear issues for many years as an activist and a writer. He served as a member of the professional staff of the U.S. Atomic Energy Commission headquarters, Germantown, Maryland, Division of Organization and Personnel, in the late 1940s. He is the author of GETTING THE STUFF: The Radioactive Waste Controversy in Manitoba (Queenston House, 1984).

Document 28

CITIZENS FOR RENEWABLE ENERGY

Ziggy Kleiman
Co-Ordinator
R.R. #4 Dorf's Road
Ontario K0H 1W0
Phone/Fax: (613) 795-7725
CANADA

Mr. Dan Tribel
U.S. Department of Energy
Los Alamos, New Mexico,87544 Sept. 17, 1997
U.S.A.

By Facsimile: 505-665-4872

Re: Predecisional Draft, EIS for the Parallex Project, Manufacture and shipment (DOE/EA-1216)

Dear Mr. Tribel,

We, the directors and members of Citizens for Renewable Energy (CFRE), an incorporated non-profit citizens' organization, are absolutely shocked to find that even though in your country public consultations are being held in regard to this undertaking, you will not insist on the same being done in Canada!

1 The danger of accidents, contamination and terrorist action is just as great here, if not greater,as in the U.S.A.!!

2 The proliferation of weapons grade reactor fuel is completely unacceptable in this central region!

3 Any attempt to burn this Plutonium enriched fuel in Canada's nuclear reactors is especially irresponsible in the light of an expert team finding that they are being operated at a minimally acceptable level (AIPA Report to Management, July,1997) !!

4 Accidents or 'incidents' would undoubt affect Americans citizens as well as Canadians due to the close vicinity of the reactors to the border!

5 We, together with many thousand adherents, express hereby our fervent opposition to the importation of plutonium and MOX fuel into Canada, and are calling on the governments of the United States and Canada to stop this undertaking !!!

On behalf of the over 600 members of CFRE
respectfully submitted

[signature] Co-Ordinator.

c.c. Rt. Hon. Jean Chretien
and Members of Parliament

TOTAL P.01

Document 29

To: Dean Tribel, US Department of Energy
From: Saskatchewan Indigenous Coalition and the Saskatchewan Local of a Nuclear Free and Independent Pacific
Date: September 18th, 1997

We would like to add our concerns along with other messages you are receiving from Canada about the proposed transport of plutonium (the Parallex Project) to Chalk River Ontario for testing in an experimental reactor.

We are deeply concerned that there has been no environmental study initiated in Canada, or public discussion of any kind on the advisability and impact of shipping such lethal cargo.

We feel that in the US and Canada a full scale comprehensive environmental study should be carried out before any shipments are contemplated.

We would therefore ask you to request the Canadian government to conduct an intensive full environmental impact alongside a similar study in the USA. And, that you develop this study in consultation with the public in USA and Canada. The border is merely a line on a map and a disaster will have dire consequences on both sides of the border.

Thank you for your consideration of this request.

J Barclay Don Kosick

Jacqui Barclay and Don Kosick for

Saskatchewan Indigenous Coalition, and Saskatchewan
Local of Nuclear Free and Independent Pacific.
c/o 614 B 10th Street, Saskatoon, Saskatchewan, Canada S7H 0G8
fax 306 653 4846.

Document 30

FROM [illegible] PHONE NO. [illegible] Sep. 17 1997 [illegible]

#30

1 The Regina Peace Council urges the Canadian Government to conduct an environmental assessment before the "Parallex Project" takes place.

[illegible] Jackson - Regina Peace Council executive,
77 Martin St.
Regina, Sk. [illegible]

Document 31

SEP [illegible] P.1

#31

Sent to U.S. Dept of Energy 505 665-4872 (2 pages)

Dean Triebel
Environmental Assessment
of MOX fuel to Canada
U.S. Dept. of Energy
Los Alamos, New Mexico, USA.

Dear Sir:

1 I am of the understanding that your Department is preparing an environmental assessment of the possibility of shipping mixed oxide fuel to Ontario, Canada to be tested in an experimental reactor. As you are, no doubt, aware seven Candu reactors have been slated for shutdown due to poor management practices and safety related maintenance problems manifested in what has been termed poor "safety culture". Bruce A reactors, which Atomic Energy of Canada Limited selected to be best candidates for possible MOX fuel, are among those seven.

2 I have been deeply concerned about the lack of wisdom in the MOX fuel plan and even more so in the last few weeks when the industry itself has admitted a lack of adequate safety. Hopefully an environmental assessment will bring to light more reasons to halt such a plan. It is not enough, however, for the U.S. Dept of Energy to carry out an environmental assessment, Canada must do so as well. Canadians share the inherent risks involved in transportation, as well we will bear the risks of burning the fuel and be left with spent fuel

Document 32

to store.

3 I respectfully ask your Department to request the Canadian government to conduct a parallel environmental assessment. As well I request your Department to delay its decision until the Canadian government undertakes and completes its own necessary environmental assessment.

Yours truly
Marvin Resnikoff
1618 Early Drive
Saskatoon Saskatchewan
Canada S7H-3K8.

September 20, 1997.

c.c. Prime Minister Jean Chretien

Fax Transmittal Cover Sheet

To: Dean Trafford, - US DOE - Ian Alanon
From: Gordon Edwards, President, Canadian Coalition for Nuclear Responsibility
Fax Number: (514) 489 3138
Date: Thu Sep 18, 1997 - 7:41 AM
Transmitting (12) pages, including cover sheet.
If there is difficulty with this transmission, please call: (514) 457 2663

Dean Triebd
US Department of Energy
Los Alamos National Laboratory
Los Alamos New Mexico

RE: Environmental Assessment of the "Parallex Project"
Proposed Action: Fabrication and Transport of MOX

Dear Mr. Triebel:

On behalf of the Canadian Coalition for Nuclear Responsibility, a federally-incorporated organization with a charitable tax-free status, I am writing concerning the "Parallex Project", which involves the fabrication of weapons-grade plutonium into reactor fuel ("MOX") at Los Alamos, and transport of said fuel to Chalk River, Ontario, for testing in an experimental reactor. I understand that the "test burn" is a precursor for the possible eventual large-scale importation of plutonium MOX fuel for use in CANDU nuclear reactors over a period of two or three decades.

1 In particular, I refer to the preliminary Environmental Assessment prepared by the US Department of Energy on the Parallex Project. As one of the credible scenarios described therein involves a traffic accident resulting in the release of plutonium oxide particles to the atmosphere and subsequent inhalation of such particles by members of the public, it is clear that a full-scale environmental assessment process must be initiated so that the details of this analysis can be critically scrutinized and alternative scenarios studied.

2 It is noteworthy that the preliminary EA does not specifically discuss security measures or armed guards for the transport of plutonium fuel, other than to describe a tamper-proof on-board satellite tracking system for the trucks. However, it is apparent that any attempt to hijack the shipments by force of arms could have environmental consequences, and is just as credible as the other accident scenarios discussed in the EA. Such scenarios must be included in a comprehensive environmental assessment process.

3 In Canada, seven CANDU reactors are slated for shutdown due to a poor "safety culture", manifested in sub-standard practices, sloppy management and a huge backlog of safety-related maintenance problems at Ontario Hydro. The reactors to be shut down include the Bruce A reactors which were selected by AECL and Ontario Hydro as the best candidates for eventual use of MOX fuel. This calls into question the judgement of AECL officials and the wisdom of consigning MOX fuel to AECL without any independent oversight. Indeed, we believe that the same "safety culture" problems that have been identified at Ontario Hydro may well apply to AECL also.

As stated in the EA, "environmental assessment of activities conducted in Canada would be the responsibility of the Canadian government". However, there has been no environmental assessment process initiated in Canada. In fact, there has been no public process of any kind to involve the Canadian parliament or the Canadian population in approving, disapproving, or otherwise commenting on this project. For US authorities to approve the project under such circumstances would inevitably lead to strong public opposition within Canada. We urge the DOE to request the Canadian government to conduct an environmental assessment in parallel with your own.

I have read the Predecisional Draft of the Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment, prepared by the Los Alamos Area Office of the US Department of Energy on August 18, 1997, "to provide sufficient information so that DOE may determine whether a Finding of No Significant Impact is warranted for the Proposed Action or whether an Environmental Impact Statement (EIS) must be prepared."

I believe that the draft document contains so many questionable assumptions that it cannot be used to support a finding of "no significant impact". A sample of these questionable assumptions is given below.

From the Executive Summary:

"All spent fuel resulting from the tests would be disposed of in Canada under the Canadian spent fuel program."

There is at present no accepted spent fuel disposal program in Canada. The report of a Federal Environmental Assessment Panel on AECL's CONCEPT of geological disposal is still not completed, and there has been no political decision made as to whether or not the concept will be considered acceptable. Thus there is no spent fuel disposal program in Canada at present.

4 During the hearings on the AECL disposal concept, the overwhelming majority of intervenors expressed their strong objections to Canada accepting nuclear waste from other countries, even if the geologic disposal concept were to be conditionally approved. While the MOX fuel may not be regarded as nuclear waste by DOE or AECL, the fact that Canada would be responsible for guarding the resulting spent fuel in perpetuity would be regarded by many Canadians as setting a very undesirable precedent. Thus, the assumption stated in the draft DOE document reveals a significant misunderstanding of the present situation in Canada regarding spent fuel and its "disposal".

In the EIS to be prepared, the option that the spent MOX fuel will be returned to the USA should be considered, with the transport, environmental and waste management implications discussed accordingly.

From the Executive Summary:

"A successful MOX fuel test could lead to the disposition of surplus weapons-grade plutonium from the U.S. and Russia by irradiation in CANDU reactors in Canada."

4 Although this idea has been proposed by Ontario Hydro and AECL – both organizations that see distinct advantages to be gained from any scheme that tends to extend the operating lifetime of nuclear reactors in Canada – there has been no parliamentary debate on this topic, no public consultation of any kind, and no mandate for the Prime Minister to make any such offer as has here been described in the draft document. The more steps that are taken (such as the Proposed Action) based on the assumption that Canadian approval will be forthcoming, without any actual public process or public consultation taking place in this country, the more indignant Canadians will become with the entire concept. It is not advisable for DOE to proceed on the assumption that Canadians will accept this industry-driven proposal.

In fact, quite recently, Professor Franklyn Griffiths of the University of Toronto (Peace and Disarmament Studies) published a report on the proposal to "burn" weapons-derived MOX in CANDU reactors based on a two-day workshop involving representatives of the Canadian government, the Ontario government, Ontario Hydro, AECL, critics of the nuclear industry, and other interested parties (held back in October 1996). After listening carefully to all sides in the debate, Professor Griffiths concluded that "the proposal should be consigned to oblivion". We believe that that may well be the consensus view among Canadians once the public is given a chance to consider the MOX proposal and to comment on it.

It is disquieting to Canadians to see unwarranted and prejudicial assumptions about Canada's eventual role in this scheme expressed in DOE documents. The EIS to be prepared should avoid making such assumptions.

1.2 Background

5 The fundamental purpose of the program is to maintain a high standard of security and accounting for these fissile materials while in storage, and to ensure the plutonium produced for nuclear weapons and declared excess to national security needs (now or in the future) is never again used for nuclear weapons.

"Burning" weapons-derived MOX in CANDU reactor can not "ensure" that the plutonium contained therein is "never again used for nuclear weapons". Plutonium-239 has a 24,000 year half-life, and only a fraction of the plutonium-239 in the MOX fuel can be fissioned in CANDU reactors before the remainder is ejected in the spent MOX fuel. Indeed, the net reduction in plutonium content (given the additional plutonium created through neutron activation) is only a little more than one-half.

6 Thus the spent MOX fuel remains a physical repository for weapons-usable plutonium for tens of thousands of years after the so-called "burning" of the MOX. At any time in the future, any regime can take the plutonium out of the spent MOX fuel and use it to make nuclear weapons. For the first few decades, the intense radiation fields caused by the fission products will make plutonium extraction difficult, but by no means impossible. However, as time goes by, the spent MOX will become less and less intensely radioactive, and more and more approachable without the need for space-age shielding. As the centuries tick by, the plutonium will become more and more accessible and usable in nuclear weapons.

I am sure that the scientists at DOE are aware of these facts. However, it is distressing to see incorrect statements, such as the one quoted above, in a draft environmental assessment document produced by those same scientists. It does not inspire confidence or lend credibility to the rest of the document. It would be helpful if the EIS to be prepared would give a more accurate description of the realistically achievable goals of the Proposed Action.

