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OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Alan S. Rosenthal, Presiding Officer
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Filing in NFS-Erwin License Amendment Proceeding, No. 70-143

Dear Judge Rosenthal,

On behalf of Friends of the Nolichucky River Valley, the State of Franklin Group of the Sierra Club, Oak Ridge Environmental Peace Alliance, and Tennessee Environmental Council, I am filing a hearing request in the NFS-Erwin license amendment proceeding. This hearing request is a substitute for the request that was filed on August 8, 2002. Please note that the attached declarations of Frances Lamberts (Exhibit 1) and Park Overall (Exhibit 4) are faxed copies of original documents. I did not receive the originals in time for this filing, but will file them as soon as I receive them. In addition, the declaration of Chris Erwin (Exhibit 5) is a copy of an original that was filed in August.

In addition, I am filing a motion to hold this proceeding in abeyance.

Copies of these pleadings have been served on the parties.

Sincerely,

Diane Curran

Cc: Service list

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November 27, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE PRESIDING OFFICER

In the matter of	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
(Materials License SNM-124)	)	

REQUEST BY FRIENDS OF THE NOLICHUCKY RIVER VALLEY, STATE OF FRANKLIN GROUP OF THE SIERRA CLUB, OAK RIDGE ENVIRONMENTAL PEACE ALLIANCE, AND TENNESSEE ENVIRONMENTAL COUNCIL TO HOLD PROCEEDING IN ABEYANCE PENDING SUBMISSION OF ADDITIONAL LICENSE AMENDMENT APPLICATIONS

I. INTRODUCTION

Friends of the Nolichucky River Valley ("FNRV"), the State of Franklin Group of the Sierra Club, Oak Ridge Environmental Peace Alliance ("OREPA"), and Tennessee Environmental Council ("TEC"), hereby respectfully request that the Presiding Officer order that this proceeding be held in abeyance, pending the submission by Nuclear Fuel Services, Inc. ("NFS") of two additional license amendment applications for the proposed "BLEU Project" at NFS's Erwin, Tennessee, facility. Petitioners submit that this relief is needed to ensure that environmental issues are addressed in a manner that complies with the National Environmental Policy Act ("NEPA"). It is also necessary to ensure that litigation of safety issues is conducted fairly and efficiently.

II. FACTUAL BACKGROUND

On February 28, 2002, NFS submitted the first of three license amendments necessary to authorize the "BLEU Project," a new operation in which NFS would downblend High Enriched Uranium ("HEU") for use in nuclear reactors owned by the Tennessee Valley Authority. The February 28 license amendment application pertains to the proposed construction of a Uranyl Nitrate Storage Building ("UNB"). According to a March 4, 2002, Federal Register notice, in July 2002, NFS was expected to submit a second license amendment application, authorizing it to perform dissolution of high-enriched uranium/aluminum alloy and uranium metal and downblending of the resulting solution into low-enriched uranyl nitrate solution.[1] Notice of Intent to Prepare an Environmental Assessment for Amendment of Special Nuclear Material License SNM-124 for Nuclear Fuel Services, Inc., Erwin Tennessee, 67 Fed. Reg. 9,791. The March 4 Federal Register notice also stated that NFS is expected to file a third license amendment application in January of 2003. The third license amendment would allow NFS to perform conversion of the low-enriched uranyl nitrate solution into uranium dioxide powder.

In June of 2002, after having received the first of the three license amendment applications, the NRC Staff issued an Environmental Assessment ("EA") for the entire BLEU Project. Environmental Assessment for the Proposed License Amendments to Special Nuclear Material License No. SNM-124 Regarding Downblending and Oxide Conversion of Surplus High-Enriched Uranium, Nuclear Fuel Services, Inc., Erwin,

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[1] Petitioners understand that the second license amendment application has not yet been filed.

Tennessee Plant, Docket 70-143 (June 2002). Conceding that in the absence of all three license amendment applications it was unable to conduct a detailed environmental review of the entire project, the NRC Staff went ahead anyway with a finding of no significant impact ("FONSI"). However, the FONSI was issued with the caveat that (a) the Staff planned to perform a second environmental review as part of its safety evaluation of the two prospective license amendment applications, and (b) it would revise the EA if the second environmental review "indicates that this EA does not fully evaluate the environmental effects" of the proposed BLEU Project. EA at 1-1. The NRC Staff also cautioned that the EA "does not serve as approval for the three proposed activities." *Id.* Thus, the EA amounts to a provisional document that the NRC Staff intends to revisit before reaching a final decision on the environmental impacts of the proposed BLEU Project.

