

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before

THE COMMISSIONERS

IN THE MATTER OF THE PETITION OF THE)	
STATE OF NEVADA FOR THE AMENDMENT)	
OF THE PHYSICAL PROTECTION)	
REGULATIONS CONTAINED IN 10 C.F.R. 73)	
AS THEY RELATE TO THE SAFEGUARDS FOR)	
SPENT NUCLEAR FUEL SHIPMENTS)	
AGAINST TERRORISM AND SABOTAGE AND)	
FOR THE INITIATION OF A COMPREHENSIVE)	PETITION TO INSTITUTE
ASSESSMENT OF THE CONSEQUENCES OF)	RULEMAKING AND TO INITIATE
RADIOLOGICAL SABOTAGE)	A COMPREHENSIVE ASSESSMENT

The State of Nevada (Petitioner) hereby respectfully requests and petitions the Nuclear Regulatory Commission (the Commission), pursuant to 5 U.S.C. § 553 and 10 C.F.R. 2.800-804, to exercise its rulemaking authority for the purpose of amending its regulations governing safeguards for shipments of spent nuclear fuel (SNF) against sabotage and terrorism. Specifically, Petitioner requests that the following regulations be amended:

- (1) Design Basis Threat: "Radiological Sabotage" (10 C.F.R. 73.1(a)(1));
- (2) Definitions: "Radiological Sabotage" (10 C.F.R. 73.2);
- (3) General Requirements: Advance Approval of Routes (10 C.F.R. 73.37(b)(7));
- (4) General Requirements: Planning and Scheduling (10 C.F.R. 73.37(b)(8));
- (5) Shipments by Road (10 C.F.R. 73.37(c)); and
- (6) Shipments by Rail (10 C.F.R. 73.37(d)).

Petitioner further respectfully requests and petitions the Commission, in support of the aforementioned rulemaking to amend safeguards regulations, to conduct a comprehensive assessment of the consequences of terrorist attacks that have the capability of radiological sabotage, including attacks against transportation infrastructure used during nuclear waste shipments, attacks involving capture of nuclear waste shipments and use of high energy explosives against a cask or casks, and direct attacks upon a nuclear waste shipping cask or casks using antitank missiles or other military weapons.

I. PROPOSED AMENDMENTS TO EXISTING REGULATIONS

Petitioner believes that the Commission should amend the current safeguards regulations in order to better deter, prevent, and mitigate the consequences of any attempted radiological sabotage against shipments of spent nuclear fuel (SNF). The Commission last publicly addressed the consequences of terrorist attacks on SNF shipments and the adequacy of its safeguards regulations in 1984. Petitioner is submitting an overview of the Commission's safeguards regulatory activities since 1979, and an analysis of the Commission's 1984 proposed rule. See Attachment A, Robert J. Halstead and David J. Ballard, *Nuclear Waste Transportation Security and Safety Issues: The Risk of Terrorism and Sabotage Against Repository Shipments* at 23-30 and Appendix B (October 1997).¹ Petitioner believes that a general strengthening of the regulations intended to safeguard SNF shipments is necessary because of new developments in two critical areas since 1984: (1) changes in the nature of the terrorist threat; and (2) increased vulnerability of shipping casks to terrorist attacks involving high-energy explosive devices.

A. Reexamine the Design Basis Threat: "Radiological Sabotage"

The Commission should reexamine the design basis threat used to design safeguards systems to protect shipments of SNF against acts of radiological sabotage. Current regulations require licensees to design safeguards systems which can protect shipments against attacks involving several well-trained and dedicated individuals, hand-held automatic weapons, a four-wheel drive land vehicle, and hand-carried equipment, including incapacitating agents and explosives. (10 C.F.R. 73.1(a)(1)(i)) The regulations also specify that the attackers may receive insider (employee) assistance (10 C.F.R. 73.1(a)(1)(ii)) and utilize a four-wheel drive land vehicle bomb (10 C.F.R. 73.1(a)(1)(iii)).

Petitioner requests that the Commission clarify the meaning of "hand-carried equipment" within the current design basis threat. Section 73.2 does not provide a definition of "hand-carried equipment." Petitioner believes that the definition of hand-carried equipment, in the hands of several well-trained attackers, using a four-wheel drive vehicle to carry their equipment, includes (but is not limited to) the following explosive devices identified in Attachment A: (1) one or more large military demolition devices, such as the U.S. Army M3A1 shaped charge weighing 40 pounds; (2) a significant quantity (limited only by the carrying capacity of the vehicle) of commercial explosives packaged in crates, boxes, suitcases, or other hand-carried containers; and (3) numerous man-portable antitank weapon systems such as the Carl Gustav M2 recoilless gun (weight 15 kg), the Milan antitank missile (weight 32 kg), and the infantry version of the TOW 2 antitank missile (weight 116 kg with tripod launcher).

Petitioner further requests that the Commission, as part of a comprehensive reassessment of the consequences of terrorist attacks, consider amending the design basis threat to include use of explosive devices and other weapons larger than those commonly considered to be hand-carried or hand-held, and the use of vehicles other than four-wheel drive civilian land vehicles. Well-trained and dedicated adversaries could conceivably obtain and use military attack vehicles or military aircraft armed with bombs, missiles, or other powerful weapons. The possibility of attacks involving stolen or otherwise diverted military weapons systems should be given special consideration considering the number and nature of military

installations in Nevada and along the transportation corridors to Nevada.

B. Reexamine the Definition of "Radiological Sabotage"

The Commission should reexamine the definition of "radiological sabotage." Current regulations define "radiological sabotage" as any deliberate act "which could directly or indirectly endanger the public health and safety by exposure to radiation." (10 C.F.R. 73.2) Petitioner requests that the Commission clarify the definition of "radiological sabotage." Petitioner believes that the wording "could directly or indirectly endanger" implies a judgment by the Commission regarding the consequences of the action, as opposed to the intentions of the individuals carrying out the action. Actions against SNF shipments which are intended to cause a loss of shielding or a release of radioactive materials should be included in the definition of "radiological sabotage" regardless of the success or failure of the action.

Petitioner also believes that the definition of "radiological sabotage" should be amended to explicitly include deliberate actions which cause, or are intended to cause economic damage or social disruption regardless of the extent to which public health and safety are actually endangered by exposure to radiation. An incident involving an intentional release of radioactive materials, especially in a heavily populated area, could cause widespread social disruption and substantial economic losses even if there were no immediate human casualties and few projected latent cancer fatalities. Local fears and anxieties would be amplified by national and international media coverage. Adverse economic impacts would include the cost of emergency response, evacuation, decontamination and disposal; opportunity costs to affected individuals, property-owners, and businesses; and economic losses resulting from public perceptions of risk and stigma effects.

C. Reexamine Requirements for Advance Approval of Routes.

The Commission should reexamine its regulations requiring advance approval of routes. The current regulations require Commission approval of the routes to be used for road and rail shipments of SNF. (10 C.F.R. 73.37(b)(7)) Advance route approvals are part of a safeguards system designed to "[m]inimize the possibilities for radiological sabotage of spent fuel shipments, especially within heavily populated areas" (10 C.F.R. 73.37(a)(1)(i)) In 1980, the Commission issued a regulatory guidance document which identified five types of route characteristics that receive special consideration when the Commission staff reviews requests for route approval: (1) routes through highly populated areas; (2) routes which would place the shipment or the escort vehicle in a significantly tactically disadvantageous position (for example, tunnels which would prevent the escort vehicle from maintaining continuous surveillance of the shipment vehicle); (3) routes with marginal safety design features (for example, two-lane routes, absence of guard rails, etc.); (4) routes with limited rest and refueling locations; and (5) routes where responses by local law enforcement agencies, when requested, would not be swift or timely.²

Petitioner believes that the Commission should thoroughly reexamine its advance route approval requirements, in light of the expected dramatic increase in SNF shipments once a