1.3 Purpose and Need for Agency Action

DOE must test and demonstrate the feasibility of burning MOX fuel in CANDU reactors as part of its ongoing mission to evaluate the disposition of surplus weapons-grade fissile materials.

It is clearly stated in the draft document that AECL will be responsible for all actions that take place once the MOX crosses the border into Canada. Thus DOE will be relying on the evaluation conducted by AECL as to the specific test results and the overall feasibility of the MOX-burning proposal. Yet the draft document seems to imply otherwise: that DOE will "test and demonstrate the feasibility" of this concept. The situation needs to be clarified: what exactly is the assumption here?

7 As it is stated in Section 2.1, Description of the Proposed Action, "The AECL would be responsible for conducting all subsequent tests of the fuel's performance and the function of the reactor during the process. Fueling the NRU reactor with MOX fuel would be part of a feasibility test to determine MOX fuel performance in a converted CANDU reactor setup."

Given AECL's track record of operating in secrecy, engaging in self-serving advocacy, and "bending the rules" to achieve what are considered to be desirable ends, we in Canada have no confidence in AECL's reliability to give unbiased advice on such matters. There will be a strong temptation for AECL to interpret the results of the test in as favourable a light as possible in order

to win approval for the project. In the absence of independent oversight and/or public process, such a temptation may be exceedingly difficult for AECL to resist. The new EIS should give a clearer account of how the best results and feasibility questions will be assessed, and by whom.

8

1.4 Scope of this EA

When details about a Proposed Action are incomplete a "bounding" analysis is often used to assess potential effects. When this approach is used, reasonable maximum assumptions are made regarding the input parameters needed for the modeling of the Proposed Action scenario. Such an analysis usually provides an overestimation of potential effects.

Many questions come to mind. First of all, in what sense are "details" about the Proposed Action incomplete? Should this not be elucidated?

9

Secondly, who decides what are "reasonable maximum assumptions", and is there not some inconsistency implied in the coupling of the words "reasonable" and "maximum"? Is there a definition, or criterion, or description, of how the concept of "reasonable" impinges on the concept of "maximum"? This should be spelled out precisely.

Finally, what measurement of probability is in use when one says that this kind of analysis "usually" provides an over-estimation of potential effects? Is this not more of a belief than a statement of fact? Do we have examples where this kind of analysis does not over-estimate the potential effects?

The new EIS should provide the necessary details.

2.1 Description of the Proposed Action

The environmental review presented herein is limited to the fabrication and transportation of MOX fuel from LANL to the Canadian border. Environmental consequence assessment for activities conducted in Canada would be the responsibility of the Canadian government.

10

Be that as it may, the Government of Canada has not initiated any environmental review process in Canada. Although this is not the responsibility of the US DOE, would it not be possible for DOE to at least request the Government of Canada to hold a parallel environmental assessment process -- since the "Parallex Project" is, after all, a parallel enterprise?

2.1.1 Manufacture of MOX Fuel and Rods

"The plutonium dioxide is put though a thermal treatment process to remove impurities, such as gallium."

11

The draft document is strangely quiet about this part of the MOX fabrication process. Are there no conceivable environmental consequences, no special contamination problems, no particular worker exposures, no conceivable accident scenarios, in connection with this thermal treatment process? Just how successful is this process in removing impurities, particularly gallium? Are the anticipated radiation exposures dependent in any way on the degree of "purity" desired in the finished product? The new EIS should have a section devoted to this process.

2.1.2 Shipping Package Description and Rod Packaging

For relatively low-level radioactive materials, DOT Specification Type A packages are used. These packages are designed to retain their contents under normal transportation conditions. For the Parallex Project, a Type A shipping package on a commercial truck would be used to transport the LANL MOX fuel to Canada.

12

The description of the shipping package seems to ignore completely the fact that plutonium is a strategic nuclear material. What about armed efforts to steal the MOX fuel or to hijack the shipment in some other way? Such scenarios should be discussed in the new EIS.

The Type A shipping package proposed for use was designed and manufactured by Canada. It is known as the Model 4H Enriched Fuel Bundle Shipping Package. This package meets DOT Type A specifications.

What evidence does DOE have that this shipping package was tested at full scale, in realistic high speed crash situations? Or are such tests going to be conducted by the DOE? All data related to the testing of the containers should be included in the new EIS.

3.3 Human Health

The four major sources of manmade radiation are medical radiation procedures, nuclear medicine, consumer products, and other miscellaneous sources (LANL 1995b) (Table 3-2).

13

It is disquieting to see no mention of nuclear fallout from bomb testing listed as one of the sources of manmade radiation, particularly in the context of the disposition of excess weapons-grade plutonium.

Penetrating exposure is used in this EA as the unit of comparison for human effects of routine and accident events for the Proposed Action.

14 Given the fact that plutonium is an alpha emitter, it is astounding and quite unacceptable that penetrating exposure should be used as the unit of comparison for human health effects in the case of accidents involving the release of plutonium into the environment. The new EIS should not adopt such a policy.

3.3.2 MOX Fuel Transportation

For shipments that require real-time tracking for security purposes, a TRANSCOM (transportation computerized satellite tracking system) linked truck is used that involves a tamper-proof satellite relay system located within the vehicle.

15 Again, this understandable preoccupation with security implies the need to include scenarios of armed efforts to hijack the shipments in the EIS.

3.6 Environmental Justice

Transportation accidents are random occurrences that could potentially affect the population around the accident site. However, the random nature of these accidents precludes any intentional disproportionate effect to minority or low-income populations.

16 Transportation accidents caused by armed intervention are not random occurrences, and may intentionally be focused on areas which are disproportionately populated by minority or low-income populations.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1.1 Human Health

The health risk to an exposed individual is best expressed as the added probability of that individual developing a fatal cancer.

17 Given the fact that civilians may inhale or ingest plutonium oxide as the result of an accident, one must look beyond fatal cancers to other detrimental health effects. For example, what about the effects on the foetus of a pregnant woman? What about genetic damage? What about non-fatal cancers?

5.0 ACCIDENT ANALYSIS

Abnormal events or accidents are hypothetical incidents that are not a planned part of routine operations. This EA evaluates three hypothetical accident scenarios (see Appendix C) that have a reasonable probability of occurrence and are provided as the bounding cases.

18 The range of accident scenarios is too limited. For one thing, it does not include the possibility of armed intervention in an effort to steal strategic nuclear material, and the potential environmental consequences of such an attack. It also does not include the possibility of an accident on a bridge leading to a drop of the truck or its contents (or in excess of the drops usually considered in designing transportation packages.

5.2 MOX Fuel Transportation Accidents

Two credible transportation accident scenarios were analysed for the shipment of MOX fuel to the Canadian border....

The first accident relates to an event that leads to the MOX fuel package container breaking open, igniting, and releasing plutonium dioxide particles into the air. As an upper bound, this accident scenario assumes the MOX fuel is transported in a one-shipment configuration. The public is assumed to be near enough to the accident to breathe air contaminated with plutonium dioxide.

19 Evidently, any accident scenarios leading to this kind of result will have to be scrutinized much more closely. How does the burning of the container result in a release of plutonium oxide into the air? What is it that limits the release of plutonium oxide into the air? If the accident involves a crushing of the container and its contents prior to the fire, how does this affect the outcome? All of this should be discussed in detail in the EIS.

The maximum potential accident consequence (50-year population dose) for the single-shipment configuration is 1.2×10^{2} person-rem committed effective dose (CED) for an urban link of a proposed route.

and again, in Appendix G:

Radiological consequences (50-year cumulative effective doses or CEDs) are calculated by RADTRAN 4.

Given that plutonium-239 has a 24,000 year halflife, why is the maximum potential consequence limited to a 50-year population dose? A more realistic analysis should be provided in the EIS.

APPENDIX C. RISK ASSESSMENT

3.1 RADTRAN 4 Computer Code for Transportation Risk Assessment

Radiological consequences (50-year cumulative effective doses or CEDs) are calculated by RADTRAN 4. The code uses test data or model predictions of the amount of material that might be released in a given severity of accident, expressed as a fraction of the total or *release fraction* (RADTRAN variable RFRAC). The release fraction is modified by properties of the material being shipped that determine how much of it might be released in aerosol and respirable aerosol form under various accident conditions, since aerosolization represents two [sic] dominant means by which any released radioactive material might be transported away from the immediate accident site.

20

Since the hypothesized accident is the only scenario foreseen in the draft document which could lead to a dose to the lungs of the population living along the transportation route, a much more detailed description of the way in which the source term is arrived at should be given. The discussion of the source term here (that is, the amount of plutonium oxide available to be inhaled) is far less detailed than in the case of the glovebox accident described in section 2 of appendix C. The new EIS should go into all the necessary detail on this important point. There should also be a thorough discussion of different factors that may affect the source term.

In reality, in a very severe accident involving a major fire, the thermal effects would be far more likely to loft any released material higher in the atmosphere, which results in considerable downwind dilution and, hence, lower individual doses.

By spreading the source over a much wider area, however, and taking into account the non-uniformity of population distribution, it is quite possible that "lofting" could result in a higher population dose, even if the individual doses are lower – and hence a greater probability of cancer induction. This is particularly so in view of the very long half-life of plutonium-239. Clearly, this type of accident requires a much more detailed analysis in the new EIS.

Since exact locations cannot be predicted in the transportation analysis, the potentially exposed population is estimated for each route segment based on the same population density used for incident-free dose calculations, which is assumed to be uniformly distributed.

This approach – assuming the population is uniformly distributed – may suffice for some route segments, but would not be acceptable for major population centres. Specific scenarios involving more densely populated areas should be provided in the new EIS. Important non-human species should also be identified and the long-term environmental consequences studied in relation to these species. In addition, costs and risks of decontamination and/or cleanup following such an accident should be addressed.

The 6M shipping package design is used by the computer model to represent 55-gal. drum-like shipping containers with sealed tops. This design is similar and comparable to the AECL Model 4H shipping package (Figure 5), which is proposed for use in this project.

20

In the new EIS, there should be a point-by-point comparison of the crash tests and fire tests that have been conducted on full-scale models of the 6M and 4H containers to see what evidence there is that they meet the same standards.

Categories developed from continuous frequency curves representing increasing effect force and fire duration at a fixed reference temperature of 800 degrees C.

In collisions involving some types of flammable fluids, would it not be possible to achieve combustion temperatures higher than 800 degrees? How would these higher temperatures affect the source term and the consequences? These matters should be discussed in the new EIS.

END

Thank you for giving me the opportunity to comment on this draft document. I hope these comments are of use to you.

Yours very truly,

Gordon Edwards, PhD.,
President, Canadian Coalition for Nuclear Responsibility,
53 Dufferin Road, Hampstead QC, H3X 2X8, Canada.

Phone & Fax: (514) 489 5118 e-mail: ccnr@web.net

internet web site: www.ccnr.org

BIOGRAPHICAL NOTES:

GORDON EDWARDS

February 1997

Gordon Edwards was born in Canada, and currently lives in Montreal. He graduated from the University of Toronto in 1961 with a gold medal in Mathematics and Physics and a Woodrow Wilson Fellowship. While studying Mathematics, Physics and Chemistry at U of T, he worked for the Ontario Fire Marshall's Office as the Lightning Rod Inspector for the Province of Ontario. At the University of Chicago, he earned Masters degrees in Mathematics (1962) and English Literature (1964). After four years of lecturing at the University of Western Ontario, he obtained a Ph.D. in Mathematics from Queen's University (Kingston, 1972).

Dr Edwards' professional activities have been diverse. From 1970 to 1974, he was the editor of *Survival* magazine, an international ecology newsletter with subscribers in a dozen countries, most of them scientists. In 1972 he co-authored a book on Lie Algebras. In 1972-73 he worked on the Economics of Ocean Fisheries, and was published in the Journal of the Fisheries Research Board. In 1973-74 he coordinated a nation-wide study of the role of the Mathematical Sciences in business, industry, government, education and science, for the Science Council of Canada; the study resulted in seven published volumes. In 1979 he made five half-hour television shows on the evolution of mathematical thought. Since 1974 he has been a professor of Mathematics at Vanier College in Montreal, where he has served as coordinator of the Integrated Science Program and a member of the Board of Directors' Executive Committee.