On November 12, 2002, NFS filed a motion with the Presiding Officer, requesting clarification of the scope of the instant hearing. NFS sought a ruling that petitioners must submit all of their concerns about the entire EA at this point in the hearing process.[2] Applicant's Motion for Clarification of Scope of Hearing at 4. The Presiding Officer denied the motion, and ruled that the scope of the instant proceeding will be limited to those safety and environmental areas of concern that directly relate to the February 2002 license amendment application. Memorandum and Order (Ruling on Motion for Clarification of Scope of Hearing) at 3. The Presiding Officer did not forbid the

[2] Petitioners anticipated responding to NFS's motion within the ten-day period allowed by NRC regulations, *i.e.*, by November 22. However, the Presiding Officer ruled on the motion on November 19, 2002.

submission of environmental contentions relating to the second or third license amendment, but simply held that such contentions "need not be now advanced." *Id.*

III. ARGUMENT

Pursuant to 10 C.F.R. § 2.1209(a), the Presiding Officer has the authority to "regulate the course of the hearing" over which he or she presides. As the Commission has explained in a Statement of Policy on the Conduct of Licensing Proceedings:

> The Commission's Rules of Practice provide the [licensing] board with substantial authority to regulate hearing procedures. In the final analysis, the actions, consistent with applicable rules, which may be taken to conduct an efficient hearing are limited primarily by the good sense, judgment, and managerial skills of a presiding board which is dedicated to seeing that the process moves along at an expeditious pace, consistent with the demands of fairness.

CLI-81-8, 13 NRC 452, 453 (1981).

In this case, to proceed now with a hearing on any aspect of petitioners' NEPA claims would be inconsistent with NEPA. It would also be unfair and wasteful of the parties' resources. Thus, the Presiding Officer should exercise his discretion to postpone the hearing until all three of NFS's license amendment applications have been submitted and reviewed by the NRC for compliance with Atomic Energy Act requirements and NEPA.

A. A Hearing on Any NEPA Issues Is Premature.

As the NRC Staff recognized in preparing an EA for all three license amendment applications, the BLEU Project cannot be separated into three separate pieces for purposes of a NEPA review. *See* NRC Staff Response to Applicant's Motion for

Clarification of Scope of Hearings at 1-2 (November 18, 2002). To do so would create a "segmentation problem." *Id.*

Petitioners agree with the Staff's conclusion that considering the environmental impacts of the proposed BLEU Project in three separate segments would constitute unlawful segmentation under NEPA. *See Duke Power Co.* (Amendment to Materials License SNM-1773 for Oconee Nuclear Station Spent Fuel Transportation and Storage at McGuire Nuclear Station), LBP-80-28, 12 NRC 459, 473-476 (1980). If the environmental impacts of one aspect of a project are examined in isolation, they may appear to be less significant than the environmental impacts of a project as a whole. And NEPA is concerned with the impacts of the "full dimensions" a proposed action. *See Duke Power,* 12 NRC at 476. Moreover, as a practical matter, in preparing their statement of concerns, petitioners have found that none of their concerns is solely related to the February 28, 2002 license amendment application. Each of petitioners' concerns relates to the BLEU Project as a whole. Thus, the hearing should await the completion of the Staff's environmental review of the entire BLEU Project.

In addition, the hearing should be postponed because there is no final NEPA determination that can be the subject of a hearing. The EA for the proposed BLEU Project is merely provisional. The NRC Staff has expressly stated that it intends to perform another environmental review when the second two license applications are submitted, and that in the meantime the EA cannot be relied on as a decision document. EA at 1-1. Thus, the NRC has not yet made a final determination of no significant

impact that is ready to go to a hearing under 10 C.F.R. § 51.104(b).[3] In any event, to go forward with a hearing on a provisional licensing document would be a gross waste of the parties' and the Licensing Board's resources.

B. Litigation of Safety Issues Should be Postponed.

Petitioners have raised two safety concerns with respect to the February 28, 2002, license amendment application: the adequacy of NFS's financial assurances for decommissioning, and the adequacy of NFS's management, procedures and equipment to assure that radiological and chemical effluents do not exceed permit limitations. While theoretically it would be possible to litigate these issues solely with respect to the Uranyl Nitrate Storage Building, to do so would not be efficient, fair or commonsensical. Both of these concerns relate to the operation of the proposed BLEU Project as a whole. To litigate these issues in three separate proceedings would not only result in a tremendous overlap and duplication of effort, but would deprive the Presiding Officer and the parties of a chance to review the safety of the BLEU project as a single integrated operation.

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[3] Petitioners submit that the NRC had no other lawful choice but to postpone its final determination regarding the significance of the BLEU Project's environmental impacts until after completion of its safety review of the three license amendment applications. In an EIS, the NRC must comply with NEPA "to the fullest extent possible" by taking a "hard look" at environmental impacts. *Natural Resources Defense Council v. Morton,* 458 F.2d 827, 838 (D.C. Cir. 1972). Clearly, the environmental impacts of greatest concern to the NRC in a nuclear facility licensing case consist of the facility's radiological emissions. The NRC Staff cannot possibly be deemed to have taken a "hard look" at the impacts of a proposed nuclear facility if it has not reviewed the facility's compliance with NRC regulations for protecting the public from unsafe levels of exposure to radiation. *See Citizens for Safe Power v. NRC,* 524 F.2d 1291, 1299 (D.C. Cir. 1975) (requirements of the Atomic Energy Act cannot "be viewed separate and apart from NEPA considerations").

Moreover, petitioners are not aware of any good reason to conduct a hearing on the proposed BLEU Project in such a piecemeal fashion. The separation of the hearing into three phases is being driven by NFS's decision to submit three separate license amendment applications for the BLEU Project. Yet, the schedule for submitting the license amendment applications is relatively short: NFS plans to submit the third license application only 11 months after the first application. The three license amendment applications could just as easily have been submitted together.