Federal repository or interim storage facility begins operations. Neither the current physical protection regulations, nor the U.S. Department of Transportation's routing regulations, require shippers and carriers to minimize shipments through highly populated areas. Since 1979, the Commission has approved many highway routes through heavily populated areas, including I-15 through Las Vegas and I-80 through Reno-Sparks.³ A transportation risk assessment recently published by the Commission assumes that tens of thousands of truck shipments to a repository at Yucca Mountain could travel through Las Vegas and other heavily populated areas of Clark County, Nevada.⁴

Moreover, neither the current physical protection regulations, nor any of the U.S. Department of Transportation's routing regulations, require shippers and carriers to follow the Commission's route selection criteria as set forth in NUREG-0561. The U.S. Department of Energy is currently evaluating highway and rail routes to Yucca Mountain which do not comply with the Commission's route selection criteria. The Petitioner is submitting an analysis of highway and rail routes currently under consideration in Attachment B, Planning Information Corporation, *The Transportation of Spent Nuclear Fuel and High-Level Waste: A Systematic Basis for Planning and Management at National, Regional, and Community Levels* at 43-100 (September 10, 1996).⁵ Attachment A identifies Nevada highway and rail routes currently under consideration which include tunnels, steep grades, sharp curves and other features that would place shipments or escorts in tactically disadvantageous positions; routes with marginal safety design features; routes with limited rest and refueling locations; and routes with a low likelihood of swift local law enforcement agency response. Attachment A at 10-22.

Petitioner requests that the Commission, as part of a comprehensive reassessment of the consequences of terrorist attacks, consider amending the advance route approval requirements. The Petitioner believes that the Commission should specifically require shippers and carriers to identify primary and alternative routes which minimize highway and rail shipments through heavily populated areas. Petitioner also believes the Commission should adopt the route selection criteria in NUREG-0561 as part of the regulations, and specifically require shippers and carriers to minimize use of routes which fail to comply with the route selection criteria.

D. Amend Escort Requirements for Shipments by Road

The Commission should reexamine its regulations requiring armed escorts for SNF shipments by road. The current regulations establish one armed escort standard for shipments "within a heavily populated area" (10 C.F.R. 73.37(1)) and a lesser escort standard for shipments "not within any heavily populated area." (10 C.F.R. 73.37(2)) For purposes of regulating SNF shipments, the Commission designates heavily populated areas as urbanized areas having a population of 100,000 or more persons, based on population data and boundaries determined by the Bureau of the Census. "A shipment within three miles of the boundary of a designated urbanized area, or located anywhere within a designated urbanized area, is considered to be within a heavily populated area."⁶

The current regulations require that for road shipments within heavily populated areas, the

transport vehicle must be:

(i) occupied by at least two individuals, one of whom serves as escort, and escorted by an armed member of the local law enforcement agency in a mobile unit of such agency; or (ii) led by a separate vehicle occupied by at least one armed escort, and trailed by a third vehicle occupied by at least one armed escort. (10 C.F.R. 73.37(1))

Petitioner requests that the Commission amend its regulations to eliminate the differential armed escort requirements based on population. The current requirement for shipments within a heavily populated area should be uniformly applied to all road shipments. As a matter of equity, Petitioner believes that residents of small cities, towns, and rural areas along shipment routes are entitled to the same level of protection as residents of heavily populated areas. As a practical matter, there are many Nevada locations outside of designated heavily populated areas with significant population concentrations within one-half mile of a potential SNF shipment route. Many difficult-to-evacuate facilities, such as schools, hospitals, industrial plants, shopping centers, hotels, and resorts, are located immediately adjacent to potential truck shipment routes in small cities and towns. Several major water supplies and outdoor recreation facilities with high seasonal population densities are located in close proximity to potential truck shipment routes in rural Nevada.

Petitioner further requests that the Commission, as part of a comprehensive reassessment of the consequences of terrorist attacks, consider increasing the armed escort requirements for truck shipments. Petitioner believes that new, high-capacity, legal-weight truck SNF shipping cask designs may be particularly vulnerable to attacks involving high-energy explosive devices. At a minimum, the Commission should consider requiring at least one armed escort each in a lead vehicle and a chase vehicle, with one escort being a state or local law enforcement officer. The Commission's consequence assessment should evaluate the advantages and disadvantages of requiring the same level of protection provided for truck shipments of strategic special nuclear materials, seven armed escorts in two escort vehicles (10 C.F.R. 73.26(i)).

E. Amend Escort Requirements for Shipments by Rail

The Commission should reexamine its regulations requiring armed escorts for SNF shipments by rail. The current regulations establish one escort standard for shipments "within a heavily populated area" (10 C.F.R. 73.37(d)(1)) and a lesser escort standard for shipments "not within any heavily populated area." (10 C.F.R. 73.37(d)(2)) For purposes of regulating SNF shipments, the Commission designates heavily populated areas as urbanized areas having a population of 100,000 or more persons, based on population data and boundaries determined by the Bureau of the Census. "A shipment within three miles of the boundary of a designated urbanized area, or located anywhere within a designated urbanized area, is considered to be within a heavily populated area."⁷

The current regulations require that for rail shipments within heavily populated areas, the shipment car must be: "accompanied by two armed escorts (who may be members of a local law enforcement agency), at least one of whom is stationed at a location on the train that will

permit observation of the shipment car while in motion." (10 C.F.R. 73.37(d)(1))

Petitioner requests that the Commission amend its regulations to eliminate the differential armed escort requirements for rail shipments based on population. The current requirement for shipments within a heavily populated area should be uniformly applied to all rail shipments. In Nevada and other western states, many small cities and towns grew up around rail lines and rail service facilities. In these communities, there are significant population concentrations within one-half mile of a potential SNF rail shipment route. In Nevada and other western states, mainline railroads are frequently located in river valleys near major water supplies. Additionally, mainline railroads of national economic significance may, in-and-of themselves, be as attractive targets for terrorists as heavily populated areas. The Union Pacific Salt Lake City-Los Angeles mainline through southern Nevada, potentially the primary shipment route to Yucca Mountain, is a rail route of national economic significance.

Petitioner further requests that the Commission, as part of a comprehensive reassessment of the consequences of terrorist attacks, consider substantially increasing the armed escort requirements for rail shipments. Petitioner believes that new, high-capacity (125 ton) rail shipping cask designs may be particularly vulnerable to attacks involving antitank missiles, and that armed escorts aboard the train could be incapacitated at the beginning of an attack, or as a result of train derailment. At a minimum, the Commission should consider requiring at least two armed escorts in an escort vehicle, in addition to the two armed escorts aboard the train.

Based on recent experience during the foreign research reactor SNF shipments through Nevada, Petitioner believes the Commission should also consider requiring continuous, real-time aircraft surveillance along certain rail route segments through rough terrain and through heavily populated areas. The Commission's consequence assessment should evaluate the advantages and disadvantages of requiring a level of protection comparable to that provided for rail shipments of strategic special nuclear materials, seven armed escorts (10 C.F.R. 73.26(k)), stationed in a variety of configurations aboard the train and in one or more escort vehicles.

F. Adopt Additional Planning and Scheduling Requirements

The Commission should adopt additional planning and scheduling requirements for the physical protection of SNF shipments based on the precautions already applied to shipments of special nuclear materials. The current regulations for shipments of special nuclear materials require:

Shipments shall be scheduled to avoid regular patterns and preplanned to avoid areas of natural disaster or civil disorders, such as strikes or riots. Such shipments shall be planned in order to avoid storage times in excess of 24 hours and to assure that deliveries occur at a time when the receiver at the final delivery point is present to accept the shipment. (10 C.F.R. 73.26(b)(1))

Petitioner requests that the Commission, as part of a comprehensive reassessment of the

consequences of terrorist attacks, consider amending the general requirements for physical protection of irradiated reactor fuel in transit (10 C.F.R. 73.37(b)) by adopting the same planning and scheduling requirements for special nuclear material in transit.