In 1975 he co-founded the Canadian Coalition for Nuclear Responsibility, and has been its president since 1978. The CCNR is a federally incorporated charitable organization with an educational mandate. In 1977, Dr. Edwards was engaged to give expert testimony and to cross-examine expert witnesses during the Cluff Lake Board of Inquiry into Uranium Mining in Saskatchewan. In 1977-78, Dr. Edwards performed a similar role over a period of several months for the Ontario Royal Commission on Electric Power Planning. Dr. Edwards has worked as a consultant on nuclear issues (such as reactor safety, health effects of radiation, uranium mining and radioactive waste management) for the Select Committee on Ontario Hydro Affairs, the Auditor General of Canada, the Science Council of Canada, and many other governmental bodies (in eight provinces and territories) as well as for such entities as the United Steelworkers of America, Global Television, the Canadian Broadcasting Corporation, and the National Film Board.

Dr. Edwards has written numerous articles and book-length publications on radiation standards, radioactive wastes, uranium mining, nuclear proliferation, the economics of nuclear power, non-nuclear energy strategies, and the history of Canada's nuclear industry. He created and continues to maintain the CCNR website at http://ccnr.org. He is married, with three sons and a grand-daughter.

Document 33

To: Dean Triebel
U.S Dept of Energy
Los Alamos
New Mexico

From: A. Style
533 Palmerston Blvd
Toronto Ontario
M6G 2S4

Dear Mr Triebel

Living as I do, in Ontario I am very concerned about the proposed importation of plutonium from your country to Chalk River.

1 Please at least insist that an environmental and safety assessment be carried out

Our nuclear industry has had an appalling safety and
2 pollution record. and we, the public, don't trust them

Sincerely.
Jeanne Style.

COPY TO JEAN CHRETIEN
Prime Minister
Ottawa
Canada.

Document 34

September 17, 1997

Dean Triebel
U.S. Department of Energy

Fax:505-665-4872
Tel: 505-665-6353
e-mail: dtriebel@doe.lanl.gov.

To the U.S. Department of Energy:

Dear Sir:

Re: Import of Plutonium to Canada

Although the following letter was taken from the Internet, it is a view with which the Raging Grannies in Victoria, BC totally agree.

We urge you to give it your fullest consideration.

We are writing concerning the "Parallex Project", which involves the fabrication of weapons-grade plutonium into reactor fuel ("MOX") at Los Alamos, and transport of said fuel to Chalk River, Ontario, for testing in an experimental reactor. We understand that the "test burn" is a precursor for the possible eventual large-scale importation of plutonium MOX fuel for use in CANDU nuclear reactors over a period of two or three decades.

1 In particular, We refer to the preliminary Environmental Assessment prepared by the US Department of Energy on the Parallex Project. As one of the credible scenarios described therein involves a traffic accident resulting in the release of plutonium oxide particles to the atmosphere and subsequent inhalation of such particles by members of the public, it is clear that a full-scale environmental assessment process must be initiated so that the details of this analysis can be critically scrutinized and alternative scenarios studied.

2 It is noteworthy that the preliminary EA does not specifically discuss security measures or armed guards for the transport of plutonium fuel, other than to describe a tamper-proof on-board satellite tracking system for the trucks. However, it is apparent that any attempt to hijack the shipments by force of arms could have environmental consequences, and is just as credible as the other accident scenarios discussed in the EA. Such scenarios must be included in a comprehensive environmental assessment process.

3 In Canada, seven CANDU reactors are slated for shutdown due to a poor "safety culture", manifested in sub-standard practices, sloppy management and a huge backlog of safety-related maintenance problems. The reactors to be shut down include the Bruce A reactors which were selected by AECL as the best candidates for eventual use of MOX fuel. This calls into question the judgment of AECL officials and the wisdom of consigning MOX fuel to AECL without any independent oversight. Indeed, We believe that the same "safety culture" problems may well apply to AECL in addition to Ontario Hydro.

4 As stated in the EA, "environmental assessment of activities conducted in Canada would be the responsibility of the Canadian government". However, there has been no environmental assessment process initiated in Canada. In fact, there has been no public process of any kind to involve the Canadian parliament or the Canadian population in approving, disapproving, or otherwise commenting on this project. For US authorities to approve the project under such circumstances would inevitably lead to strong public opposition within Canada. We urge the DOE to request the Canadian government to conduct an environmental assessment parallel with your own.

Yours truly,
Raging Grannies, Victoria, B.C.
C/o 835 Wollaston St., Victoria BC V9A 5A9

cc. Rt. Hon. Jean Chretien, Prime Minister of Canada, Keith Martin MP, David Anderson MP, House of Commons, Ottawa Ontario, K1A 0A6.

Prime Minister Jean Chretien at: Fax: 613-941-6900 Telephone: 613-992-4211

Document 35

Vanier College

FAX: 505-665-4892

September 11, 1997

Dean Triebel
U.S. Department of Energy

Dear Mr. Triebel,

As a parent and a teacher I am writing this letter to tell you not to send the shipment of plutonium fuel to Canada. We do not need this potentially dangerous substance in our country! 1

Until a complete environmental study has been done, we do not want to involve ourselves with your endeavours.

Sincerely,
Carolyn Ballah

Document 36

CAW TCA CANADA

LOCAL 199

September 16, 1997

Mr. Dean Triebel
U.S. Department of Energy
Washington, D.C.

Dear Mr. Triebel,

The Peace & Disarmament Committee of Local 199, C.A.W. is extremely concerned with developments surrounding the "Parallex Project". Our committee views with alarm the potential danger to Canadian Citizens with the transportation of deadly weapons grade plutonium to Chalk River, Ontario. 1

We in Canada have been plagued with poor safety standards, improper management and a host of other problems at our nuclear facilities. Our prime concern is the lack of information to the Canadian Public of which this is just another example.

We are shocked that this plutonium is to be transported over sovereign Canadian territory with no parliamentary approval, no environmental assessment or indeed any public process of any kind. 2

Our committee protest this outrageous action most vigorously.

Sincerely,

Ron Boyer
Chairperson

Mohammad Nasir
Vice/Chairperson

Vince Baldo
Secretary

Peace & Disarmament Committee
Local 199, C.A.W.

Document 37

FAX TRANSMISSION
2 pages including this one

TO: **Mr. Dean Triebel**
US Department of Energy
Los Alamos National Laboratory
Los Alamos New Mexico

FAX: **(505) 665-4872**

FROM: **Elizabeth Wilton**
The Nature of Things
CBC, Toronto

DATE: **September 30, 1997**

MESSAGE

Please see attached. Thank you

CBC Radio-Canada

Mr. Dean Triebel
US Department of Energy
Los Alamos National Laboratory
Los Alamos New Mexico

September 30, 1997

Dear Mr. Triebel:

I am interested in obtaining a copy of the Draft Environmental Assessment of the Parallex Project prepared by the Department of Energy in August of this year. I would like to get a copy of this document as soon as possible as I am putting together a one hour television documentary about the nuclear industry in Canada that will include an examination of the mox fuel proposal. The documentary is produced by the Canadian Broadcasting Corporation.

I would appreciate it very much if someone in your office could contact me this week, by telephone so that I can give them our FEDEX number and the courier address.

Thank you very much for your attention to this matter.

Sincerely,

Elizabeth Wilton

Fed Ex:
Nature of Things
CBC 250 Front St.
Room 6E511
Toronto, Ontario Canada
M5V 3G5
(416) 205-3700

The Nature of Things, PM 6E521, CBC, Station A, Box 500, Toronto, Ontario, Canada M5W 1E6
Tel: (416) 205-6904 Fax: (416) 205-3579

Document 38

From: Mike Nickerson, Inviting Debate <sustain@web.net>
To: LAAO,LAAO WPO(deleted)
Date: 9/19/97 6:47am
Subject: Plutonium

To Whom it May Concern:

When I was young, I was told not to play with fire. There was good reason, while much of the activity might be harmless, it opens the possibility for accidents.

Plutonium is extremely dangerous. I don't think there is any controversy about that statement. Correct me if I'm wrong.

The more it is handled and moved around, the greater the potential for serious accidents. Accidents do happen.

How would the department of Energy be responsible in case of accident?
Are you responsible?

Please take the most cautious action possible.
Yours, Mike N.

Document 39

From: Michael Murphy <murphym@duke.usask.ca>
To: LAAO,LAAO WPO(deleted)
Date: 9/17/97 6:32am
Subject: Plutonium Shipments

Dear Ms. Traicoff:
We are terribly concerned about the possibility of MOX fuel travelling through our country and being burned in our inept Candu reactors. We urge you to vote such a plan until, at the very least, Canada has an environmental review.

Yours truly,
Linda Murphy

CC: LAAO,smtp("President@WhiteHouse.gov","Vice-Presiden...

Document 40

16 September 1997

To: Dean Triebel, US Department of Energy
Parallax Project: Environmental Assessment / Fax (505) 665-6353
From: Robert Del Tredici / Fax (514) 485-8822

I write to request a FULL environmental assessment of the Parallax Project's plutonium shipments to Canada for a "test burn-up" at the Chalk River Laboratory in Ontario. My understanding is that the US DOE has done an Environmental Assessment for the MOX fuel on its journey from Los Alamos to Canada, but the assessment, unlike the fuel, stops at the Canadian border. It is logical for the US DoE to look after matters within US boundaries and to expect Canadian officials to do the same. However, the Canadian government has not begun any environmental assessment process regarding safety and security issues around the Parallax Project, nor has there been any public debate on the project, which means that the controversial fuel will be entering uncharted territory when it crosses into Canada. While the failure of the Canadian government to assess the impact of this project on its own people is not strictly speaking the concern of the DoE, I feel that DoE needs to pick up the slack here. If it does nothing, it will appear that US-generated Parallax plutonium is being rammed down the throats of the Canadian public. I say it will appear this way because I'm confident this is not the intent of the DoE but is rather the result of the Canadian government's dropping the ball in this matter. But given the Canadian government's failure to focus on the environmental, social, and political aspects of the project, it falls to the DoE as the plutonium-supplier, to insure that these shipments are secure and the communities through which the shipments pass do not get up in arms over the passage of these sensitive and hazardous materials.

It thus behooves the US DoE to put some kind of pressure on the Canadian government to conduct its own proper environmental assessment along the same lines as the US assessment. For US officials to turn a blind eye to the situation, approving of the entire project as if it had gone through a review process in Canada when no such process has been initiated -- will look bad to the Canadian public and to thinking people everywhere.

Sincerely,

Robert Del Tredici

cc: Prime Minister Jean Chrétien / Fax: (613) 992-4211

Document 43

"RE this - Hi Eliz - I swear there is not one person up there with half a brain in their head. Is your goal to poison all life on this planet? Each year you introduce more radionuclides to our world and then raise the "background" and claim it is all just natural.

Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

Ms. Bonnie Bonneau
P. O. Box 314
El Prado, New Mexico 87529-0351

Dear Ms. Bonneau:

The U.S. Department of Energy (DOE) is proposing to manufacture and transport mixed oxide fuel pellets from the Los Alamos National Laboratory (LANL), New Mexico, to Chalk River Laboratories (CRL), Ontario, Canada. In accordance with DOE National Environmental Policy Act (NEPA) policy, I am notifying you that an Environmental Assessment (EA) will be prepared for this project. Furthermore, you will be given the opportunity to review and comment on a pre-decisional EA prior to DOE making a final determination on this project. A brief discussion of the project is provided below.

1 Under the proposed action, DOE would manufacture mixed oxide fuel pellets that contain uranium and a total of 1.3 pounds (0.6 kg) of plutonium and transport these pellets from LANL to CRL by commercial carrier. If additional testing is required, DOE would manufacture additional pellets containing a total of 8.5 pounds (0.2 kg) of plutonium and transport them from LANL to CRL. This action is part of a proposed joint United States, Canada, and Russia experimental project to simultaneously irradiate a small number of United States and Russian mixed oxide fuel pellets made with weapons grade plutonium oxide under conditions representative of those expected in a commercial Canadian deuterium uranium reactor. A test and demonstration program for burning mixed oxide fuel in Canadian deuterium uranium reactors was discussed in the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement, December 1996. This initiative has been named Parallax (parallel experiment) because of the work being done with both the United States and Russian plutonium.

this is not natural nor sane! this is criminal

If you have any questions concerning this proposal, please contact me at (505) 667-[illegible].