Finally, the piecemeal submission of license amendment applications will not hasten NFS's ability to start construction. The NRC has not yet decided whether it must prepare an Environmental Impact Statement ("EIS") for the proposed BLEU Project. As explained in the EA at 1-1, that determination will not be made until the NRC conducts another environmental review, in conjunction with its safety review of the three license amendment applications. EA at 1-1. Until the NRC concludes that no EIS is necessary, NFS is precluded by 10 C.F.R. § 70.23(a)(7) from commencing any construction activity for the proposed BLEU Project.[4]

[4] In recent weeks, petitioners have noticed new construction activity at the NFS-Erwin plant. Petitioners request that the Presiding Officer obtain clarification from NFS regarding whether this construction activity has any relationship to the proposed BLEU Project. In that event, petitioners anticipate that they may seek a stay of construction activities, in order to ensure that compliance with NEPA is not foreclosed by such construction activities.

IV. CONCLUSION

For the foregoing reasons, the Presiding Officer should grant petitioners' motion and hold this proceeding in abeyance pending NFS's submission of all three license amendment applications for the proposed BLEU Project.

Respectfully submitted,

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
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In the matter of	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
(Materials License SNM-124)	)	

REQUEST FOR HEARING BY FRIENDS OF THE NOLICHUCKY RIVER VALLEY, STATE OF FRANKLIN GROUP OF THE SIERRA CLUB, OAK RIDGE ENVIRONMENTAL PEACE ALLIANCE, AND TENNESSEE ENVIRONMENTAL COUNCIL

I. INTRODUCTION

As provided by the Presiding Officer's Memorandum and Order of October 31, 2002, petitioners, Friends of the Nolichucky River Valley ("FNRV"), the State of Franklin Group of the Sierra Club, Oak Ridge Environmental Peace Alliance ("OREPA"), and Tennessee Environmental Council ("TEC"), hereby request a hearing regarding this proceeding for the amendment of Nuclear Fuel Services's ("NFS's") materials license for its Erwin, Tennessee facility. This filing also responds to a Federal Register notice published by the U.S. Nuclear Regulatory Commission ("NRC") at 67 Fed. Reg. 45,555 (July 9, 2002), revised at 67 Fed. Reg. 66,172 (October 30, 2002).

This hearing request is a substitute for the petitioners' previous hearing request, filed on August 8, 2002. *See* Request for Hearing by Oak Ridge Environmental Peace

Alliance, Tennessee Environmental Council, State of Franklin Group/Sierra Club, Friends of Nolichucky River Valley.

Petitioners' hearing request has two sections. In Section II, petitioners address their standing to participate in this proceeding. In Section III, petitioners address their areas of concern. Petitioners note that the statement of concerns is broader than the scope of the hearing that the Presiding Officer set forth in a Memorandum and Order of November 19, 2002. In that decision, the Presiding Officer held that the scope of the hearing would be restricted to only those safety and environmental issues that directly relate to the February 28, 2002, license amendment application filed by NFS-Erwin. The February 28, 2002, license application relates solely to the construction and operation of a Uranyl Nitrate Storage Building ("UNB"). The UNB will house uranyl nitrate produced by downblending high-enriched uranium ("HEU") in NFS's proposed "BLEU Project." As described in the Environmental Assessment for the proposed project, NFS intends to file two other license amendment applications that will address the downblending process and the process for converting uranyl nitrate to uranium oxide. *See* Environmental Assessment for the Proposed License Amendments to Special Nuclear Material License No. SNM-124 Regarding Downblending and Oxide Conversion of Surplus High-Enriched Uranium, Nuclear Fuel Services, Inc., Erwin, Tennessee Plant, Docket 70-143 at 1-1 - 1-2 (June 2002) (hereinafter "EA"). Taken together, the three license amendments will comprise what NFS calls the "BLEU Project." The NRC Staff prepared an EA for the entire project, rather than just the UNB, in order to avoid segmentation.

In preparing their statement of concerns, Petitioners have found that none of their environmental concerns can be isolated to any one part of the BLEU Project. This is in part because there would be no need for the UNB if NFS was not planning to blend down a large quantity of HEU at the Erwin plant. The sole purpose of the UNB is to store uranyl nitrate that is generated by the downblending of HEU. Accordingly, the environmental concerns submitted by petitioners relate to the entire BLEU Project.[1]

Petitioners request that any aspect of this hearing that is held as a public meeting be conducted locally. It should also be conducted in the evening so that working people can attend.

II. STANDING

It is well-established that a petitioner organization can demonstrate representational standing to participate in an NRC licensing proceeding on behalf of its members. *See Power Authority of the State of New York* (James A. Fitzpatrick Nuclear Power Plant; Indian Point, Unit 3), CLI-00-22, 52 NRC 266, 293 (2000); *International Uranium (USA) Corp.*, (White Mesa Uranium Mill), CLI-01-21, 54 NRC 247, 250 (2001). FNRV, State of Franklin Group of the Sierra Club, OREPA, and TEC all constitute environmental groups with an interest in protecting the quality of the environment of East Tennessee and the Nolichucky River, into which NFS discharges effluent. All of these petitioner organizations have members who live and/or own property and/or recreate in the area of the NFS-Erwin facility and/or the Nolichucky

[1] Petitioners note that, in conjunction with this hearing request, they have filed a motion to hold the proceeding in abeyance, pending submission of all three of NFS's license amendment applications for the BLEU Project.