G. Amend Regulations To Require That All Rail Shipments Be Made In Dedicated Trains

The Commission should amend its regulations for shipments by rail (10 C.F.R. 73.37(d)) to require that all rail shipments of SNF be made in dedicated trains. Considering the potential large number of cross-country rail shipments to a repository and/or storage facility, more than 12,000 rail cask shipments of SNF and more than 1,000 rail cask shipments of HLW, Petitioner believes that the performance objectives set forth in 10 C.F.R. 73.37(a)(1) can only be met by requiring all rail shipments to be made in dedicated trains. Petitioner further requests that the Commission, as part of a comprehensive reassessment of the consequences of terrorist attacks, consider the physical protection implications of shipping SNF in dedicated trains compared to general rail freight service.

Petitioner, along with other stakeholders including the Association of American Railroads, has long advocated mandatory use of dedicated trains for all rail shipments of SNF in order to promote safety and security. The U.S. Nuclear Waste Technical Review Board recently stated: "One possible approach to maximizing safety and to preventing undue burdens on the nationwide railroad network could be the use of dedicated trains for transporting spent nuclear fuel."⁸ While continuing to believe that use of dedicated trains should be mandatory, Petitioner acknowledges arguments that dedicated trains may pose certain disadvantages from a physical protection standpoint. For example, dedicated trains may facilitate target tracking and attack scheduling by potential adversaries, and multiple casks in a short train may facilitate target selection and weapon delivery. The Commission's consequence assessment should evaluate the advantages and disadvantages of shipping SNF in dedicated trains, assuming both current and enhanced requirements for rail shipment armed escorts.

H. Conduct A Comprehensive Assessment Of The Consequences Of Terrorist Attacks That Have The Capability Of Radiological Sabotage

Petitioner further respectfully requests and petitions the Commission to conduct a comprehensive assessment of the consequences of terrorist attacks that have the capability of radiological sabotage, including attacks against transportation infrastructure used during nuclear waste shipments, attacks involving capture of a nuclear waste shipment and use of high energy explosives against a cask or casks, and direct attacks upon a nuclear waste shipping cask or casks using antitank missiles or other military weapons. Petitioner is submitting a recommended general approach for conducting such an assessment in Attachment A at 31-48. Petitioner is submitting specific guidelines for assessing the consequences of terrorist attacks employing antitank weapons in Attachment A at 49-71.

II. GROUNDS AND INTEREST

Petitioner State of Nevada (Nevada) has been, and will likely continue to be, a corridor state for spent nuclear fuel (SNF) shipments. Nevada has been a destination and origin state for

SNF shipments to and from federal research facilities. As the potential host state for a federal geologic repository and/or interim storage facility, Nevada would be the ultimate destination for the entire nation's SNF and high-level radioactive waste (HLW). Nevada has an interest in protecting its citizens from risks associated with the transportation of SNF and HLW. Nevada also has an interest, as the entity responsible for immediate emergency response, in ensuring that transporters of spent nuclear fuel have adequately prepared for potential emergencies. Nevada is particularly concerned about the physical protection of shipments of SNF under the Commission's regulations at 10 C.F.R. Part 73.

Between 1964 and 1998, Nevada was traversed by approximately 321 truck shipments and 16 rail shipments of civilian SNF to and from nuclear reactor sites, research facilities, and interim storage facilities.⁹ Nevada will likely continue to be a corridor state for SNF shipments to and from the Idaho National Engineering Laboratory. Nevada would also likely be traversed by SNF shipments to and from the Private Fuel Services storage facility proposed for the Skull Valley Goshute Reservation in Utah.

Petitioner's primary interest is the potential for many thousands of SNF and HLW shipments to Yucca Mountain and the Nevada Test Site. The Nuclear Waste Policy Amendments Act (NWPAA) designated Yucca Mountain as the only site to be characterized for a national geologic repository for SNF and HLW. Legislation pending in Congress would designate the Nevada Test Site as sole location for a centralized interim storage facility. According to a study prepared for the Nevada Agency for Nuclear Projects, the base case projection for repository transportation requirements is 20,200 shipments (13,900 rail/6,300 truck) over about 30 years. The same study projected 56,600 to 104,500 shipments over 40 years, for a repository combined with an interim storage facility. See Attachment B at 61-4. A recent study prepared for the Commission estimated 50,000 to 75,000 shipments to Yucca Mountain if all civilian SNF were transported by truck.¹⁰

While repository shipments are not scheduled to begin until 2010 or later, the U.S. Department of Energy (DOE) has already begun planning for transportation to a repository at Yucca Mountain. DOE plans to release a draft EIS addressing transportation risks and impacts in July, 1999. Cross-country SNF shipments to Nevada could begin as early as 2004 if Congress enacts interim storage facility legislation.

Under the NWPAA, DOE is responsible for the transportation of SNF and HLW from more than 80 generator and storage sites to the repository. Once repository and/or storage facility operations begin, DOE shipments of SNF and HLW will impact more than 40 states, dozens of Indian nations, and hundreds of cities and local governments. For the first time in its history, DOE will ship SNF and HLW as a fully regulated licensee of the Commission. The NWPAA specifically requires that DOE transport SNF and HLW in accordance with the Commission's regulations promulgated under 10 C.F.R. parts 71 and 73. Petitioner Nevada is particularly concerned about the physical protection of DOE shipments of SNF under the Commission's regulations at 10 C.F.R. part 73.

Spent nuclear fuel shipments to a geologic repository and/or centralized interim storage facility will be dramatically different from past shipments in the United States. See

Attachment A at 18-22. Petitioner Nevada believes the following differences, discussed in detail in Attachment A, will create greater opportunities for terrorist attacks and/or sabotage against SNF shipments, and may also increase the consequences of any incidents which occur:

- (a) long-duration, highly visible, nationwide shipping campaign;
- (b) regular and predictable shipments, to a single destination;
- (c) large increase in amount of spent fuel shipped, and increased numbers of truck and rail shipments annually, averaging several cask shipments per day, every day, for 30 years;
- (d) substantial increase in number of active routes and average shipment distances, with potential implications for selection of targets and attack locations;
- (e) significant concentration of shipments along certain highway and rail routes west of the Mississippi River, with implications for shipments through heavily populated areas (HPAs) and through locations which place shipments in significantly disadvantageous tactical positions; and
- (f) potential use of routes within Nevada with marginal safety design features, limited rest and refueling locations, and low likelihood of swift local law enforcement agency response.

Petitioner believes that a national repository or interim storage facility may have a greater symbolic value to terrorists as a target for attack than current at reactor storage facilities, and that the enhanced symbolic value of the facility as a target may extend to SNF shipments to such a facility. In its review of national storage and disposal policy options, the U.S. Nuclear Waste Technical Review Board (NWTRB) observed that compared to reactor sites "a single facility with a large stockpile of spent fuel might be a more tempting and visible target."¹¹ Petitioner concurs with the NWTRB conclusion that more analyses are needed to determine if "either an at-reactor or centralized storage facility would be more exposed to theft or sabotage," and that such analyses should also consider SNF shipments to a centralized facility. Petitioner requests that the Commission consider this issue in rulemaking.

Petitioner further believes that a storage or disposal facility operated by DOE, the U.S. government agency responsible for producing nuclear weapons, may have greater symbolic value to terrorists as a target for attack than commercial storage facilities, and that the enhanced symbolic value may extend to DOE's shipments of SNF and HLW to such a facility. In the mid-1980s, DOE's Inspector General commissioned two studies of potential terrorist threats against DOE nuclear facilities and programs. Both reports, prepared for DOE by the Rand Corporation and published in 1986, identified potential domestic and foreign threats to DOE nuclear facilities, and recommended continued safeguards vigilance and further studies.