Sincerely,

Elizabeth R. Withers
NEPA Compliance Officer
Office of Environment and Projects

LAAMEP:EDT-[illegible]

I guess the MAD agenda still proceeds as you make work to mutate more genes, cause more cancers and hope we all die before the criminal code catches up with corporate polluters like LANL. Clean - Stop NO MORE - Reform now! Bonnie

Table A-2. Responses to Comments

Comment Code [1]	Response
01-1	Technical Area (TA)-3 is first discussed in section 2.1.3 of the EA. The staging area for shipping the MOX fuel to Canada is in TA-3. The MOX fuel would be transported from TA-55 to TA-3 for shipment by commercial carrier to Canada.
01-2	The sentence in Section 3.3.2 was changed to read "Responsibility for each shipment would transfer from DOE to AECL at the border." The transfer of the responsibility for the shipment would be accomplished by negotiated agreements and in accordance with existing treaties. MOX fuel would remain in the same transportation containers and on the same truck. Transfer of responsibility would be largely a paper activity with no handling of the MOX fuel cargo.
01-3	High Efficiency Particulate Air (HEPA) filters on the individual gloveboxes are typically replaced at the end of a campaign, but some are replaced more frequently as needed. Building HEPA filters are replaced on a quarterly basis or a shorter period if needed. Pressure gauges on either side of the HEPA filters are used to detect performance degradation. Spent HEPA filters are generally managed as TRU waste and therefore undergo testing and certification as required by the TRU waste management program. Section 4.1.2 was revised to include this information.
01-4	DOE is aware of the responsibility to meet the requirements of 40 CFR 61, Subpart H and all requirements have been, and will continue to be, met.
01-5	The Parallex MOX fuel manufacture is located within TA-55, which is a permitted facility.
01-6	The description of the packaging for the MOX fuel has been changed. The MOX fuel will be transported in a Type-B package which is much stronger than a Type-A package. Type-B containers are tested to withstand a variety of severe accidents and have been used for years to ship radioactive materials in the U.S. and around the world. To date, no Type-B container has been punctured or released any of its contents, even in actual highway accidents. With this strong packaging system and DOE's safe record in transporting such materials, DOE believes that MOX fuel can be safely transported in Type-B containers to Canada. See Section 2.1.2.
01-7	Alternative methods of shipping the MOX fuel are discussed in sections 2.3.3, 2.3.4, and 2.3.5 of the EA, but none of the alternatives were considered reasonable. As discussed in the response to comment 01-6, DOE now proposes to use Type-B shipping containers which are more robust than Type-A containers. The discussion of the use of commercial trucks to carry the shipment (s) is contained in section 2.3.5.
03-1	We share your concern for making shipment of MOX fuel as safe as economically possible. As discussed in the response to comment 01-6, DOE now proposes to use Type-B shipping containers which are more robust than Type-A containers. Also, the EA states in section 2.1.4 that pursuant to DOT and Nuclear Regulatory Commission (NRC) requirements, the transportation route would principally use interstate highways, minimize bridge crossings, not pass through tunnels, bypass high population areas (where possible), minimize distance and time, minimize public effects, and generally be safe. The shipment(s) would be transported along interstate highways, whenever possible. Shipment over specific routes, i.e., using interstate bypasses around cities and using the most direct interstate highways, is required for shipments identified by the DOT as Highway Route Control Quantity (HRCQ). Although not required, as an added safety measure, all of the LANL MOX fuel shipments to Canada would follow routes meeting HRCQ requirements. In addition to using interstate highways and bypasses, routing regulations require that the quickest routes must be selected in order to reduce the time the radioactive material is in transit. Seven routes from LANL to the Canadian border were analyzed to present a bounding case for transportation effects. All seven routes meet the DOT transportation routing regulations and are acceptable for transporting the MOX fuel to the Canadian border from Los Alamos. DOE has determined that the Port Huron route would not be used due to construction on the Blue Water Bridge. In addition, it is unlikely that the Detroit route would be used due to hazardous material restrictions on the Ambassador Bridge.
04-1	Your preference for the No Action alternative is noted.
04-2	There are ongoing discussions with Russia and Canada as part of the Parallex Project. These are described in section 1.2 of the EA.
04-3	This EA discusses the affected environment at LANL and describes the operations that would be used by the Parallex Project. There is no attempt to describe existing conditions throughout the Laboratory that would not be affected by the proposed action. See the LANL Site-Wide EIS (DOE, 1998a) for more information about the environmental consequences of ongoing operations at LANL.

Comment Code [1]	Response
04-4	On November 4, 1996, the Department of Energy and the Los Alamos National Laboratory withdrew an application for a license to export mixed oxide fuel pellets in support of the Parallex Project. The withdrawal was not based upon any legal impediment but rather a desire to avoid unnecessary expenditure of resources in litigation of the issue. The Department also reserved the right to renew the application in the future. The Nuclear Control Institute, National Resource Council, Inc. and Greenpeace contented that the application should be deferred pending completion of a review of plutonium disposition options in accordance with the National Environmental Policy Act. The S&D PEIS was completed and a record of decision issued in January 1997. The PEIS ROD also explained that DOE would propose to test and demonstrate CANDU MOX fuel, consistent with cooperative efforts with Russia and Canada, and based on appropriate review under NEPA (42 USC 4371 et seq.). If a Finding of No Significant Impact is issued as a result of this environmental assessment, the Department will resubmit the application to the Nuclear Regulatory Commission for a license to export a small quantity of mixed oxide fuel pellets in support of the Parallex Project.
04-5	All radionuclides in the air with the possibility of being inhaled by workers or the public are considered potentially hazardous by DOE and systems are in place to minimize this possibility. Each radionuclide has a corresponding Derived Air Concentration (DAC) representing the relative hazard of the inhalation of the material in question. The DAC for PuO_2 is 2.5 times lower than the corresponding DAC for UO_2. Therefore, the accident analysis was performed on the most hazardous component (plutonium) in the MOX fuel matrix.
04-6	Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
04-7	The Canadian government will be involved in determining if MOX fuel can be safely and efficiently used in CANDU reactors. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
04-8	The three existing batches of MOX test fuel are composed of 3.1 percent plutonium fabricated with intermediate homogeneity. The 9.2 lbs (4.2 kg) of acceptable fuel from these three batches met the specifications for the Parallex Project as required by the *"Technical Specification: Mixed Oxide (MOX) Pellets for Demountable Fuel Elements, Parallex Project"* [Atomic Energy of Canada Limited (AECL), 100-37351-TS-001 Revision 0, March 1996]. The remainder of the test fuel that did not meet the required specifications were rejected because of cracks and chips on the final sintered pellets.
04-9	Weapons-grade plutonium may contain various trace amounts of many elements such as up to 100 ppm of chromium, manganese, tantalum and zinc; up to 200 ppm of carbon and tungsten; and up to 500 ppm of calcium and magnesium. Small amounts, in the ppm range, of aluminum, iron, beryllium, and silicon are also commonly found. Significant amounts of americium may also be found, depending upon the age of the plutonium. According to the *"Technical Specification: Mixed Oxide (MOX) Pellets for Demountable Fuel Elements, Parallex Project"* (Atomic Energy of Canada Limited, 100-37351-TS-001 Revision 0, March 1996), fuel containing elements in amounts exceeding specifications would be reported by LANL in a nonconformance report. Each nonconformance report is then evaluated by AECL for disqualification or acceptance.
04-10	As described in Section 2.3.5 the quantity and form of plutonium in MOX fuel does not warrant shipping via SST, although as described in Section 2.1.4. shipments would be tracked using the TRANSCOM satellite tracking system. Also, as discussed in the response to comment 01-6, DOE now proposes to use the more robust DOT Type-B shipping containers.
04-11	There will be a negligible increase in radiation exposure to the workers, but no health effects. The EA has been changed in section 4.2.1 to clarify this concern.
05-1	Although Ontario Hydro's Bruce reactors were identified as candidates for using MOX fuel, other CANDU reactors could be used if the Bruce reactors were not available.
05-2	The Parallex Project evaluated in this EA is proposed only to demonstrate the feasibility of using MOX fuel in CANDU reactors, not to implement the activity on a large scale. The Parallex Project must proceed in order to collect data on the performance of MOX fuel in CANDU reactors. Full implementation of using MOX fuel in CANDU reactors would require additional studies, NEPA review, and discussions between the U.S., Canada and the Russians. The ongoing discussions with Russia and Canada are described in section 1.2 of the EA.

Comment Code '	Response
05-3,4,5	The Parallex Project evaluated in this EA is proposed only to demonstrate the feasibility of using MOX fuel in CANDU reactors, not to implement the activity on a large scale. The nonproliferation issues expressed by this commentor would be examined in more detail before a decision is made to implement large scale use of MOX fuel in CANDU reactors.
06-1,2,3,4, 5,6,7	The scope in the EA deals only with the fabrication of the mixed oxide fuel at Los Alamos National Laboratory and the transportation of that fuel to the Canadian border. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
07-1	The EA includes an estimate of human health effects for activities occurring in the U.S. and is adequate NEPA documentation according to U.S. laws and regulations.
07-2	See response to comments 06-1,2,3,4,5,6,7
07-3	The EA uses generally accepted methods to estimate health effects from radiological exposure. Comments on current radiation protection standards are outside the scope of this EA.
07-4	See response to comments 06-1,2,3,4,5,6,7
08-1	Sections 2.1.4 and 3.3.2 of the EA discuss the security associated with the MOX fuel shipment. Security measures are included in the planning for radionuclide material shipments to deter illegal activity and lessen the risk of illegal activity. This does not imply that the risk of the illegal activity is considered to be great. DOE believes that the accident scenarios evaluated in this EA bound the consequences of the armed hijacker scenario.
08-2	See response to comment 05-1
08-3	The DOE has completed an environmental assessment under the laws and regulations of the U.S. government. This EA will help to determine if an EIS is required or if a Finding of No Significant Impact (FONSI) is warranted.
08-4,5	The DOE has completed this environmental assessment under the laws and regulations of the U.S. Government. This EA will help to determine if an EIS is required or if a Finding of No Significant Impact (FONSI) is warranted. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. DOE will make it's decision on the Parallex Project as-soon-as practical, realizing that no shipment of MOX fuel could be made until cleared by the Canadian Government. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
09-1	See response to comments 08-2
09-2	See response to comments 08-4,5
10-1,2,3,9	See response to comments 06-1,2,3,4,5,6,7
10-4	Accident scenarios are discussed and consequences are documented in section 5 and Appendix D of this EA. The transportation accident described in the EA is believed to be a scenario that would bound the consequences of all credible accidents. The Canadian portion of the Parallex Project will be performed in compliance with Canadian laws and regulations.
10-5	Because of the small amount of plutonium and the form of the plutonium the MOX fuel shipments would have little value for terrorists. The analysis in the EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). The EA analyzes an accident event which would bound all credible types of incidences.
10-6	See response to comment 04-10
10-7	See response to comment 05-3,4,5
10-8	Although Ontario Hydro's Bruce reactors were identified as candidates for using MOX fuel, other CANDU reactors could be used if the Bruce reactors were not available. The concerns you expressed about the safety of CANDU reactors are outside of the scope of the limited action proposed in the EA. The scope in the EA deals only with the fabrication of the mixed oxide fuel at Los Alamos National Laboratory and the transportation of that fuel to the Canadian border.