River. As demonstrated by the attached declarations of petitioners' members, these members' health and property interests, and their interests in a clean and healthful environment, would be injured by increased releases of radiological and chemical effluents from the NFS-Erwin plant. These individuals have also authorized their respective organizations to represent them in this proceeding.[2]

To demonstrate standing in a Subpart L proceeding, petitioners must meet "judicial standards for standing." 10 C.F.R. § 2.1205(h). The petitioner must allege:

> (a) an actual or threatened, concrete and particularized injury, that (2) is fairly traceable to the challenged action, (3) falls among the general interests protected by the Atomic Energy Act (or other applicable statute, such as the National Environmental Policy Act), and (4) is likely to be redressed by a favorable decision.

Sequoyah Fuels Corporation (Gore, Oklahoma Decommissioning), CLI-01-2, 53 NRC 9, 13 (2001). Moreover, the injury need not be great in order to confer standing. A "minor exposure to radiation, even one within regulatory limits, is sufficient to state an injury in fact" for standing purposes. *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-01-35, 54 NRC 403, 417 (2001), citing *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-7, 43 NRC 235, 247-48

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[2] *See* Declaration of Frances Lamberts (November 25, 2002), attached as Exhibit 1; Declaration of Ruth Gutierrez (November 22, 2002), attached as Exhibit 2; Declaration of Trudy L. Wallack (November 25, 2002), attached as Exhibit 3; Declaration of Park Overall (November 22, 2002), attached as Exhibit 4; Declaration of Chris Erwin (August 7, 2002), copy attached as Exhibit 5. (Mr. Erwin's original declaration was filed with the Secretary on August 8, 2002.) Ms. Lamberts is a member of the State of Franklin Group of the Sierra Club, FNRV and TEC. Ms. Gutierrez is a member of the State of Franklin Group of the Sierra Club. Ms. Wallack is a member of FNRV. Ms. Overall is a member of FNRV, OREPA, and TEC. Mr. Erwin is a member of OREPA.

(1996). *But see Babcock & Wilcox* (Appollo, Pennsylvania Fuel Fabrication Facility), LBP-93-4, 37 NRC 72, 87 (1993) (denying standing where offsite airborne or effluent releases were "only a fraction of regulatory limits.")

As discussed herein and also demonstrated in the attached declarations by petitioners' members, NFS's proposed HEU downblending operation poses an actual injury in the form of increased discharges of radiological effluent to the Nolichucky River. *See* EA, Section 5.1.12 and Table 5.1. As also acknowledged in Section 5.1.2 of the EA, the proposed HEU downblending operation poses a hazard of an accidental loss of control of the processes to be used at the facility, resulting in spills or unplanned releases. Section 3.9 of the Environmental Assessment also observes that NFS has a history of causing radiological and nonradiological contamination of the soil and groundwater at the site.[3] Obviously, these releases to the environment were not planned, nor were they in accordance with requirements of NFS's operating license. The fact that NFS has contaminated the environment in the past raises serious questions as to whether it is capable of controlling an expanded operation in the future. Thus, there is a risk of unplanned releases to air, soil and water from the proposed BLEU Project.[4]

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[3] Although the EA does not identify offsite contamination, NFS has been sued by a neighboring landowner for offsite groundwater contamination. *See Impact Plastics Incorporated, Preston Tool and Mold Inc. and General M. O'Connor v. NFS Inc.* (No. 2:02CV148). The case is now pending in Federal District Court for the Eastern District of Tennessee in Greenville.

[4] Petitioners acknowledge that the injury caused by the licensing of the Uranyl Nitrate Storage Building, which is the sole subject of this proceeding, may be significantly less than the injury caused by the licensing of the entire BLEU Project. However, as the Atomic Safety and Licensing Board held in *Duke Cogema Stone and Webster,* LBP-01-35, standing may be predicated on injury from an activity that is not the direct subject of a proposed licensing action, if the licensing action would allow the injurious activity to

The attached declarations by petitioners' members demonstrate that the increased normal effluent discharges and risk of accidental discharges to the Nolichucky River, which will occur as a result of the licensing of the proposed BLEU Project, threaten these individuals with injury that is real and concrete, and which is directly traceable to NFS's proposed HEU downblending operation. For instance, Frances Lamberts and Ruth Gutierrez draw their drinking water from the Jonesborough municipal water supply, which is about eight miles below the NFS-Erwin plant. *See* Exhibits 1 and 2. According to the EA, the downblending operation would result in increased discharges of radioactive contaminants to the municipal water supply in Jonesborough.[5] Ms. Lamberts and Ms. Gutierrez are both concerned about the health effects of both increased normal radiological discharges and accidental discharges from the NFS-Erwin plant. Given NFS's history of contaminating soil and groundwater at the Erwin site, they have reasonable cause for concern that NFS will not be able to control its discharges.