The first study concluded:

With their greater resources and lesser political concerns, state-sponsored terrorist groups could constitute a significant danger to nuclear weapons sites. This not to say that the threat from domestic terrorist groups is negligible. On the basis of past modus operandi, targeting, motivation, and mindset, Islamic fanatics, right-wing terrorists, left-wing terrorists, and Puerto Rican separatists could conceivably attack a nuclear installation.¹²

The subsequent reassessment concluded:

Increased visibility of American nuclear programs could make them inviting targets for disruptive and destructive missions. The increased resources of state-sponsored terrorists (and the concomitant use by states of terrorists as instruments of national policy) should alert policy makers against any relaxation of the safeguards regimen. Renewed analysis of nuclear safeguards should be actively considered, even though current trends do not indicate any immediate or pressing danger.¹³

Petitioner believes that DOE SNF facilities and shipments may be peculiarly attractive targets to a wide range of enemies of the United States, and requests that the Commission consider this issue in rulemaking.

III. STATEMENT IN SUPPORT OF PETITION

A. Request for Amendments to Current Regulations

Petitioner believes that the Commission should amend the current safeguards regulations in order to better deter, prevent, and mitigate the consequences of any attempted radiological sabotage against shipments of spent nuclear fuel. The Commission last publicly addressed the consequences of terrorist attacks on SNF shipments and the adequacy of its safeguards regulations in 1984. The Petitioner believes that a general strengthening of the regulations intended to safeguard SNF shipments is necessary because of new developments in two critical areas since 1984: (1) changes in the nature of the terrorist threat; and (2) increased vulnerability of shipping casks to terrorist attacks involving high-energy explosive devices.

1. **Changes in the nature of the terrorist threat.** The nature of the terrorist threat has changed significantly since the Commission last evaluated the adequacy of its SNF transportation safeguards regulations. In the decade and a half since 1984, three major changes have occurred in the nature of the terrorist threat that argue for a strengthening of the safeguards regulations: (1) the increasing lethality of terrorist attacks in the United States; (2) an increase in serious terrorist attacks and threats against transportation systems; and (3) renewed concerns about nuclear terrorism generally, and specifically, terrorist actions involving potential radioactive contamination.¹⁴

The lethality of terrorist intentions was generally down played at the time the Commission last publicly considered the consequences of a terrorist attack on a spent fuel shipment. A

1980 contractor study prepared for the Commission reported:

Pronuclear activists and the nuclear industry believe radioactive materials, in general, are highly overrated as targets for acts of sabotage to produce widespread death and destruction or for acts of theft for purposes of weapons fabrication. A crude nuclear device requires technical expertise to construct, which is usually not available in today's terrorist organizations. Such terrorist groups would find it easier to try to disperse radioactive materials through other means, such as by dynamite. Still, it has not been the pattern of terrorist groups in the past to kill large numbers of people or to cause large numbers of lingering deaths. Terrorist groups have typically used violent means to make a political statement. "Terrorists want a lot of people watching, not a lot of people dead."¹⁵

During the past few years, however, the willingness of terrorists to kill large numbers of Americans has been demonstrated in the World Trade Center and Oklahoma City bombings. The Federal Bureau of Investigation (FBI) reported in 1995: "In the past year, the country witnessed the re-emergence of spectacular terrorism with the Oklahoma City bombing. Large-scale attacks designed to inflict mass casualties appear to be a new terrorist method in the United States." The Oklahoma City bombing reflected a "general trend in which fewer attacks are occurring in the United States, but individual attacks are becoming more deadly." The FBI voiced concern about terrorist interest in advanced technologies and improving terrorist capabilities regarding electronic communications, computer databases, and analysis of past events which "could prompt future terrorists to plan their attacks with greater care." The FBI also noted "a chilling trend" in continued terrorist interest in unconventional weapons such as biological agents, concluding that "terrorists and other criminals may consider using unconventional weapons in an attack here sometime in the future."¹⁶ The willingness of terrorists to kill or injure large numbers of Americans, demonstrated in the World Trade Center and Oklahoma City bombings, compels a focus on incidents which are clearly intended to cause, or could cause, radiological sabotage.

One of the most comprehensive recent terrorism studies, *America's Achilles Heel* by Falkenrath, Newman, and Thayer, attributes the increasing lethality of attacks to increased terrorist activity by "violent non-state actors:"

Terrorist groups and most other non-state actors have historically had little interest in killing large numbers of people with their attacks, and for many non-state actors, the reasons for this aversion will remain compelling. Nonetheless, non-state violence appears to be growing more lethal: mass-casualty terrorist attacks are becoming more frequent, and the percentage of attacks that result in fatalities is increasing. The best explanation for this trend is that there are increasing numbers of violent non-state actors for whom the logic of limited lethality applies only weakly, such as fanatical religious groups and cults, anti-American Islamic extremists in the Middle East, right-wing chauvinists, and loosely affiliated terrorists who lack the traditional concern with group preservation.¹⁷

Terrorism threats against transportation systems have increased since the Commission's 1984 consequence assessment. The FBI reported in 1996:

Recently, terrorist attacks against aircraft and other transportation facilities, both here in the United States and abroad, have taken a disturbing upswing. Examples include the conspiracy by Ramzi Ahmed Yousef and others to bomb U.S. airliners in Asia in 1994; the derailment of an Amtrak passenger train near Hyder, Arizona, in October 1995, which killed 1 and injured 78; and the bombing of the World Trade Center in February 1993, which substantially damaged the Port Authority Transportation and Housing Railway Line. The latter is a major commuter line running from New Jersey to New York City. At one point, it passes through the parking garage of the World Trade Center Complex, where the 1,200-pound urea nitrate bomb detonated. Less than four months later, a group of followers of Shaykh Omar Abdel Rahman planned to use explosives to unleash a campaign of terror in New York City. Their targets included the Lincoln and Holland Tunnels, major arteries into and out of New York City. Obviously, the worldwide terrorist threat to aviation and transportation systems still exists, both within the United States and outside.¹⁸

The George Washington Bridge on Interstate 95 was one of the facilities targeted for bombing by the followers of Sheik Omar Abdel Rahman. The George Washington Bridge is a major gateway from Manhattan, Long Island, and New England into New Jersey for trucks traveling I-95 to the South and I-80 to the West, and has previously been used for truck shipments of irradiated reactor fuel and plutonium from Brookhaven National Laboratory to the Savannah River Plant in South Carolina. The George Washington Bridge could potentially be used for truck shipments of spent fuel from Connecticut reactors to a storage or disposal site in Nevada. Attachment A at 40-41.

Lessons learned from the 1995 Arizona derailment and previous incidents of rail sabotage, and from the Abdel Rahman transportation terrorism prevention, include four findings about the intentions and capabilities of potential adversaries: (1) their willingness to attack trains, bridges, and tunnels without warning shows a willingness if not an intention to kill, maim, and terrify tens to hundreds of people at a time; (2) their technical expertise in planning their attacks, at least in the case of the rail sabotage events, may be sufficient to defeat existing warning systems; (3) their ability to cause accident conditions such as 50 mph collisions and 30 foot drops, demonstrates their ability to at least challenge the containment performance standards of NRC-certified shipping containers; and (4) attacks on infrastructure may be carried out with use of homemade explosives and do not require the procurement of exotic weapons to be successful. Attachment A at 41-42.

Concerns about nuclear terrorism generally have increased significantly since the early 1990s. Recent threat assessments have addressed potential terrorist use of nuclear weapons, potential terrorist actions to disperse radioactive contamination using so-called "radiological weapons," and reactor sabotage.¹⁹ Indeed, the Commission responded to similar concerns by adopting new safeguards regulations in 1994 to protect commercial nuclear reactors from attacks using truck bombs.