Comment Code [1]	Response
11-1	See response to comment 04-6.
11-2,3	The EA discusses an accident involving the MOX fuel shipment as an extremely unlikely event. The probability that the fuel package container would break open, ignite and release plutonium dioxide from the MOX fuel pellets in an accident is considered to be extremely unlikely. The amount of plutonium dioxide disbursed as a result of this extremely unlikely event is estimated to be minimal and well below the 27 micrograms quoted by the commentor as sufficient to cause cancer in an adult person.
11-4	The transportation accident scenario that could release plutonium is considered to be extremely unlikely. This scenario was included in the EA in order to bound the consequences of potential accidents. There is virtually no scenario under which pellets could be converted into a dust capable of being inhaled. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal. The EA does not attempt to downplay risk factors and international recommendations on maximum permissible exposures. The EA uses generally accepted methods to estimate health effects from normal operations and accidents.
11-5	See response to comment 05-1
11-6	Environment justice issues for actions occurring in the U.S. are described in Sections 3.6, (affected environment), and 4.1.4, and 4.2.4 (environmental consequences). Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
11-7,8,9	See response to comments 05-3,4,5
12-1	See response to comment 11-1
12-2	The Parallex Project evaluated in this EA is proposed only to demonstrate the feasibility of using MOX fuel in CANDU reactors, not to implement the activity on a large scale. The nonproliferation issues expressed by this commentor would be examined in more detail before a decision is made to implement large scale use of MOX fuel in CANDU reactors. DOE also believes vitrification is a reasonable method for the disposition of plutonium, and plans to pursue this method for plutonium disposal according to the Record of Decision for the Storage and Disposition of Weapons-Usable Materials Programmatic EIS. The Parallex project would demonstrate an option reserved in the S&D PEIS ROD for disposal of some of the U.S. weapons-usable plutonium, depending on further NEPA analysis and future multinational agreements.
13-1	See response to comment 11-1
13-2	See response to comment 04-6.
13-3	The DOE has completed this environmental assessment under the laws and regulations of the U.S. government. This EA will help to determine if an EIS is required or if a Finding of No Significant Impact (FONSI) is warranted. The EA adequately discusses human health, accidents, and security issues according to the 'sliding scale' approach as discussed in section 1.4 of the EA. The EA uses generally accepted methods to estimate health effects from radiological exposure. Comments on the current radiation protection standards are out side the scope of this EA.
14-1	A copy of the EA was sent as requested.
15-1	See response to comment 08-4,5
16-1,2,3	See response to comment 05-3,4,5
18-1,2,3,4	See response to comment 08-4,5
18-5,6	Weapons derived plutonium is different than reactor derived plutonium. This is why the Parallex Project is needed to collect data on how weapons derived MOX fuel would perform in CANDU reactors. The NRU reactor is the only reactor that can perform these tests.
19-1	See response to comment 10-8

Comment Code [1]	Response
19-2	As noted by the commentor, weapons derived plutonium is different than reactor derived plutonium. This is why the Parallex Project is needed to collect data on how weapons derived MOX fuel would perform in CANDU reactors. As described in Section 2.1.1, the plutonium dioxide is put through a thermal treatment process to remove impurities, such as gallium.
20-1	See response to comment 06-4,5
21-1	The DOE has completed this environmental assessment under the laws and regulations of the U.S. Government. This EA will help to determine if an EIS is required or if a Finding of No Significant Impact (FONSI) is warranted. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. DOE will make it's decision on the Parallex Project as-soon-as practical, realizing that no shipment of MOX fuel rods could be made until cleared by the Canadian Government. As described in Section 4.5, impacts of this action in Canada are likely to be minimal. Accident scenarios are discussed and consequences are documented in section 5 and Appendix D of the EA. The transportation accident described in the EA is believed to be a scenario that would bound the consequences of most credible incidents. The analysis in this EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments).
21-2	See response to comment 10-8
21-3	See response to comment 05-3,4,5
21-4	See response to comment 11-1.
22-1	The Parallex Project evaluated in this EA is proposed only to demonstrate the feasibility of using MOX fuel in CANDU reactors, not to implement the activity on a large scale. The Parallex Project must proceed in order to collect data on the performance of MOX fuel in CANDU reactors. Full implementation of using MOX fuel in CANDU reactors would require additional studies, NEPA review, and discussions between the U.S., Canada and the Russians. The ongoing discussions with Russia and Canada are described in section 1.2 of the EA. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. DOE will make it's decision on the Parallex Project as-soon-as practical, realizing that no shipment of MOX fuel rods could be made until cleared by the Canadian Government. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
22-2	See response to comment 05-1
22-3	The Parallex Project must proceed in order to collect data on the performance of MOX fuel in CANDU reactors. Full implementation of using MOX fuel in CANDU reactors would require additional studies, NEPA review, and discussions between the U.S., Canada and the Russians. The ongoing discussions with Russia and Canada are described in section 1.2 of the EA.
23-1,2,3	See response to comment 11-1
23-4	The Parallex Project would involve a small number of MOX fuel rods that would be managed along with other spent fuel from the NRU test reactor. If large scale use of MOX fuel in CANDU reactors was to be proposed in the future, the MOX spent fuel would replace the spent fuel normally generated by the reactors, and in fact, may result in the generating of less spent fuel.
24-1	See response to comment 11-1.
24-2	The EA discusses an accident involving the MOX fuel shipment as an extremely unlikely event. The probability that the fuel package container would break open, ignite and release plutonium dioxide from the MOX fuel pellets in an accident is considered to be extremely unlikely. The amount of plutonium dioxide disbursed as a result of this extremely unlikely event is estimated to be minimal and well below the 27 micrograms quoted by the commentor as sufficient to cause cancer in an adult person. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.

Comment Code [1]	Response
24-3	Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal. Sections 2.1.4 and 3.3.2 of this EA discuss the security associated with the MOX fuel shipment. Because of the small amount of plutonium and the form of the plutonium the MOX fuel shipments would have little value for terrorists. The analysis in this EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). DOE believes that the accident scenarios evaluated in this EA bound the consequences of the armed hijacker scenario.
24-4	See response to comment 05-3,4,5
24-5,6	See response to comment 10-8
25-1	As described in Section 4.1.1 of this EA, DOE estimates that there would be no significant health risk from the conduct of the Parallex Project in the U.S. The potential use of MOX fuel in CANDU reactors is being investigated as a possible way to transform surplus weapons-grade plutonium into a form that is more proliferation resistant. If it were to fall into the wrong hands, surplus weapons-usable plutonium metal and oxide could be readily formed into nuclear weapons without the need for a large infrastructure. Conversion to MOX fuel and irradiation in a nuclear reactor serves to greatly lessen the attractiveness of this material to those that would use plutonium in nuclear weapons. To extract plutonium from spent nuclear fuel requires a significant infrastructure that is difficult to screen from the intelligence community.
25-2	Sections 4.1.1.2 and 5.2 of this EA describe the impacts of potential transportation accidents. Impacts of credible scenarios are not expected to be major. The analysis in this EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). DOE believes that the accident scenarios evaluated in this EA bound the consequences of the armed hijacker scenario. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
26-1,2,3	See response to comment 22-1.
26-4	DOE scientists in cooperation with Canadian scientists have determined that testing MOX fuel in the NRU reactor could provide necessary information for the feasibility of using weapons-grade plutonium as MOX fuel in CANDU reactors. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
26-5	See response to comment 10-8.
26-6,7	See response to comment 11-1.
26-8	DOE originally considered several options for disposition of surplus weapons plutonium including transmutation by accelerators. In Section 2.1.4 of the S&D PEIS (DOE, 1996a), accelerator options were discarded from further consideration due to their technical immaturity, and attendant costly and lengthy development and demonstration effort required to bring them to a viable, practical status which would enable disposition options to be initiated with certainty. This decision was reaffirmed in the ROD for the S&D PEIS.
26-9	See response to comment 22-1
27-1	See response to comment 22-1.
28-1	See response to comment 11-1.
28-2	It is the responsibility of the Canadian government to make this evaluation. See Section 4.5
28-3,4,5	See response to comment 10-8
29-1	See response to comment 08-4,5.
30-1	See response to comment 11-1.
31-1	See response to comment 10-8.
31-2,3	See response to comment 08-4,5.

Comment Code '	Response
32-1	Accident scenarios are discussed and consequences are documented in section 5 and Appendix D of the EA. The EA discusses an accident involving the MOX fuel shipment as an extremely unlikely event. The probability that the fuel package container would break open, ignite and release plutonium dioxide from the MOX fuel pellets in an accident is considered to be extremely unlikely. The amount of plutonium dioxide disbursed as a result of this extremely unlikely event is estimated to be minimal. The transportation accident described in the EA is believed to be scenario that would bound the consequences of all credible accidents. The DOE has completed this environmental assessment under the laws and regulations of the U.S. government. In the U.S. an EA is used to determine if an EIS is required or if a Finding of No Significant Impact (FONSI) is warranted.
32-2	See response to comment 10-5
32-3	See response to comment 10-8.
32-4	The Parallex Project would involve a small number of MOX fuel rods that would be managed along with other spent fuel from the NRU test reactor. If large scale use of MOX fuel in CANDU reactors was to be proposed in the future, the MOX spent fuel would replace the spent fuel normally generated by the reactors, and in fact, may result in the generating of less spent fuel. The Parallex Project evaluated in this EA is proposed only to demonstrate the feasibility of using MOX fuel in CANDU reactors, not to implement the activity on a large scale. The Parallex Project must proceed in order to collect data on the performance of MOX fuel in CANDU reactors. Full implementation of using MOX fuel in CANDU reactors would require additional studies, NEPA review, and discussions between the U.S., Canada and the Russians. The ongoing discussions with Russia and Canada are described in section 1.2 of the EA. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. DOE will make it's decision on the Parallex Project as-soon-as practical, realizing that no shipment of MOX fuel rods could be made until cleared by the Canadian Government. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
32-5,6	If surplus weapons-usable plutonium metal and oxide were to fall into the wrong hands, it could be readily formed into nuclear weapons without the need for a large infrastructure. Conversion to MOX fuel and irradiation in a nuclear reactor serves to greatly lessen the attractiveness of this material to those that would use plutonium in nuclear weapons. To extract plutonium from spent nuclear fuel requires a significant infrastructure that is difficult to screen from the intelligence community. After irradiation, uranium oxide fuels that are typically used in commercial reactors contain plutonium. Therefore, the spent MOX fuel would not be significantly more attractive then spent uranium oxide fuels.
32-7,8	As described in Section 2.1 The AECL would be responsible for conducting all subsequent tests of the fuel's performance and the function of the reactor. Fueling the NRU reactor with MOX fuel would be part of a feasibility test to determine MOX fuel performance in converted CANDU reactors. Section 1.3 was revised to clarify the actual situation. Section 4.5 was added to summarize the environmental conditions at CRL and the potential effects of testing U.S. MOX fuel in the NRU reactor in Canada. As described in Section 4.5, impacts of this action in Canada are likely to be minimal.
32-9	The term "bounding" as used in the EA refers to a condition where the calculated dose or human health consequence is from an accident that is known to produce consequences greater than all other credible accidents or events. No implication is made that "bounding" is used to replace the lack of details. The term "reasonable" as used with regard to the "reasonable maximum" is defined as pertaining to impacts that may have relatively large or catastrophic consequences, even if their probability of occurrence is low, provided that the impact analysis is (1) supported by credible scientific evidence, (2) not based on pure conjecture, and (3) within the rule of reason. DOE experts decide what are reasonable maximum assumptions based on the available scientific knowledge of the subject as related to the Proposed Action.