Trudy Wallack lives on the banks of the Nolichucky River, about 20 to 25 miles downstream of the NFS-Erwin plant. *See* Exhibit 3. Ms. Wallack spends many hours picnicking, fishing, boating and swimming in the Nolichucky River. Ms. Wallack is also an avid canoeist and rafter, who frequently boats on various parts of the Nolichucky

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occur. 54 NRC at 417. Here, NFS will not have any reason to operate the UNB unless it obtains a license for the rest of the BLEU Project. Thus, the Presiding Officer should look to the effects of the entire BLEU Project in evaluating petitioners' standing to challenge the licensing of the UNB.

[5] Table 5.1 of the EA shows that as a result of NFS's proposed HEU downblending operation, levels of radiological contaminants in drinking water would increase in the following proportions: uranium (16.6%), thorium (210,000%), and plutonium (5.8 million %). At page 5-6, the Environmental Assessment states that the "receptor" used for the purpose of estimating these contaminant levels is the nearest point of water use, *i.e.,* the Jonesborough Water Plant.

River. She considers the waters just below the NFS-Erwin plant to be suitable for both canoeing and white water rafting, but she does not boat there because she is concerned about the effects on her health from exposure to the chemical and radioactive effluents that NFS discharges from the plant. She is further discouraged from boating there by the prospect of increased discharges of chemical and radioactive effluent from the NFS plant. Ms. Wallack also drinks water from the Nolichucky River, eats produce that is irrigated by Nolichucky River water, and eats shrimp that are raised in Nolichucky River water. She is concerned about the potential effects on her health of increased radiological and chemical contamination discharged from the NFS-Erwin plant into the Nolichucky River, during normal operation as well as conditions of flooding. In addition to her concern for her health and the health of her family, she is concerned about the impacts of contamination on her property values.

Park Overall has a home on the banks of the Nolichucky River, about 31 miles downstream of the NFS-Erwin plant. *See* Exhibit 4. While she does not swim or raft in the river now because it is highly sedimented, she would like to do so in the future if the sedimentation is cleaned up. However, she will not be able to do so if levels of chemical and radioactive effluent from the NFS-Erwin facility are unacceptably high. In addition, she is concerned that the municipal drinking water supply for the town where she lives, Afton, Tennessee, will become contaminated by chemical and radioactive effluent from the NFS-Erwin plant. Drinking contaminated water from the Nolichucky River could have an adverse impact on her health. She is also concerned about the potential decline in the value of her property as a result of excessive contamination of the Nolichucky

River. Finally, she is concerned about the effect of chemical and radioactive contamination of the river on plants and wildlife, which she enjoys.

Chris Erwin is a former river guide on the Nolichucky River. *See* Exhibit 5. He continues to boat and hike along the Nolichucky on a regular basis, but he restricts his activities to the area upstream of the NFS-Erwin plant. He would boat and hike in the area downstream of the Erwin plant, but he is concerned about the effects on his health of radioactive and chemical effluents that NFS emits from the plant. If NFS is allowed to increase its radioactive and chemical effluents from the plant, this will discourage him even further from hiking or boating downstream of the Erwin plant.

Petitioners' injuries fall within the zone of interests protected by the Atomic Energy Act, whose purposes include protection of the health and safety of the public. 42 US.C. § 2013. Petitioners' interest in a safe and healthful environment is also protected by NEPA, which fosters protection of the human environment, through "widespread discussion and consideration of the environmental risks and remedies" associated with a pending federal project. *LaFlamme v. FERC,* 852 F.2d 389, 398 (9th Cir. 1988).

Finally, petitioners' injuries are likely to be redressed by a favorable decision. The hearing may result in the denial or modification of NFS's requested license amendment, in which case the health and safety risks and environmental impacts about which petitioners are concerned would be avoided or mitigated.

III. PETITIONERS' AREAS OF CONCERN

Pursuant to 10 C.F.R. § 2.1205(e), a Subpart L petitioner must describe its areas of concern "in detail." The Commission has interpreted this provision to require the petition to provide the presiding officer with "the minimal information needed to ensure the intervenor desires to litigate issues germane to the licensing proceeding." *See* Statement of Considerations to 10 C.F.R. Part 2, Subpart L, 54 Fed. Reg. 8,269, 8,272 (February 28, 1989); *Sequoyah Fuels Corporation* (Source Materials License No. Sub-1010), LBP-94, 40 NRC 314, 316, *affirmed* 40 NRC 64 (1994). *See also Babcock & Wilcox Company* (Pennsylvania Nuclear Services Operations, Parks Township, Pennsylvania), LBP-94-12, 39 NRC 215, 217 (1994).

Petitioners seek to raise the following areas of concern in the hearing:

A. Concerns Regarding Compliance With NEPA

1. The EA prepared by the NRC Staff is not sufficient to support the issuance of a license amendment for any of the three licensing actions described in the EA, because the potential impacts of the activities to be licensed are significant and therefore warrant preparation of an Environmental Impact Statement ("EIS"). The following are examples of significant environmental impacts posed by the proposed BLEU Project:

a. The proposed license amendment involves the shipping, storage, handling, and processing of HEU. It also involves the shipping, storage, handling and processing of hazardous chemicals. As the EA concedes:

> The conversion of HEU materials to low-enriched uranium dioxide at the BLEU Project will require the handling, processing, and storage of radioactive material and hazardous chemicals. An uncontrolled release of these materials from accidents could pose a risk to the environment as well as to workers and public health and safety.