The U.S. Interagency Counterproliferation Program Review Committee (CPRC) 1997 Report to Congress summarized potential threats resulting from terrorist acquisition of nuclear weapons and dispersal of radioactive materials utilizing conventional weapons. Based on

extensive literature reviews, the CPRC concluded:

[N]on-fissile radioactive materials dispersed by a conventional explosive or even released accidentally could cause damage to property and the environment, and cause social, political, and economic disruption. Examples of non-fissionable, radioactive materials seen in press reports are cesium-137, strontium-90, and cobalt-60. These cannot be used in nuclear weapons but could be used to contaminate water supplies, business centers, government facilities, or transportation networks. Although it is unlikely they would cause significant numbers of casualties, they could cause physical disruption, interruption of economic activity, and psychological trauma to the work force and general populace, and require some measure of post-incident cleanup.²⁰

Falkenrath, Newman, and Thayer conclude similarly:

The simplest radiological weapon would consist of a conventional explosive surrounded by a quantity of any radioactive material. Crude radiological weapons are far more accessible than nuclear weapons, and are therefore more likely to be used by non-state actors. However, although a radiological weapon could contaminate an area and be costly to clean up, building and using such a weapon is not an easy way to produce mass casualties. Large quantities of highly radioactive material would generally be needed to produce strong effects over even a moderate area. Obtaining and working with large amounts of such materials would be challenging because of the high radiation levels involved. Due to widespread public fear of radiation, however, a radiological attack might trigger panic and social and economic disruption out of proportion with its real destructiveness.²¹

According to the CPRC, there have been threats but no actual radiological contamination incidents by terrorist groups to date. In 1995, Chechen insurgents threatened to turn Moscow into an "eternal desert" by dispersing cesium-137.

The Chechens directed a Russian news agency to a small amount of cesium-137 in a shielded container in a Moscow Park which the Chechens claimed to have placed there. Government spokesmen told the press that the material was not a threat, and would have to have been dispersed by explosives to be dangerous. According to DoD assessments, there was only a very small quantity of cesium-137 in the container. If it had been dispersed with a bomb, an area of the park could have been contaminated with low levels of radiation. This could have caused disruption to the populace, but would have posed a minimal health hazard for anyone outside the immediate blast area.²²

The CPRC also noted that the Japanese Aum Shinrikyo cult "which twice attacked Japanese civilians with deadly sarin nerve gas, also tried to mine its own uranium in Australia and to buy Russian nuclear warheads."²³

On March 2, 1999, Secretary of Energy Bill Richardson began his speech to the National Press Club by disclosing a previously unreported threat:

The FBI receives word of a phone threat that radioactive material is aboard an AMTRAK

train in Montana and that its passengers are in danger. Within hours, specialists including the Department of Energy's Nuclear Emergency Search Team arrive. Both the eastbound and westbound trains are diverted to a lonely stretch of track and searched for a potential killer. This is not a plot twist in a Tom Clancy thriller nor a figment of a Hollywood screenwriter's imagination. This incident occurred February 20th, aboard the Empire Builder in central Montana. No radioactive material was found. No one was injured. This time.²⁴

To Petitioner's knowledge, only two threats against spent fuel shipments have been reported in the United States since 1984. In November, 1984, Northern States Power (NSP) began shipping spent fuel from the Monticello reactor north of the Twin Cities to the General Electric storage facility at Morris, Illinois. On February 4, 1985, NSP corporate headquarters received a telephone threat warning that a group of anti-nuclear protesters would use a small airplane to stop a train carrying spent fuel from Monticello to Morris.²⁵ On October 27, 1986, a person or persons unknown removed a 39-foot long section of rail along the Burlington Northern route used for these shipments in Golden Valley, Minnesota.²⁶ Near the tracks authorities found a sign reading "Stop Rad-Waste Shipments." This incident did not result in damage to the train transporting spent fuel. However, a Burlington Northern train hauling lumber, scheduled immediately prior to a train transporting spent fuel from Monticello, derailed at the site of the sabotage. The initial investigation focused on anti-nuclear activists and disgruntled railroad employees. Attachment A at 37-9

The October, 1986 apparent attempted sabotage of a spent fuel shipment has not been studied in detail. The incident is not reported in the relevant volume of the Commission's *Safeguards Summary Event List* (SSEL). The omission of this incident is curious because Governor Tony Earl of Wisconsin, a state along the route, formally notified the Chairman of the Commission of his concerns about the reported sabotage incident and requested specific regulatory and investigative actions by the Commission.²⁷ The omission of the incident from the SSEL is incongruous considering that the SSEL does report the February 4, 1985 telephone threat.²⁸ Petitioner Nevada believes the 1986 Minnesota incident is evidence of a credible risk of terrorism or sabotage against nuclear waste shipments, specifically damage to transportation infrastructure with the intent of causing an accident, although there is no clear evidence that the perpetrators intended to damage the shipping casks or cause a release of radioactive materials. Attachment A at 37-9.

Falkenrath, Newman, and Thayer point out: "The absence of attacks can be mistaken for the absence of vulnerability, since both have identical manifestations."²⁹ Petitioner Nevada believes that the threat of a terrorist attack on a spent fuel shipment capable of causing radiological sabotage should be considered credible, even though no such attacks have occurred. Petitioner requests that the Commission judge the potential threat to spent fuel shipments by the same standard it applied in adopting additional safeguards regulations to protect reactors from truck bomb attacks:

NRC has concluded there is no indication of an actual vehicle threat against the domestic commercial nuclear industry. However, based on recent events, NRC believes that a vehicle intrusion or bomb threat to a nuclear power plant could develop without warning in the future. To maintain a prudent margin between what is the current threat estimate (low) and

the design basis threat (higher), NRC is amending 10 C.F.R. 73 to modify the design basis threat for radiological sabotage to include protection against malevolent use of vehicles at nuclear power plants.³⁰

2. Increased vulnerability of shipping casks to terrorist attacks involving high-energy explosive devices. Developments in two related areas have increased the vulnerability of spent fuel shipping casks to terrorist attacks involving high-energy explosive devices since the Commission last evaluated the adequacy of its SNF transportation safeguards regulations. First, the capabilities and availability of explosive devices, especially antitank weapons, have increased significantly. Second, new spent fuel shipping cask designs, developed to increase payloads without exceeding specified weight limits, appear to be more vulnerable to attacks involving past, current, and future weapons systems and commercial explosives. These developments argue for a strengthening of the safeguards regulations.

Portable antitank weapons have become more powerful, more reliable, and more available worldwide since the early 1980s. This development is documented in Attachment A at 49-63.³¹ Publicly available performance data on some of the better known antitank missiles is summarized in Attachment A, Table 5. Under the current design basis threat (10 C.F.R. 73.1(a)(1)(i)), Petitioner believes that the definition of hand-carried equipment, in the hands of several well-trained and dedicated attackers, using a four-wheel drive vehicle to carry their equipment, includes (but is not limited to) all of the weapons identified in Attachment A, Table 5.

Petitioner believes that most, if not all, of the antitank missiles identified have warheads capable of completely perforating a truck cask and its spent fuel cargo, and most are capable of deeply penetrating or completely perforating a rail cask and damaging the spent fuel inside. These weapons are designed to hit moving targets at a distance of 30 meters or more, eliminating the need to capture the cask, and facilitating selection of optimal attack times and locations. Portability of these weapons allows further flexibility in attack planning, including use of multiple warheads, and in escape planning. Many different types of antitank missiles are currently being produced, in many different countries, and in some instances, tens to hundreds of thousands of units of particular designs have been produced. Most older weapons have been used in battle, and newer versions have been extensively field tested. The limitations and deficiencies of specific weapons (such as backblast effects, operator error in guidance control, guidance system failure, fuse and warhead failure) are known, and can be factored into a consequence assessment. Given the general trend of improved armor penetration capability over the past four decades, it should be assumed that even more effective weapons will become available over the next four decades when repository shipments occur. Potential adversaries could obtain such weapons through a variety of channels, including terrorist state-sponsorship, purchase, theft, or blackmail. Attachment A at 50-7.

Under the current design basis threat for radiological sabotage, man-portable versions of the TOW or Milan missiles, or their equivalent, should be used as the reference weapon for terrorism consequence assessment. The reference weapon should be assumed hand-carried to and from the four-wheel drive vehicle, transported to or near the attack site by the reference

vehicle, operated by one to three persons, capable of firing up to three missiles, with a minimum range of 75 meters and a maximum range of 2,000. The reference weapon should be assumed capable of penetrating 25 to 40 inches of armor plate steel, with a hole diameter of 3 to 6 inches. A hit-probability of 90 percent or greater should be assumed. Attachment A at 59-63.