Comment Code [1]	Response
	The statement of overestimation of potential effects is based on process knowledge and scientific knowledge of computer codes. For example, for a particular accident scenario, values can be used in the computer code to assure conservatism to protect public health. Conservatism often leads to an overestimation of potential effects. Conservative values are used in NEPA analyses, even though the Proposed Action does not require conservative risk estimates.
32-10	See response to comment 11-1.
32-11	The thermal treatment process used in the fabrication of Parallex fuel consists of heating the plutonium dioxide in a furnace to remove impurities. This process is identical to the pellet sintering process and as such presents no additional environmental consequences, special contamination problems, or particular worker exposures not already considered for pellet sintering. This process has been demonstrated to reduce the amount of gallium present in the fuel to <10 ppm. Rather than attempting to achieve a degree of purity, the parameters (time and temperature) for this process are set ahead of time. Purity in the finished product, therefore will not affect anticipated exposures.
32-12	The description of the packaging for the MOX fuel has been changed. The MOX fuel will be transported in a Type-B package which is much stronger than a Type-A package. The much more robust Type-B package is designed to retain its contents under both normal conditions of transportation as well as under most hypothetical accident conditions. See Section 2.1.2. Section 2.3.5 of the EA discusses the security associated with the MOX fuel shipment. Our analysis does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). Also, DOE believes that the accident scenarios evaluated in this EA bound the consequences of the armed hijacker scenario.
32-13	Table 3-2 has been modified to show that the "other" category includes doses from air travel and weapons test fallout.
32-14	Penetrating radiation is the type of radiation used for assessing human health effects of routine events because, based on actual worker dose data (the bench-scale R&D already conducted at LANL), it is penetrating radiation that has resulted in mild exposure of involved workers. However, under uncontrolled conditions, such as those that may occur during an accident, inhalation exposure may occur. An internally deposited dose through inhalation of alpha-emitting plutonium is what was modeled for the accident using the MACCS consequence assessment computer code.
32-15	Security measures are included in the planning for radioactive material shipments to deter illegal activity and lessen the risk of illegal activity. This does not imply that the risk of the illegal activity is considered to be great. The analysis in this EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). Also, DOE believes that the accident scenarios evaluated in this EA bound the consequences of the armed hijacker scenario.
32-16	It is not possible to predict the location of a possible terrorist act against a shipment of MOX fuel rods.
32-17	There is no statement or implication in Section 4.1.1 that civilians will inhale or ingest plutonium dioxide. Routine activities in fuel fabrication may expose workers to gamma and neutron radiation as estimated, but not the public. The radiological dose to the public from transportation is negligible as stated in Section 4.1.1.2. Where there could be a dose to the public from a fuel fabrication accident, latent cancer is generally regarded as the most sensitive response. DOE has no evidence that there is a measurable relationship between effects, such as teratogenic and mutagenic, and the very low alpha-type dose of 3.1×10^{-5} rem.
32-18	The analysis in this EA does not consider terrorist acts or hijacking the shipments because of the low probability of an incident (given the very low proliferation value of the MOX fuel and the security associated with MOX fuel shipments). DOE believes that the accident scenarios evaluated in this EA bound the consequences of the range of credible accident scenarios.
32-19	The accident scenarios analyzed in the EA contain a number of conservative assumptions. DOE believes that the accident scenarios evaluated in this EA bound the consequences of the range of credible accident scenarios. Appendix D, Section D.3.1 states that "The release fractions for the eight accident-severity categories are based on physical test data (McWhirter et al., 1975). For this transportation analysis, the release fractions for accident -severity categories 5 through 8 were the same (5.0×10^{-6}). No effects are expected in categories 1 through 4 because the release fractions for these categories are zero. The

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	release fractions are zero due to the highly accident resistant design of the Type-B shipping container. For the RADTRAN 4 modeling, a total containment failure was presumed for categories 5 through 8." Plutonium released during an accident is assumed to be cleaned-up to levels that would be protective of human health and the environment. Therefore, health effects could occur to persons exposed during the accident over their lifetimes, but would not be expected for other persons not exposed during the accident.
32-20	The RADTRAN computer risk assessment code determines the amount of MOX fuel that can be aerosolized under the parameters of the hypothetical accident. The fraction of the respirable plutonium dioxide determined by RADTRAN is used as the source term for estimating human health effects. The respirable source term is dependent on the specific accident scenario and the amount of MOX fuel being transported for that scenario. The RADTRAN analysis uses the conservative assumption that the accident fire will not be major. For the same amount of plutonium dioxide released, a major fire would disperse more of the plutonium downwind and lower the dose to the maximally exposed individual. RADTRAN establishes a population distribution along the transportation route based on real data from a United States population database. Conservatism is written into the code to overestimate potential risk to the public. A very low estimated risk for a uniformly distributed population does not mean there will be a high public risk to densely populated areas. The estimated health risk to the human population is extremely low for the hypothetical accident scenario. RADTRAN does not estimate the risk to nonhuman species or their long-term environmental consequences. The costs of decontamination of the environment from a hypothetical transportation accident are not addressed because the probability of the described hypothetical accident occurring is extremely unlikely. Separate documentation exists detailing the testing and acceptability standards for the two types of shipping package designs. The temperature of 800 degrees Celsius (1,472 degrees Fahrenheit) is used as a reference point to determine the increasing effect of force and fire for each of the RADTRAN Accident-Severity Categories. Jet fuel burns at 800 degrees Celsius.
33-1,2	See response to comment 32-10.
34-1	See response to comment 32-1.
34-2	See response to comment 32-15.
34-3	See response to comment 10-8.
34-4	See response to comment 11-1.
35-1	See response to comment 06-1,2,3,4,5,6,7
36-1,2	See response to comment 04-6.
37-1	See response to comment 14-1.
38-1	Under the terms of the Price-Anderson Act, the U.S. Government could be responsible for remediation and restitution for accidents that occur in the U.S.
39-1	See response to comment 22-1.
40-1	See response to comment 22-1.
43-1	As described in Section 4.1.1 of this EA, DOE estimates that emissions from the proposed activities would be small, and no adverse health effects would be expected from the conduct of the Parallex Project in the U.S.

1. The comment code is composed of the document number followed by the comment number. Therefore comment code 38-1 represents the first comment in document number 38. Documents are presented on pages A-2 through A-39.

APPENDIX B. CANADIAN SHIPPING PACKAGE CERTIFICATE

Description of Model 4H Shipping Package

Certification

Atomic Energy Control Board / Commission de contrôle de l'énergie atomique

RADIOACTIVE MATERIAL TYPE B(U) PACKAGE DESIGN APPROVAL CERTIFICATE NO. CDN/4212/B(U)F, (REV. 7)

30-A1-153-0 September 25, 1998

The Atomic Energy Control Board hereby certifies that the package, as described below, has been demonstrated to meet the regulatory requirements prescribed for Type B(U) Fissile packages as described in the Canadian *Transport Packaging of Radioactive Materials Regulations* and in the IAEA Regulations*, subject to the following limitations, terms and conditions.

All users of this authorization shall register their identity in writing with the Atomic Energy Control Board prior to the first use of this authorization and shall certify that they possess the necessary instructions for preparation of the package for shipment.

This certificate does not relieve the shipper from any requirement of the government of any country through or into which the package will be transported.

PACKAGE IDENTIFICATION

Atomic Energy of Canada Limited Model 4H Enriched Fuel Bundle Shipping Package, Serial Nos. 1 to 8 inclusive.

PACKAGING DESCRIPTION

The Atomic Energy of Canada Limited (AECL) Model 4H Enriched Fuel Bundle Shipping Package, as shown on AECL Drawing Nos. A-5580-A12, B-5580-A2, E-5580-2, E-5580-3 and E-5580-SA1, consists of a reinforced 208 litre drum filled with foam, vermiculite and plywood. The matching lid is attached by a 2.66 mm (12 gauge) closure ring with drop forged lugs and a 15.9 mm diameter bolt. A 2.4 mm diameter hole is provided for a security seal. The drum contains a weldment of spacers and plates attached to four Specification 2R containers on 216 mm centres. The 2R containers are closed by lutes (Teflon tape) and threaded steel plates. The plates are colour-coded and numbered to match the 2R containers. The 2R containers enclose felt-lined aluminum carriers, packing materials as restricted below, and the authorized radioactive contents.

Canada

Containment for Type A and LSA quantities is provided by the closed drum and Specification 2R containers and additional containment for Type B quantities is provided by the leak tight fuel cladding on the elements and bundles. The maximum gross weight of the package is 250 kg.

An illustration of the package is shown on attached Drawing No. A-5580-A12, (Rev 0)

The package shall bear the competent authority identification mark "CDN/4212/B(U)F".

AUTHORIZED RADIOACTIVE CONTENTS

The contents are described for individual Specification 2R compartments. When the contents of the four compartments are common, the package mass limit is four times (4x) the compartment mass limits. Paragraphs a) through e) below list the appropriate Transport Indices and Allowable Numbers for a package. When the contents of the four compartments are not common, the package mass limit is the total of each of the appropriate compartment mass limits but the Transport Index and Allowable Number for the package shall be based on the most restrictive contents of any one compartment.

As prepared for shipment, each of the Specification 2R compartments may contain up to 100 grams hydrogen, and

(a) not more than 22.6 kg of unirradiated uranium oxide containing up to 20 kg uranium enriched in the isotope U-235 to a maximum of 10 weight percent in the form of pellets, powder or scrap with Allowable Number and Transport Index as set out in Table 1;

TABLE 1: UO_2 Limits as Transport Indices and Allowable Numbers

Max. weight percent U-235 in U	Transport Index (per package)	Allowable Number
2.75	1.3	38
3.00	1.7	29
3.50	2.7	18
5.00	4.2	11
10.00	50.0*	1

* Transport as Exclusive Use

or

(b) not more than 20 kg of unirradiated uranium enriched in the isotope U-235 up to 5 weight percent as metal in the form of slugs, powder, pellets or scrap or as carbide (UC) in the form of pellets, elements or bundles sealed in fuel cladding with Allowable Numbers and Transport Indices as set out in Table 2;

CDN/4212/B(U)F, (REV. 7) Page 3 of/de 5 Canada

TABLE 2: U and UC Limits on Transport Indices and Allowable Numbers

Max. weight percent U-235 in U	Transport Index (per package)	Allowable Number
2.00	1.3	38
2.25	1.4	35
2.50	2.0	25
2.75	3.0	16
3.00	4.2	11
3.50	8.4	5
5.00	12.5*	4

* Transport as Exclusive Use

or

(c) not more than 0.35 kg of unirradiated uranium enriched in the isotope U-235 up to a nominal level of 93 weight percent (maximum of 0.33 kg U-235) as slugs, powder, pellets or scrap shipped exclusive use with an Allowable Number of 2 and Transport Index of 25; or

(d) mixed oxides of unirradiated uranium and thorium, $(U,Th)O_2$, containing not more than 3 weight percent UO_2 with uranium enriched in the isotope U-235, up to 93 weight percent in quantities not exceeding:

1) 7 kg total uranium plus thorium when the UO_2 content is equal to or exceeds 1.75 weight percent $(U+Th)O_2$ in the form of powder, pellets or scrap not in sealed fuel cladding; or

2) 20 kg total uranium plus thorium when the UO_2 content is less than 1.75 weight percent $(U+Th)O_2$ in the form of powder, pellets or scrap not in sealed fuel cladding; or

3) 20 kg total uranium and thorium in the form of pellets, elements or bundles sealed in zirconium alloy fuel cladding, with Allowable Numbers and Transport Indices as set out in Table 3;

TABLE 3: $(U,Th)O_2$ Limits on Transport Indices and Allowable Numbers

Max. Weight percent UO_2 in $(U, Th)O_2$	Transport Index (per package)	Allowable Number
4.25	1.3	38
4.50	1.4	35
4.75	1.6	31
5.00	1.8	27

or

CDN/4212/B(U)F, (REV. 7) Page 4 of/de 5 Canada

(e) not more than 22.6 kg of oxides of unirradiated uranium (natural or depleted) and plutonium (separated and further described in reference **), $(U,Pu)O_2$, containing a maximum of 20 kg total of uranium and plutonium with up to 4 weight percent PuO_2 in $(U+Pu)O_2$ sealed in zircaloy alloy fuel cladding with Allowable Numbers and Transport Indices as set out in Table 4;

TABLE 4: $(U,Pu)O_2$ Limits on Transport Indices and Allowable Numbers

Max. weight percent PuO_2 in $(U,Pu)O_2$	Transport Index (per package)	Allowable Number
1.25	1.3	38
1.50	1.5	33
1.75	2.0	25
2.00	2.4	17
2.25	3.0	13
2.50	5.0	10
2.75	6.3	7
3.00	8.4	5
3.50	10.0	5
4.00	12.5*	4

* Transport as Exclusive Use

SHIPMENT

This package shall be prepared for shipment in accordance with AECL Procedure No. A-12052-PR-1, the Canadian *Transport Packaging of Radioactive Materials Regulations*, and the IAEA Regulations*.

Calculation of Allowable Numbers for nuclear safety include conservative evaluations of spacing of normal packages and damaged packages, as determined by testing, and worst combination of moderation by water of any density within the packaging and in the interstitial space of arrays of packages fully reflected by water.

Shipment is authorized as Fissile Class II, with a minimum Transport Index as specified under Authorized Radioactive Contents, or the highest radiation dose rate, in microsieverts per hour divided by 10, measured at one metre from any accessible external surface of the package, whichever is larger.

EXPIRY DATE

This certificate expires September 30, 2001.

R. Thomas
Director
Materials Regulation Division

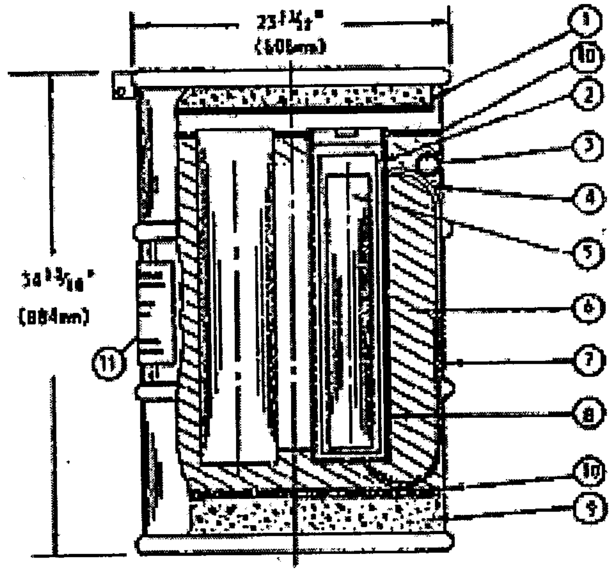
REFERENCES

* International Atomic Energy Agency Safety Series N° 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (as amended).