67 Fed. Reg. at 66,175. In preparing the EA, the NRC Staff apparently assumes that accidents involving HEU and/or hazardous chemicals are not credible, and therefore that no EIS is needed. *See, e.g.,* October 30, 2002, Federal Register Notice, 67 Fed. Reg. at 66,175 ("Accidental releases of contaminants to groundwater appear unlikely due to design and control measures implemented by NFS"; "safety controls to be employed in the processes for the BLEU Project appear to be sufficient to ensure planned processing will be safe.") However, the EA lacks a reasonable factual basis for making such a determination. As the NRC concedes in the October 30, 2002, Federal Register notice, the NRC has not even received, let alone reviewed, two of the three license amendment applications needed to complete the BLEU Project. *Id.* Given that radiological accidents constitute the principal means by which the NFS Erwin facility could have an adverse impact on the environment, and given that the NRC's chief area of expertise lies in assessing compliance with its safety regulations for the control of radiological releases, the NRC cannot be considered to have taken the proverbial "hard look" at the environmental impacts of the expansion of the NFS-Erwin facility if it has not reviewed any license amendment application regarding the safety of the proposed operation. *See Natural Resources Defense Council v. Morton,* 458 F.2d 827, 838 (D.C. Cir. 1972).

b. As discussed above in subsection (a), the NRC Staff's apparent rationale for its Finding of No Significant Impact is that NFS will comply with its permit. However, over the course of its operating history, NFS has had a long

history of exceeding permit limitations with respect to the emission of effluent to the environment, with the result that soil and groundwater on the Erwin site are contaminated. *See* Section 3.9 of the EA.[6] In addition, NFS has reported and/or been cited on numerous occasions for violations of its permit, some of which resulted in spills and/or exposure of workers to contamination. These incidents demonstrate a serious risk that NFS will continue to pollute the environment, causing significant adverse impacts to the health and welfare of workers, the public, and the general environment.

c. Operation of the BLEU Project will involve transport, storage, handling, and processing of tons of HEU, an attractive target for terrorists and insane individuals who might seek to do harm to the facility, or to steal HEU for the production of a nuclear weapon. As noted in a recent publication by the Pugwash Conferences on Science and World Affairs, a relatively small amount of HEU can be made into a crude but powerful nuclear bomb using information available in open and easily available sources.[7] The events of September 11, 2001, and subsequent investigations by the NRC, demonstrate that such an attack or theft is foreseeable. An EIS should be prepared to address the significant risk of such intentional destructive acts or theft of HEU.[8]

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[6] As discussed in note 3, *supra,* NFS has also been sued for offsite contamination.

[7] Jeffrey Boutwell, Francesco Calogero, Jack Harris, *Nuclear Terrorism: The Danger of Highly Enriched Uranium (HEU),* Pugwash Issue Brief (September 2002). A copy of this report is attached as Exhibit 6. It can also be found at www.pugwash.org/publication.htm.

[8] Until recently, the Commission has held to a policy of refusing to examine the environmental impacts of destructive acts of malice or insanity, on the ground that such

The impacts listed above should be addressed in a new EIS, because they are significant and because they have not been addressed in any other EIS. As acknowledged by the EA at page 1-2, the generic EIS for the disposal of HEU does not address the site-specific impacts of blending down HEU. *See* DOE, Disposition of Surplus Highly Enriched Uranium, Final Environmental Impact Statement (June 1996) (hereinafter "GEIS for Surplus HEU Disposition"). At page 1-1, the EA also relies on an environmental assessment prepared by the NRC for renewal of NFS's license in 1999 for an analysis of the environmental impacts of HEU downblending. *See* Finding of No Significant Impact and Environmental Assessment (TAC No. L30873 (January 29, 1999) (hereinafter "1999 EA"). But the 1999 EA is extremely cursory, and does not go into any detail regarding NFS's existing HEU downblending operation; nor does it address the different characteristics of the proposed operation. Indeed, because it is an EA and not an EIS, the 1999 EA does not have the scope or depth that is required for a "hard look" at environmental impacts of a proposed action. *Natural Resources Defense Council v. Morton,* 458 F.2d at 838. An EIS would provide a detailed analysis of reasonably foreseeable environmental impacts of the proposed action. It would also address a

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events are not foreseeable. *See Philadelphia Electric Co.* (Limerick Generating Station, Units1 and 2), ALAB-819, 22 NRC 681, 697-701 (1985), *aff'd on this ground and rev'd on other grounds, Limerick Ecology Action v. NRC,* 869 F.2d 719, 743-44 (3rd Cir. 1989). In the wake of the September 11, 2001, attacks on the World Trade Center and the Pentagon, however, the Commission has undertaken to reconsider this policy in the context of several pending licensing cases. *See Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Unit 1), CLI-02-05, 55 NRC 161 (2002); *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), CLI-02-04, 55 NRC 158 (2002); *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2), Catawba Nuclear Station, Units 1 and 2), CLI-02-04, 55 NRC 164 (2002); *Private Fuel Storage, L.L.C.* (Independent Fuel Storage Installation), CLI-02-03, 55 NRC 155 (2002). The question is still pending before the Commissioners.

reasonable range of alternatives for mitigating or avoiding those impacts, and weigh the costs and benefits of alternatives.[9]

Finally, neither the DOE's Generic EIS for HEU Disposition nor the 1999 EA addresses the environmental impacts of acts of malice or insanity against the BLEU Project, or the impacts of theft of HEU. These environmental studies were prepared before the events of September 11, 2001. Thus, there is no EIS that considers the risks of such intentional destructive acts, or alternatives that would avoid or mitigate those risks.[10]

2. The geographic zone of impact of the BLEU Project, as depicted in the EA in Figure 3.1 and evaluated throughout the EA, does not include Greene County, which is contiguous with Unicoi County and lies downstream of the NFS-Erwin facility. Because NFS discharges effluent to the Nolichucky River, which passes through Greene County, it should be considered to constitute an affected area.