Petitioner believes that SNF shipping casks are vulnerable to attacks utilizing military and commercial explosives, particularly conical shaped charges. DOE sponsored tests in the early 1980s demonstrated that an attack on a truck cask using a large military shaped charge could result in a release of one percent of the SNF cargo. Commenting on those tests in response to the NRC's 1984 proposed reduction in transportation safeguards regulations, the Sierra Club Radioactive Waste Campaign took the position that terrorists might attack a cask more effectively with commercial explosives. "Sabotage of an irradiated fuel shipment could be relatively fast and simple, with explosive devices that are commercially available. Because of its long association with the military, Sandia Laboratories tested the military M3A1 shaped charge device, weighing 45 pounds." According to the Sierra Club reviewers:

[E]ffective devices weighing much less, on the order of 1 1/2 pounds are available. A conical-shaped charge, with an incendiary device, . . . would be much more effective. Such a device could pierce 14 inches of metal, thus entering and exiting a shipping cask. The interior of the cask could be heated to 1,649 degrees C. This would ignite the zirconium cladding, further raising the temperature until the oxygen in the cask were exhausted. These temperatures would vaporize certain of the radionuclides, such as cesium. These devices [conical shaped charges] are commercially available and in use in well-drilling, spaceship and other applications. . . . We therefore disagree with the NRC assumption that tens to hundreds of pounds of explosives are needed to disperse radioactivity from a shipping cask.³²

Petitioner believes that the threat described by the Sierra Club reviewers in 1984 has grown more urgent in the decade of the 1990s. Well-trained terrorists planning to capture, control, and directly attack spent fuel shipping casks are likely to use shaped charges as their weapon of choice. The technology of shaped charges and detonation systems, especially for applications in the construction and petroleum industries, and for specialized purposes such as military demining, have continued to evolve since the early 1980s. Numerous "off the shelf" military and commercial shaped charges weighing around one kilogram are capable of penetrating 10 to 20 inches of steel.³³ Shaped charges developed for use in oil and gas well perforating are particularly powerful, efficient, and stable.³⁴ Secular oil-producing regimes such as Iraq and theocratic oil states such as Iran would have ready access to commercial shaped charges, as would governments, groups and individuals in natural gas and petroleum production regions around the world.

Petitioner believes that terrorists planning to attack transportation infrastructure are likely to use commercial or homemade explosives, rather than military devices. Indeed, most illegal bombings in United States are committed by perpetrators using non-military explosives. The vast majority of commercial explosives sales are used in the mining industries, and the bulk of these sales involve unpackaged ammonium nitrate and related explosives.³⁵ Ammonium nitrate explosives could be used in a variety of ways to attack the transportation infrastructure

used for spent fuel shipments.

New spent fuel shipping cask designs. New spent fuel shipping cask designs, developed to increase payloads without exceeding specified weight limits, appear vulnerable to attacks involving current and future military weapons systems and commercial explosives. The casks used for shipments to a repository and/or interim storage facility shipments will have different design configurations and use different structural and shielding materials, compared to casks currently in use, and compared to the older casks which were assumed in the DOE and NRC sabotage consequence assessments in the early 1980s. Some of these differences may make them more vulnerable to attack with armor-piercing weapons or high-energy explosives.³⁶

The majority of truck shipments to a repository and/or storage facility will likely use the new General Atomics GA-4 and GA-9 legal-weight truck casks, or new high-capacity casks of similar design. The side-to-side width of the GA-4 is 37 inches, with a shell containing 2 inches of stainless steel, 2.6 inches of depleted uranium, and 4.5 inches of borated polypropylene. The GA-9 is 35 inches wide, with a shell containing slightly more stainless steel and slightly less depleted uranium. The Petitioner believes that either of these casks would be completely perforated by an attack utilizing the reference antitank weapon and by most of the military weapons and commercial explosives previously discussed. Moreover, the GA 4/9 designs differ from the casks assumed in previous DOE and NRC radiological sabotage consequence assessments in several respects: rounded square versus circular body, polypropylene neutron shielded versus steel shelled water jacket, and depleted uranium gamma shield versus lead gamma shield. The first two of these differences could result in even greater vulnerability to attack with the reference weapon. The elimination of the water jacket could result in a larger release of respirable particulates.

The majority of rail shipments to a repository and/or interim storage facility will likely use new high-capacity casks similar to the Nuclear Assurance Corporation NAC-TSC, the Holtec HI-STAR 100, or the DOE-proposed design for the large MPC Rail Transporter. The diameter of the NAC-TSC is about 96 inches, with a shell containing 4.1 inches of stainless steel, 3.7 inches of lead, and 5.5 inches of borated polypropylene. The diameter of the HI-STAR 100 is about 96 inches, with a shell containing about 7 inches of stainless steel, 2.5 inches of carbon steel, and 4.6 inches of Holite neutron absorber. The diameter of the large MPC transportation cask is 85 inches, with a shell containing 5.25 inches of stainless steel, 1.5 inches of depleted uranium, 0.5 inches of lead, and 6 inches of borated polypropylene. Petitioner believes that all three of these casks would be easily breached and deeply penetrated by an attack utilizing the reference antitank weapon and by most of the military weapons and commercial explosives previously discussed. Petitioner further believes that all three of these casks could be completely perforated by an attack utilizing the Milan or TOW antitank weapons. Moreover, the new rail cask designs differ from the casks assumed in previous DOE and NRC radiological sabotage consequence assessments in the use of polypropylene neutron shields versus steel shelled water jackets. The elimination of the water jackets could result in a larger release of respirable particulates.

Petitioner believes that a successful terrorist attack using large antitank missiles, such as the

Milan or TOW, or sufficient hand-carried quantities of commercial shaped charge explosives, against a GA-4 truck cask, would cause a release of radioactive materials at least equal to the one percent release demonstrated in the SANDIA full-scale test. A one percent release from a GA-4 cask loaded with reference 10-year cooled SNF would involve a source term of more than 8,000 curies, with fission products such as Sr-90, Cs-134, and Cs-137 constituting over a third of the total curies, and transuranic such as Pu-241 could constitute twenty percent or more. A one percent release from a large rail cask similarly loaded could involve more than 40,000 curies. Attachment A at 68-9. Petitioner is further concerned that a successful attack, especially on a GA-4 truck cask, could have far greater radiological consequences than those calculated in previous assessments due to: (1) a potentially larger percentage release of SNF; (2) a potentially higher percentage of respirable particulates and/or vaporized radionuclides; and (3) potentially more widespread dispersal and deposition because of complete cask body perforation, accompanying use of an incendiary device or multiple high-energy explosive devices, and a potential accompanying fire from combustion of the transport vehicle fuel supply or another fuel source. Petitioner requests that the Commission specifically consider these issues in rulemaking supported by a new consequence assessment.

B. Need for a Comprehensive Consequence Assessment

As documented in the foregoing sections of this petition, Petitioner Nevada is requesting that the Commission completely reexamine the issue of terrorism and sabotage against spent nuclear fuel and high-level radioactive waste shipments, in order to determine the adequacy of the current physical protection regulations under 10 C.F.R. 73, and in order to assist the DOE and the affected stakeholders in the preparation of a legally sufficient environmental impact statement as part of the NRC licensing process for a geologic repository or an interim storage facility. To accomplish this, the Commission should conduct a comprehensive assessment of the consequences of three types of attacks which have the potential for radiological sabotage: attacks against transportation infrastructure used by nuclear waste shipments, attacks involving capture of a nuclear waste shipment and use of high energy explosives against the cask, and direct attacks upon a nuclear waste shipping cask using antitank missiles. The consequence assessment for repository shipments should be based on program-specific and location-specific assumptions as outlined in Attachment A at 49-71, and should address the full range of impacts of a terrorism/sabotage event resulting in a release of radioactive materials: immediate and long-term implications for public health; environmental impacts, broadly defined; standard socioeconomic impacts, including cleanup and disposal costs and opportunity costs to affected individuals and business; and so-called special socioeconomic impacts, including individual and collective psychological trauma, and economic losses resulting from public perceptions of risk and stigma effects.