** Fissile Material Packaging 4H Compliance with Canadian Transport Regulations, Report No. CRNL 1698, W.R. Taylor.

NOTES

1. Revision 0: August 2, 1978. Original certificate.
2. Revision 1: August 4, 1981. Certificate renewed.
3. Revision 2: September 15, 1983. Certificate renewed.
4. Revision 3: June 3, 1987. Certificate renewed.
5. Revision 4: August 31, 1990. Registered user requirement added.
6. Revision 5: September 27, 1991. Certificate renewed.
7. Revision 6: September 16, 1994. Certificate renewed.
8. Revision 7: September 25, 1998. Certificate renewed.



1. TOP THERMAL SHIELD (VERMICULITE)
2. FELT LINED ALUMINUM CAN
3. [illegible] RETAINING PIPE
4. 12.7mm STAINLESS STEEL SPACER - 4 PLACES
5. PAYLOAD ([illegible])
6. SHIELDING MATERIAL ([illegible])
7. [illegible] DRUM, 45 IMPERIAL GALLONS, 16 GAUGE MATERIAL, FULL REMOVABLE HEAD
8. [illegible] SPECIFICATION [illegible] CONTAINER, [illegible] O.D. x [illegible] I.D., [illegible] OUTSIDE HEIGHT x [illegible] INSIDE HEIGHT - 4 PLACES
9. BOTTOM THERMAL SHIELD (VERMICULITE)
10. 12.7mm [illegible] SHEET
11. IDENTIFICATION AND THERMAL SHIELD PLATE

NOTES:

1. AUTHORIZED RADIOACTIVE CONTENTS - SEE AECB CERTIFICATE NO. CDN/[illegible]
2. CONFORMS TO [illegible] TYPE B(U) AND FISSILE PACKAGING REQUIREMENTS AS SPECIFIED IN "REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS" SAFETY SERIES NO. 6
3. GROSS WEIGHT [illegible] kg ([illegible] lb.) MAXIMUM
   TARE WEIGHT [illegible] kg ([illegible] lb.)
4. RADIOACTIVE CONTENTS TO BE PACKAGED AS PER DRAWINGS [illegible] AND [illegible]
5. PACKAGING DESIGN DRAWINGS

   E-5500-A1 ASSEMBLY
   E-5500-2 SUB-ASSEMBLY AND DETAILS
   D-5500-3 [illegible] DETAILS
   [illegible] PACKING [illegible]
   [illegible] OPERATING PROCEDURES

FIGURE 1 MODEL 4H PACKAGING CDN/[illegible]

ATOMIC ENERGY OF CANADA LIMITED CHALK RIVER ONTARIO, CANADA	APPROVED	A-5500-A12 REF. No.	SHEET 1 OF 1

APPENDIX C. USA SHIPPING PACKAGE CERTIFICATE

US Department of Transportation
Research and Special Programs Administration

CONFINED ADVANCED CERTIFICATION
FOR A TYPE B(U)F FISSILE
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0488/B(U)F, REVISION 1

[illegible] Washington, D.C. 20590

REVALIDATION OF CANADIAN COMPETENT AUTHORITY CERTIFICATE CDN/4213/B(U)F

This certifies that the radioactive materials package design described below is hereby approved for use within the United States for import and export shipments only. Shipments must be made in accordance with the applicable regulations of the International Atomic Energy Agency[1] and the United States of America[2].

1. Package Identification - Atomic Energy of Canada Limited Model 1X Marlshaul Fuel Bundle Shipping Package, Serial Nos. 1 thru 8 (inclusive).

2. Packaging Description and Authorized Radioactive Contents - as described in Canadian Certificate of Competent Authority CDN/4213/B(U)F, Revision 7 (attached).

Shipment is authorized as Fissile Class II with a minimum transport index of as noted in Canadian certificate per package.

3. General Conditions -

a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation in accordance with the enclosed certificate.

b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Technology, (DHM-32), Research and Special Programs Administration, U.S. Department of Transportation, Washington D.C. 20590-0001.

c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

d. This certificate provides no relief from the limitations for transportation of plutonium by air in the United States as cited in the regulations of the U.S. Nuclear Regulatory Commission 10 CFR 71.88.

1 "Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition, as amended," published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

2 Title 49, Code of Federal Regulations, Parts 100 - 199, United States of America.

[- 2 -]

CERTIFICATE USA/0488/B(U)F, REVISION 1

4. Marking and Labeling - The package shall bear the marking USA/0488/B(U)F in addition to other required markings and labeling.

5. Expiration Date - This certificate expires on September 30, 2001.

This certificate is issued in accordance with paragraphs 806 and 814 of the IATA Regulations and Section 173.473 of Title 49 of the Code of Federal Regulations, in response to the petition and information dated November 3, 1998 submitted by Transport Logistics International, Inc., Washington, DC, and in consideration of other information on file in this Office.

Certificate No.

NOV 10 1998

(DATE)

Alan I. Roberts
Associate Administrator for Hazardous Materials Safety

Revision 1 - Issued to endorse Canadian Certificate of Competent Authority No. CDN/4212/B(U), Revision 7, and to extend the expiration date.

APPENDIX D. RISK ASSESSMENT

D.1 Potential Effects on Human Health from MOX Fuel Fabrication Accident

Potential accidents associated with MOX fuel fabrication at LANL are reported in the document *Process Hazard Analysis (PrHA) for Fuel Pellet Fabrication and Pin Assembly Operations* (LANL/NMT-8 1997). The construction and engineering features of the TA-55 building structure and HEPA filtration system are such that essentially no off-site radiological consequences would result from accidents involving MOX fuel fabrication. The procedures, training, and equipment in use at TA-55 result primarily in low-level risk scenarios for TA-55 personnel and personnel on the Laboratory site. Because of this, the involved worker was found to be the primary receptor for most of the identified hazards.

The single (reasonable probability of occurrence) accident with the potential highest consequence was selected for description in this EA (DOE 1993a). This accident is termed "bounding," meaning that other potential credible accidents related to MOX fuel fabrication operations at LANL would pose less serious risks. The bounding accident described below is "Fire External to the Glovebox." In addition to this accident being bounding, the assumptions made to evaluate the accident tend to lead to an overestimate of risk. This is done in order to be protective of human health.

The fire is assumed to occur adjacent to a granulation glovebox where the pellets are screened through a sieve. The basic elements for the localized fire scenario are that low-level waste boxes filled with combustible room waste are stacked in front of the glovebox and ignited from internal heat generation or a spill of flammable liquid. The laboratory room is unattended at the start of the fire, and the initiating fire ignites the gloves of the glovebox. Workers are assumed to enter the room after the gloves have been ignited, exposing themselves to finely divided plutonium dioxides that have been suspended in the air by the fire, thus obtaining an internally deposited dose through respiration.

An assessment of risk considers the chance or likelihood that an accident would occur and the consequences that result from the accident. The likelihood that an accident would occur is generally a function of multiple events occurring in succession. Some of the events necessary for this accident to proceed to the point of worker exposure include ignition of the waste boxes, spread of the fire, failure of sprinkler systems, ignition of gloves, and breaching of gloves. The likelihood of occurrence of this accident was estimated at between once in 100 and one in 10,000 years (10^{-2} to 10^{-4} per year), or "unlikely" (LANL/NMT-8 1997). This qualitative estimate of likelihood is conservative, i.e., the accident can be realistically expected to occur at a lower frequency than 10^{-2} to 10^{-4} per year.

Determining the potential exposure to radiological material resulting from an accident begins with estimating the amount of material at risk (MAR). For this accident scenario, the MAR was estimated in LANL/NMT-8 (1997) and is detailed in Section 2.0 of this appendix. The MAR is then used to estimate the "source term," which is the amount of material made airborne that is of a size that can enter the human breathing system. The MAR was estimated to be 10.2 g and the source term was estimated as 0.10 g of aerosol (LANL/NMT-8 1997).

The exposure portion of the consequence analysis is for the maximum exposed individual (MEI) located at the Royal Crest Trailer Park, which is 2,953 ft (900 m) north of TA-55. The radiation dose to the MEI was calculated using the standard Gaussian model parameters of source term development, dispersion, intake and dose conversion factor. The Gaussian modeling was performed with the MELCOR Accident Consequence Code System (MACCS) (LANL/NMT-8 1997) using meteorological data described by Haskin (1995). The estimated dose to the MEI from this accident is 3.14×10^{-5} mrem. Combining the accident's estimated consequence and likelihood of occurrence, the risk to the MEI is minimal as explained in the following sections of this appendix.

D.2 Summary of Supporting Calculations for the Bounding Accident: Fire External to the Glovebox

Process Description

For fuel pellet production activities, approximately 24 gloveboxes (atmosphere controlled), powder preparation equipment, four automatic pellet presses, three synthesis furnaces, and three sintering furnaces are available for use. The fuel is a ceramic pellet of mixed plutonium dioxide and uranium dioxide. Fuel is normally processed in 7-lb (3-kg) or less batches. Typical process steps followed for this operation are

- receipt of oxide powders,
- removal of gallium in high-temperature furnace,
- ball milling,
- blending the powder in tubular blender,
- compacting in hydraulic press,
- granulation – push through screen,
- pressing the granules into pellets,
- binder removal through heating,
- pellet sintering,
- centerless grinding of pellet to achieve final dimensions,
- vibratory milling,
- batch characterization (measurement and analysis),
- heat in tube furnace to adjust oxygen content,
- fuel pin assembly and welding, and
- characterization of the welds and helium leak testing.

The fire is assumed to occur adjacent to a granulation glovebox where the pellets are screened through a sieve. The source term is finely divided plutonium in oxide form. The basic elements for the localized fire scenario are that LLW boxes filled with combustible room waste are stacked in front of the glovebox and ignited from internal heat generation. The laboratory room is unattended at the start of the fire, and the initiating fire ignites the gloves of the glovebox. Workers are assumed to enter the room after the gloves have been ignited exposing themselves to plutonium dioxide particles suspended in the air by the fire.

Accident Estimated Likelihood of Occurrence

Expert judgement was used to qualitatively estimate that the likelihood of occurrence of this accident is "unlikely," or between one in 100 and one in 10,000 years (10^{-2} to 10^{-4} per year) (LANL/NMT-8 1997). The likelihood that an accident would occur is generally a function of multiple events occurring in succession.

Some of the events necessary for this accident to occur include chance or frequency of fire in similar facilities, failure of sprinkler systems, ignition of the gloves, and breaching of the gloves. Table 5-1 shows that unlikely accidents are not anticipated to occur in the lifetime of a facility or operation. Two of the events mentioned above, chance or frequency of fire in similar facilities and failure of sprinkler systems are quantified here to confirm that the qualitative estimate of unlikely is conservative (over-estimates the likelihood of occurrence).

In 1982 a report was issued by the DOE Office of the Assistant Secretary of Environment Protection, Safety, and Emergency Preparedness; Office of Operation Safety on the performance and reliability of automatic sprinkler systems (DOE 1982). Over 30,000 automatic sprinkler system experiences of DOE and its predecessor agencies were analyzed in detail for the time period 1952–1980 from the standpoint of effectiveness and reliability. From 1952 to 1980, 115 fires large enough to activate sprinkler systems occurred in DOE facilities, and the accumulated sprinkler system operating experience for DOE facilities nationwide during this period is greater than 30,000 sprinkler system-years (DOE 1982). Therefore, the average frequency of fires was estimated as follows:

$$F(\textit{fire}) = \frac{115\ \textit{fires}}{30{,}000\ \textit{sprinkler system-years}} = 0.0038\ \textit{fires per sprinkler system-year}$$

Of the 115 fires involving sprinkler systems in DOE facilities since 1952, the sprinklers were successful in controlling or extinguishing the fire in 113 of the incidents. Therefore, the probability of sprinkler failure on demand is $2 \div 115 = 0.017$. The combined frequency of fire in similar facilities and failure of sprinkler systems is then $0.0038 \times 0.017 = 6.5 \times 10^{-5}$. Thus, the frequency of damaging fires based on real operational experience is slightly less than one chance in 10,000 years (or 6.5×10^{-5} per year). This adequately supports that the qualitative estimate of occurrence of unlikely for this accident scenario is conservative, i.e., the accident can be expected to occur at a frequency of no more than once in one hundred years.