B. Safety Concerns Regarding the February 28, 2002 Application

1. NFS has not publicly demonstrated that it has made adequate arrangements to fund the decommissioning of the Uranyl Nitrate Storage Building at the end of the

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[9] An EIS whould also give "due consideration" to NFS's compliance with requirements of agencies other than the NRC, including the Environmental Protection Agency ("EPA"); and state, regional and local agencies. *See* 10 C.F.R. § 51.71(d).This is particularly important, because (a) uranium emissions are regulated by EPA as well as NRC, including regulation for toxicity; (b) NFS's non-radiological effluents to air, surface water, and groundwater will increase. To petitioners' knowledge, NFS has not obtained any EPA, State or local permits for the proposed activities.

[10] Reasonable alternatives would include minimizing HEU transportation; increasing protection of HEU during transport, storage, handling and processing; or increasing the rate of HEU downblending to LEU, rather than tying the downblending rate to market demand.

facility's life, and thus has not demonstrated compliance with 10 C.F.R. § 70.23(a)(5) or § 70.25. Consideration of the adequacy of financial assurance for decommissioning should take into account NFS's liability for cleaning up existing contamination on the NFS site. The NRC should not license an expanded operation at the Erwin site until it has reasonable assurance that NFS has adequate resources to clean up *both* existing contamination and any additional contamination that may occur as a result of operation of the Uranyl Nitrate Storage Building. Petitioners note that NFS has withheld decommissioning funding information as proprietary. In the course of litigating this issue, petitioners intend to seek public disclosure of the information.

2. NFS has not demonstrated that it can and will comply with 10 C.F.R. §§ 70.23(a)(2), (3), or (4). These provisions require that the application must show that:

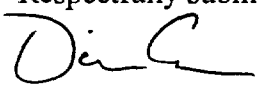
> (2) The applicant is qualified by reason of training and experience to use the material for the purpose requested in accordance with the regulations in this chapter;
> (3) The applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property;
> (4) The applicant's proposed procedures to protect health and to minimize danger to life or property are adequate.

As discussed above in Section II, NFS has a long history of contaminating the soil and groundwater at the NFS site, and is also alleged to have caused offsite contamination. NFS has also been cited on numerous occasions for violations of its permit, including violations that resulted in spills or contamination of workers. Taken together, these incidents reflect inadequacies in management, procedures, and equipment that undermine NFS's ability to comply with NRC safety regulations.

IV. CONCLUSION

For the foregoing reasons, petitioners have demonstrated that they have standing to participate in this proceeding. Moreover, they have presented a set of admissible areas of concern.

Respectfully submitted,



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Dated: November 27, 2002

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE PRESIDING OFFICER

In the matter of	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
(Materials License SNM-124)	)	

DECLARATION OF FRANCES LAMBERTS

Under penalty of perjury I, Frances Lamberts, declare that:

1. My name is Frances Lamberts. I live at 113 Ridge Lane, in Jonesborough, Tennessee.

2. I get my drinking water from the Jonesborough Water Plant, which provides the town's municipal water supply.

3. I am aware that Nuclear Fuel Services ("NFS") has filed the first in a series of related license amendment applications to the U.S. Nuclear Regulatory Commission ("NRC"), that would allow NFS to downblend high-enriched uranium ("HEU") at its plant in Erwin, Tennessee. According to an Environmental Assessment prepared by the Staff of the U.S. Nuclear Regulatory Commission in June of 2002, the downblending operation would result in increased discharges of radioactive contaminants to the municipal water supply in Jonesborough. Table 5.1 of the EA shows that levels of radiological contaminants in drinking water would increase in the following proportions: uranium (16.6%), thorium (210,000 %), and plutonium (5.8 million %). At page 5-6, the Environmental Assessment states that the "receptor" used for the purpose of estimating these contaminant levels is the nearest point of water use, *i.e.*, the Jonesborough Water Plant. The Jonesborough Water Plant is located on the Nolichucky River, 13 km (8 miles) downstream from the Erwin plant.

4. As described in Section 3.9 of the Environmental Assessment, operation of the NFS facility has resulted in radiological and nonradiological contamination of soil and groundwater. This causes me to be concerned that NFS does not have sufficient control of its operation to ensure that radiological and chemical effluents from the proposed downblending operation can and will be contained properly.

5. For a long time, I have had concerns about radiological and chemical contaminants released from the NFS-Erwin plant into the Nolichucky River, which is the source of my drinking water. I believe that increased levels of radiological and chemical contaminants

in my drinking water, caused by normal operations and potential accidental releases, have the potential to adversely affect my health.