As part of its comprehensive reexamination of terrorism/sabotage consequences, the Commission should engage an independent technical organization with appropriate expertise to advise the Commission on two critical issues: (a) the need for physical testing, full-scale and/or scale model, to evaluate weapons capabilities, cask vulnerability to attack with high-energy explosive devices, and the response of spent nuclear fuel to such attacks (specifically, to determine fuel mass release from a cask, particle size distribution of released fuel, and

special concerns associated with volatile radionuclides such as Cs-134 and Cs-137); and (b) the appropriateness of existing computer models for evaluating near-site environmental dispersion of released radionuclides, resulting health effects, cleanup and disposal requirements, and economic costs.

The Commission should conduct its comprehensive reassessment of terrorism/sabotage consequences in a forum conducive to meaningful participation by all affected stakeholders. Commission should consider creation of a stakeholder advisory group to assist the Commission in this task.

The Commission should publish a full report on all unclassified findings of its consequence reassessment, regardless of whether the Commission determines that modifications are necessary to the physical protection regulations. The Commission should specifically avoid the approach followed in the 1984 proposed rulemaking, where stakeholders and the general public were never advised of the Commission's findings and conclusions.

As part of the comprehensive reassessment, the Commission should reevaluate the current definition of radiological sabotage used for determining inclusion of events in the Safeguards Summary Event List. Current practice apparently results in the omission of at least some potential threats from this important risk assessment and risk management data base.

IV. CONCLUSION

Based on the foregoing petition, Petitioner State of Nevada respectfully requests that the Commission exercise its rulemaking authority pursuant to 10 C.F.R. 2.800-2.804, by amending specific regulations enumerated herein governing safeguards for shipments of spent nuclear fuel against sabotage and terrorism. Further, Petitioner State of Nevada petitions the Commission to conduct a comprehensive assessment of the consequences of terrorist attacks that have the capability of radiological sabotage.

Petitioner submits that the foregoing regulatory amendments and the need for a comprehensive assessment are necessitated by changes in the nature of the terrorist threat and increased vulnerability of shipping casks to terrorist attacks involving high-energy explosive devices as set forth in the petition. In the interest of safeguarding the public health, safety and welfare, the State of Nevada urges the Commission to undertake the tasks outlined in the petition.

Dated this 22 day of June, 1999.

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Footnotes

1. Report prepared for Nevada Agency for Nuclear Projects, Carson City, Nevada
2. U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, *Physical Protection of Shipments of Irradiated Reactor Fuel: Interim Guidance*, NUREG-0561, Revision 1 Washington DC: U.S. Nuclear Regulatory Commission, June, 1980, at 20-5.
3. U.S. Nuclear Regulatory Commission, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, *Public Information Circular for Shipments of Irradiated Reactor Fuel*, NUREG-0725, Rev. 13, October, 1998, Washington DC US Nuclear Regulatory Commission at 3-9.
4. U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, § 6.3 - Transportation, Draft Report for Comment, NUREG-1437, Vol. 1, Addendum 1, 2-5 (February, 1999).
5. Report prepared for Nevada Nuclear Waste Project Office, Carson City, Nevada.
6. NUREG-0561, Rev. 1, p.8
7. NUREG-0561, Rev. 1, p.8.
8. *Report to the U.S. Congress and the Secretary of Energy* at 23 (January to December 1998).
9. U.S. Department of Energy, *Nevada Commercial Spent Nuclear Fuel Transportation Experience*, YMP/91-17, 5-7 (September 1991), U.S. Nuclear Regulatory Commission, Public Information Circular for Shipments of Irradiated Reactor Fuel, NUREG-0725, Rev. 13, 6-7, 20-21, (October 1998)). An unknown number of naval reactor SNF shipments traveled through Nevada during the same period.
10. U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, § 6.3 - Transportation, Draft Report for Comment, NUREG-1437, Vol. 1, Addendum 1, 2-5 (February, 1999).
11. *Disposal and Storage of Spent Nuclear Fuel - Finding the Right Balance: A Report to Congress and the Secretary of Energy* at 20 (March 1996).
12. Bruce Hoffman, *Terrorism in the United States and the Potential Threat to Nuclear Facilities*, prepared for the U.S. Department of Energy, Rand Publication Series, R-3351-DOE, at 53 (January 1986).
13. Bruce Hoffman, et al., *A Reassessment of Potential Adversaries to U.S. Nuclear Programs*, prepared for the U.S. Department of Energy, Rand Publication Series, R-3363-DOE, at 25-6 (March, 1986).
14. The following discussion is primarily based on, and documented in, Attachment A at 31 - 48; and James David Ballard, *A Preliminary Study of Sabotage and Terrorism as Transportation Risk Factors Associated with the Proposed Yucca Mountain High-Level Nuclear Waste Facility*, NWPO-TN-018-96, Published by State of Nevada Agency for Nuclear Projects, 9-24, 34-49 (September 1997).
15. C. Cluett, et al., *Identification and Assessment of the Social Impacts of Transportation of Radioactive Materials in Urban Environments*, Prepared by Battelle Human Affairs Research Centers, NUREG/CR-0744, Washington D.C.: U.S. Nuclear

- Regulatory Commission at 100 (July 1980).
16. Terrorist Research and Analytical Center, National Security Division, *Terrorism in the United States* : 1995, Washington DC: U.S. Department of Justice, Federal Bureau of Investigation at i,14-15 (no date).
 17. R.A. Falkenrath, R.D. Newman, and B.A. Thayer, *America's Achilles Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack*, Cambridge, MA: The MIT Press at 214 (1998).
 18. Counter-Terrorism Threat Assessment and Warning Unit, National Security, Division, *Terrorism in the United States: 1996*, Washington D.C.: U.S. Department of Justice, Federal Bureau of Investigation at 24 (no date).
 19. See for example: Robert W. Marrs, "Nuclear Terrorism: Rethinking the Unthinkable", MA Thesis, Naval Postgraduate School, Monterey, CA (December 1994); Peter J. DiPaolo, "Motivations for Nuclear Terrorism in the United States," MA Thesis, Naval Postgraduate School, Monterey, CA (June 1995); Stanley S. Jacobs, "The Nuclear Threat as a Terrorist Option," Paper Presented at the Annual Meeting of the American Society of Criminology, San Diego, CA (November 19-22, 1997); and Denise A. DeLawter, "Nuclear Weapons, Proliferation, and Terrorism: U.S. Response in the Twenty-First Century," MA Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS (June 1998).
 20. Counterproliferation Program Review Committee (CPRC), *Report on Activities and Programs for Countering Proliferation and NBC Terrorism*, Washington, DC: U.S. Congress, 3-4 (May 1997).
 21. *America's Achilles Heel*, at 15.
 22. Counterproliferation Program Review Committee(CPRC), *Report on Activities and Programs for Countering Proliferation and NBC Terrorism*, Washington, DC: U.S. Congress, 3-4 (May 1997).
 23. *Ibid.*
 24. "Securing America from Emerging Threats in the 21st Century," Department of Energy Secretarial Speeches, .
 25. Preliminary Notification of Event or Unusual Occurrence, PNO-III-85-15, Date February 2, 1985, Subject: THREAT AGAINST SPENT FUEL SHIPMENT, PDR, 8502080205 850201.
 26. Preliminary Notification of Event or Unusual Occurrence, PNO-III-86-123, Date October 27, 1986, Subject: APPARENT SABOTAGE OF RAIL LINE, PDR, 8611040366-861027.
 27. Preliminary Notification of Events or Unusual Occurrence, TNO-III-86-123A, Date October 31, 1986, Subject: APPARENT SABOTAGE OF RAIL LINE-UPDATE, PDR, 8611070025 861031
 28. *Safeguards Summary Event List: Pre-NRC through December 31, 1989*, NUREG-0525, Vol. 1, Washington DC: U.S. Nuclear Regulatory Commission, at 381 (July 1992).
 29. *America's Achilles' Heel*, at 145.
 30. D.K. Rathbun to J. Lieberman, July 28, 1994, 73 59FR14085 PDR 9408110274 40728
 31. See also, Chris Bishop, Editor, *The Vital Guide to Combat Guns and Infantry Weapons*, London: Airlife Publishing Limited, at 103-115 (1996); Ian Hogg, *Tank*