D.2.1 Accident Scenario Release Source Term

For material released in the form of particulate matter or aerosols, the "source term" or amount of material made airborne that is of respirable size can be estimated by the following expression:

$$\text{Source Term (ST)} = \text{MAR} \times \text{DR} \times \text{ARF} \times \text{RF} \times \text{LPF (DOE 1994c)},$$

where

MAR = amount of material at risk (the amount available to be acted on),

DR = damage ratio (the fraction of the MAR affected by the accident conditions),

ARF = airborne release fraction (fraction of the affected material that is made airborne),

RF = respirable fraction (fraction of the airborne particles that are respirable), and

LPF = leak path factor (the fraction of material transported through some type of confinement).

The total source term would be a linear combination of the source terms from all mechanisms by which respirable Pu powder is driven airborne. The DR is the fraction of the MAR that can actually be acted upon by the stresses caused by the accident conditions.

The product of the first four factors in the source term formula gives the respirable initial source term to the workers. The initial source term multiplied by the LPF determines the final source term released to the environment. Calculation of the source term is summarized in Table D-1 and details of the source term calculation are discussed below.

Table D-1. Source Term Development

Scenario Source	MAR	DR	ARF × RF	LPF	Source Term
Fire External to Glovebox	0.36 oz (10.2 g)	1.0	0.01	1.0	3.5×10^{-3} oz (0.1 g)

Source: Preliminary estimates from DOE and LANL Risk Assessment Team.

Because this operation is similar to operations for producing heat source pellets, information on the MAR from heat source production in the TA-55 Final Safety Analysis Report (FSAR) was used.

The MAR for the source term from combustion of the gloves is estimated to be 0.36 oz (10.2 g). This is derived from the following conservative assumptions:

- 2.5 oz (70 g) of fine Pu powder is lost during a 7-lb (3-kg) campaign.
- All of the lost powder has been distributed evenly as depositions on the glovebox internal walls and on the inside surfaces of the 12 gloves (normal airflow would draw most of the powder into the glovebox HEPA filter and routine internal glovebox surface cleaning would also decrease surface loading).
- Each glove has 5.9×10^{-2} oz (1.7 g) of powder deposited on it (normally the gloves are replaced approximately every two weeks).
- 6 gloves on one side of the glovebox are ignited and burn completely.

The loss of 2.5 oz (70 g) during a campaign is based on operational experience. However, the exact amount of powder lost is not as relevant as the degree of glove contamination for the present source term analysis. The value of 5.9×10^{-2} oz (1.7 g) per glove represents the maximum expected contamination level on the gloves.

The gloves are made of a rubber derivative called Hypalon (chlorosulphonated polyethylene). Airborne release fractions and respirable fractions for rubber and elastomers based on the experimental data are published by DOE (DOE 1994c). The ARF values range from 2.0×10^{-4} (plutonium nitrate solution on pieces of rubber glove) to 3.5×10^{-2} (uranyl nitrate hexahydrate [UNH] on polychloroprene [PC]). The extreme values are both for liquid solutions on combustible rubber/elastomer but represent a difference in heat input. For balled-milled depleted uranium dioxide and air-dried UNH salt on PC, the ARFs range from 3.7×10^{-3} to 1.0×10^{-2} with an RF of 0.16. Therefore, a reasonably conservative bound for ARF and RF for the accident conditions is 0.01 and 1.0, respectively. If the ARF and RF values of 0.01 and 1.0, respectively are applied to the MAR of 0.36 oz (10.2 g), the initial source term is 3.5 × 10-3 oz (0.10 g).

D.2.2 Accident Consequences

Worker Dose

The dose to workers in the room is calculated as follows:

$$CEDE = ST \times SA \times BR \times ET \times DCF/RV,$$

where

CEDE = cumulative effective dose equivalent (rem),

ST = source term (g),

SA = specific activity (Ci/g),

BR = breathing rate (m^3/s),

ET = evacuation time(s),

DCF = dose conversion factor (rem/Ci), and

RV = room volume (m^3).

Using a BR of 3.33×10^{-4} m^3/s, an ET of 30 seconds, an RV of 850 m^3, and SAs and DCFs (Clow et al. 1994), the 50-year CEDE is a maximum of 1,800 mrem (1.8 rem) as shown in Table D-2. The short-term effects from this initial dose would be minor and should not cause lost time or disability (NRC 1995).

Table D-2. Intake Calculations

ST	SA	BR	ET	DCF	RV	CEDE (rem)
5.0×10^{-3}	6.133×10^{-2}	3.33×10^{-4}	30	5.1×10^{6}	850	1.8

Public Dose

The dose to the public was calculated using the Gaussian dispersion model MACCS2, as described by Haskin (1995) and in the TA-55 FSAR. MACCS2 performs probabilistic calculations of the potential off-site consequences of atmospheric releases of radioactive material resulting from accidents. MACCS was extensively verified (checked and tested) during its development. The standard Gaussian model parameters of source term development, dispersion, intake, and dose conversion factor were used. Weather information used in the Gaussian modeling was based on the 95th percentile weather information. The 95th percentile weather is stability class F and a wind speed of 1.9 m/s. About 5 percent of the time TA-55 weather would be more stable, i.e., less favorable for atmospheric dispersion of releases. The MEI is located 2,953 ft (900 m) from PF-4 at the Royal Crest Trailer Park. The CEDE for the fire scenario is 3.14×10^{-5} mrem. This assumes a LPF of 2×10^{-6} which is based on two-stage HEPA filtration. (Note: The MEI dose is not used in cancer fatality estimates, but rather, an integrated dose is used as described in a later section). The estimated dose of 3.14×10^{-5} mrem to the MEI is expected to cause no long-term health effects (DOE 1993b).

D.2.3 Risk Assessment

Maximum Exposed Individual

Risk estimates consider the estimated likelihood of occurrence of an accident and the dose consequence of the accident so that the magnitude of potential effect from the accident can be estimated. With an estimated likelihood of occurrence of "unlikely" and a dose consequence of 3.14×10^{-5} mrem, the risk to the MEI at the Royal Crest Trailer Park is minimal. No LCFs would be expected among the surrounding population from this dose.

D.3 Potential Effects on Human Health from MOX Fuel Transportation and Accidents

D.3.1 RADTRAN 4 Computer Code for Transportation Risk Assessment

RADTRAN 4 (Neuhauser and Kanipe 1992) produces estimates of incident-free population dose, accident doses, and individual doses. Doses may be converted to health effects. RADTRAN 4 calculates incident-free population dose for subgroups of members of the public [persons adjacent to the route (off-link), persons sharing the route (on-link), and persons at stops] and for persons who may be occupationally exposed [mainly crew members and inspectors]. Incident-free dose is defined as that dose which may be incurred by persons on or near a transportation route that results from exposure to external radiation emitted by the intact package in the course of normal transportation. The external radiation emitted by packages containing radioactive material is limited by regulation, but for certain types of shipments (e.g., spent nuclear fuel) measurable doses may be incurred by individuals within short distances of the shipment. In the present analysis, the package dose rates are well below regulatory limits.

The most important input parameters for these calculations are (1) route characteristics and (2) package characteristics. A highway route is normally divided into *route-segments* or *links* according to population density and road type. All travel in the U.S. for all three routes considered in this analysis is on interstate highways except for the access route from LANL to the nearest interstate highway (Interstate Highway 25). Population densities and road type information are among the outputs of routing codes such as HIGHWAY (ORNL 1993), which was used in this analysis. Population-density data are also used to assign a rural, suburban, or urban designation to each route-segment. This designation influences other input parameters such as vehicle speed. The two most important package characteristics for incident-free dose estimation are external dose rate and package dimension. These values are used to model the package as a point source. Both moving point-source [e.g., for off-link population] and stationary point-source [e.g., for stops] calculations are performed by RADTRAN 4 to conservatively estimate dose to persons within 2,625 ft (800 m) of the lane centerline and at truck stops. Dose to crew members is estimated with a stationary point-source calculation in which the distance from source to the crew cab is a parameter and time of exposure is estimated by dividing the distance term by the velocity. In the present analysis the package dose rates are quite low.

Accident doses are estimated for a series of separate *accident-severity categories* that represent the full spectrum of accidents from minor (a "fender bender") to extremely severe (total containment failure). For each severity category, a probability is calculated based on state-level accident-rate data and condition probabilities, given that an accident has occurred, that it would be of a particular severity. In this analysis, an eight-category severity scheme is used (NRC 1977), and package response is based on test data, including tests to failure, for the 6M package type (McWhirter et al. 1975; Bonzon 1977).

Radiological consequences (50-year cumulative effective doses or CEDs) are calculated by RADTRAN 4. The code uses test data or model predictions of the amount of material that might be released in a given severity of accident, expressed as a fraction of the total or *release fraction* (RADTRAN variable RFRAC). The release fraction is modified by properties of the material being shipped that determine how much of it might be released in aerosol and respirable aerosol form under various accident conditions, since aerosolization represents the dominant means by which any released radioactive material might be transported away from the immediate accident site. This transport is conservatively modeled as a ground-level dispersion from a small-diameter plume, regardless of the type of accident, which maximizes both downwind ground deposition and inhalation values. In reality, in a very severe accident involving a major fire, the thermal effects would be far more likely to loft any released material higher in the atmosphere, which results in considerable downwind dilution and, hence, lower individual doses. The exposure pathways considered in this analysis are inhalation, resuspension (delayed inhalation from particles originally deposited on the ground and subsequently resuspended), groundshine (exposure to external radiation from

deposited particulates), and cloudshine (exposure to external radiation from particulates in the passing plume). Since little penetrating radiation is emitted by the MOX payload in this analysis, doses from inhalation and resuspension dominate the consequence calculation. The output is a calculation of population dose for each accident severity. The potentially exposed population consists of all persons located under the plume footprint out to a downwind distance of 50 mi (80 km). Since exact locations cannot be predicted in the transportation analysis, the potentially exposed population is estimated for each route segment based on the same population density used for incident-free dose calculations, which is assumed to be uniformly distributed. The population estimate for each route is also given in the RADTRAN 4 output.

The probability and accident dose values are combined to generate dose risk estimates, which are the primary output of RADTRAN 4. Probability and accident dose values are also shown separately, however, to reveal the magnitudes of the two components. An estimate of the maximum individual inhalation dose to a person located near the hypothetical accident site for each severity is also generated by RADTRAN 4. This value is useful in that it puts the population dose estimates in perspective.

Dose estimates may be multiplied by a health-effects factor to estimate the expected number of cancer fatalities in the exposed population. That factor is 5.0×10^{-4} health-effects per rem (ICRP 1991). In addition, RADTRAN examines the individual dose estimates for varying distance from the hypothetical accident site to determine whether early fatality (i.e., death within one year) would be expected. The dose threshold for early fatality is quite large and was not expected to be exceeded in this analysis.

The RADTRAN 4 computer model was used to estimate human health effects from the proposed MOX fuel shipments. Health effects were estimated on a per shipment basis for the material transported from Los Alamos, New Mexico to the Canadian border. The total radiological dose and LCF estimates were calculated for each shipment along the three routes to the Canadian border. The human health risk analysis was an integral component of the overall transportation analysis performed by RADTRAN 4. Therefore, there was overlap in the input parameters used by the code. For human health, the normal (incident-free) transportation radiological exposure and the nonradiological emissions effects were estimated. The potential recipients of radiological and nonradiological effects are the crew (occupational exposure) of the transport and the public (nonoccupational exposure) along the route.

The RADTRAN 4 input parameters were developed for each route for this analysis with the HIGHWAY computer routing code (ORNL 1993). One parameter, known as a link, represents urban, suburban, or rural travel within a state. Urban, suburban, and rural population data are used by the HIGHWAY code to develop route-specific population densities. In addition, the code uses state-level accident rate data to uniquely describe each link. The HIGHWAY code also maximizes the use of interstate highways along the selected