- Killing: Anti-Tank Warfare by Men and Machines*, New York: Sarpedon Publishers, at 54-64, 101-103, 170-202 (1996); and John Norris, *Anti-Tank Weapons*, London: Brassey's Inc., at 7-8, 92-95, 114-115, 130-132, 139-140 (1996).
32. "Comments by the Sierra Club Radioactive Waste Campaign on Proposed Rule 10 CFR Part 73 Modification of Protection Requirements for Spent Fuel Shipments," prepared by Dr. Marvin Resnikoff, cited in Attachment A at 43-4.
 33. Paul W. Cooper and Stanley R. Kurowski, *Introduction to the Technology of Explosives*, New York: Wiley-VCH Inc., 132-157 (1996).
 34. Andrew Pettitt, "Perforating - An Oilfield Application of Explosives," in John E. Dolan and Stanley S. Langer, *Explosives in the Service of Man: The Nobel Heritage*, Cambridge: Royal Society of Chemistry, 141-152 (1997).
 35. National Research Council, *Containing the Threat from Illegal Bombings*, Washington, D.C.: National Academy Press, 24-38 (1998).
 36. The following discussion is based on Attachment A, at 63-9, and Marvin Resnikoff to Bob Halstead, Unpublished Memorandum Report on HI-STAR 100 Shipping Cask Vulnerability Assessment at 1-4 (October 21, 1998).

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STATE OF NEVADA

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January 31, 2000

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attn: Rulemakings and Adjudications Staff

RE: Comments on State of Nevada Petition for Rulemaking, Docket PRM 73-10

Dear Commissioners:

Since the State of Nevada petitioned the Commission in June, 1999, the U.S. Department of Energy (DOE) has published new information regarding the consequences of radiological sabotage involving use of high-energy explosive devices against spent nuclear fuel shipping casks. Petitioner Nevada believes that this new information supports our request for amendments to strengthen the current transportation safeguards regulations (10CFR73). However, the new DOE analysis, in our opinion, does not satisfy the documented need for a new and comprehensive assessment of the human health and environmental consequences of sabotage and/or terrorist attacks against spent nuclear fuel shipments.

DOE released its Draft Environmental Impact Statement (DEIS) for a Geologic Repository at Yucca Mountain (DOE/EIS-0250D) in August, 1999. Chapter 6 of the DEIS, Environmental Impacts of Transportation, contains an analysis entitled "Impacts of Acts of Sabotage." DOE's analysis "evaluated the consequences of possible credible sabotage events and found them to be comparable with the impacts of maximum reasonably foreseeable accident events." [DEIS, p. 6-33] DOE

commissioned a study by Sandia National Laboratories (Luna, Neuhauser, and Vigil 1999, all) which demonstrated that high-energy explosive devices were "capable of penetrating a cask's shield wall, leading to dispersal of contaminants to the environment." [DEIS, p. 6-33] The DEIS analysis used new release estimates developed by Sandia, including an estimated respirable release six times greater than that found by previous studies and the RISKIND consequence assessment model developed by Argonne National Laboratory. Assuming the attack took place in an urbanized area under average weather conditions, the DEIS estimated that a successful attack on a truck cask would result in a population dose of 31,000 person-rem and 15 latent cancer fatalities, and that a successful attack on a rail cask would result in a population dose of 4,900 person-rem and 2.4 latent cancer fatalities. The attack on the smaller truck cask would release greater quantities of radioactive material, "even though the amount of spent nuclear fuel in a rail cask would be as much as six times that in a truck cask." [DEIS, p. 6-34]

Petitioner Nevada believes that DOE's new consequence assessment, in and of itself, strongly supports Nevada's contention that the current safeguards regulations should be strengthened. However, the release and resulting consequences could be ten times greater, according to the new Sandia study, if the weapon fully perforated the cask. [Luna, Neuhauser, and Vigil, 1999, p.20] Based on the Army Ballistics Research Laboratory 1982 peer review of the original Sandia report [Sandoval, 1982], cited in Nevada's petition, full perforation of a truck cask by the reference weapon (the M3A1 military demolition device) should have been assumed in the 1999 analysis. The DEIS should have used a bounding scenario approach, resulting in a range of estimated impacts between 31,000 and 310,000 person-rem population dose and 15 to 150 latent cancer fatalities.

Nevada is presently preparing a detailed critique of the DOE consequence assessment as part of comments on the Yucca Mountain DEIS. Nevada's comments will be submitted to DOE by February 9, 2000. In order to comply with the January 28, 2000 extended deadline for comments in this docket, Nevada is today submitting as attachments to this letter contractor reports prepared as part of the DEIS review. (These contractor reports are available from the State of Nevada web page at <http://www.state.nv.us/nucwaste/eis/yucca/ballard01.htm> and <http://www.state.nv.us/nucwaste/eis/yucca/rwmaymeis.pdf> respectively.) Nevada will provide the Commission with a copy of its final comments on the DEIS impacts of acts of sabotage as soon as possible after February 9, 2000. We conclude this letter with a summary of the major comments Nevada will be submitting to DOE.

1. DOE failed to conduct a systems analysis of the potential impacts of sabotage and terrorism during all phases of transportation, including planning, storage

prior to transport, cask loading, transportation, intermodal transfer, lag storage at the receiving facility, and cask unloading. Nevada is particularly concerned that DOE ignored the potential for attacks at intermodal transfer stations and on large rail casks during transport on slow-moving heavy haul trucks.

2. DOE failed to evaluate the full range of potential sabotage and terrorism events, including terrorist attacks on transportation infrastructure used during nuclear waste shipments, attacks involving capture of a shipment and use of high-energy explosive devices against a cask, and direct attacks upon shipping casks using antitank missiles.
3. Sandia used the military definition of man-portability rather than the Commission's definition of the design basis threat in selecting the reference weapons used in the analysis. As a result, Sandia failed to consider weapons such as the TOW and Milan missiles which are capable of completely perforating rail as well as truck casks.
4. Sandia failed to consider credible attack scenarios involving use of more than one penetrating weapon, use of an incendiary device in conjunction with a penetrating weapon, and use of commercial shaped charges which are more efficient metal penetrators than the M3A1 military demolition device.
5. Sandia's "swept volume" method of estimating the release from the cask is subject to alternative interpretations, especially when coupled with consideration of blast temperature effects.
6. Sandia apparently did not consider the potential contribution of fuel oxidation to generation of respirable fines in any instance where the weapon completely perforated the cask.
7. Sandia relied solely upon computer simulations and the 1980s experimental data to evaluate cask response to the reference weapons. No new tests were performed.
8. Sandia used the SCAP computer code, which is not appropriately benchmarked for modeling multi-layer cask walls composed of different numbers of layers, different thicknesses, and different materials combinations.

Nevada also directs the Commission's attention to the large number of references to sabotage and terrorism during comments presented at DOE's public hearings on the DEIS. Members of the public have frequently commented on issues such as the likelihood of attacks, methods of attack, and unique local conditions along potential shipment routes which would facilitate attacks and exacerbate consequences. Nevada recommends that Commission staff review the transcripts of the DOE public hearings, and treat these public comments as if they had been submitted as part of

this docket.

The State of Nevada appreciates the manner in which the Commission has responded to our petition for rulemaking. Thank you for your further consideration of these comments.

Sincerely,

--/s/--

Robert R. Loux
Executive Director

RRL/cs
Attachments