6. I am a member of State of Franklin Group of the Sierra Club, and serve on the executive committee. I am also a member of the Friends of the Nolichucky River Valley and the Tennessee Environmental Council. I have authorized the State of Franklin Group of the Sierra Club, the Friends of the Nolichucky River Valley, and Tennessee Environmental Council to represent me in this proceeding, for the purpose of ensuring that the NRC's decision on NFS's license amendment application includes adequate measures for the protection of my health and welfare and the quality of my environment.

Frances Lamberts

Frances Lamberts

Date: 11/25/02

Exhibit 2

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE PRESIDING OFFICER

In the matter of	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
(Materials License SNM-124)	)	

DECLARATION OF RUTH GUTIERREZ

Under penalty of perjury I, Ruth Gutierrez, declare that:

1. My name is Ruth Gutierrez. I live with my family at 232 Spring Street, Jonesborough, Tennessee.

2. My family and I get our drinking water from the Jonesborough Water Plant, which provides the town's municipal water supply.

3. I am aware that Nuclear Fuel Services ("NFS") has filed the first in a series of related license amendment applications to the U.S. Nuclear Regulatory Commission ("NRC"), that would allow NFS to downblend high-enriched uranium ("HEU") at its plant in Erwin, Tennessee. According to an Environmental Assessment prepared by the Staff of the U.S. Nuclear Regulatory Commission in June of 2002, the downblending operation would result in increased discharges of radioactive contaminants to the municipal water supply in Jonesborough. Table 5.1 of the EA shows that levels of radiological contaminants in drinking water would increase in the following proportions: uranium (16.6%), thorium (210,000%), and plutonium (5.8 million %). At page 5-6, the Environmental Assessment states that the "receptor" used for the purpose of estimating these contaminant levels is the nearest point of water use, *i.e.*, the Jonesborough Water Plant. The Jonesborough Water Plant is located on the Nolichucky River, 13 km (8 miles) downstream from the Erwin plant.

4. As described in Section 3.9 of the Environmental Assessment, past operations of the NFS facility have resulted in radiological and nonradiological contamination of soil and groundwater. This causes me to be concerned that NFS does not have sufficient control of its operation to ensure that radiological and chemical effluents from the proposed downblending operation can and will be contained properly.

5. I am concerned that increased levels of radiological and chemical contaminants in my drinking water, caused by normal operations and potential accidental releases, has the

potential to affect my health and the health of my family. I am also concerned that the value of my property will potentially decline as a result of public perception that increased contaminant levels in the Jonesborough drinking water supply pose a health risk.

5. I am a member of State of Franklin Group of the Sierra Club, and serve on the executive committee. I have authorized the State of Franklin Group/Sierra Club to represent me in this proceeding, for the purpose of ensuring that the NRC's decision on NFS's license amendment application includes adequate measures for the protection of the health and welfare of myself and my family, and the quality of the environment in which we live.

Ruth Gutierrez

Ruth Gutierrez

Date: 11-22-02

Exhibit 3

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE PRESIDING OFFICER

In the Matter of	)	
	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
	)	SNM License 124
(Blended Low Enriched Uranium Project	)	

DECLARATION OF TRUDY L. WALLACK

Under penalty of perjury, I, Trudy L. Wallack, declare that:

1. My name is Trudy L. Wallack. I reside at 2210 West Allen's Bridge Road, Greeneville, Tennessee. I live there with David Wallack.

2. Our property consists of about ten acres, including about 900 feet of riverfront, on the banks of the Nolichucky River. I estimate that the property lies about 20 to 25 miles downstream from the NFS-Erwin facility.

3. David and I have a very large extended family, including my 85-year-old father, our grown children, grandchildren, and nieces and nephews. They all visit us regularly at our home on the Nolichucky River.

4. Our property has a beach on it, where my family and I spend many hours swimming. We also own several boats, and we frequently canoe or raft on the river.

5. I am aware that Nuclear Fuel Services ("NFS") has filed the first in a series of related license amendment applications to the U.S. Nuclear Regulatory Commission ("NRC"), that would allow NFS to downblend high-enriched uranium ("HEU") at its plant in Erwin, Tennessee. According to an Environmental Assessment prepared by the Staff of the U.S. Nuclear Regulatory Commission in June of 2002, the downblending operation would result in increased discharges of radioactive contaminants to the municipal water supply in Jonesborough. Table 5.1 of the EA shows that levels of radiological contaminants in drinking water would increase in the following proportions: uranium (16.6%), thorium (210,000%), and plutonium (5.8 million %). At page 5-6, the Environmental Assessment states that the "receptor" used for the purpose of estimating these contaminant levels is the nearest point of water use, *i.e.*, the

Jonesborough Water Plant. The Jonesborough Water Plant is located on the Nolichucky River, 13 km (8 miles) downstream from the Erwin plant.

6. As described in Section 3.9 of the Environmental Assessment, operation of the NFS facility has resulted in radiological and nonradiological contamination of soil and groundwater. This causes me to be concerned that NFS does not have sufficient control of its operation to ensure that radiological and chemical effluents from the proposed downblending operation can and will be contained properly.

7. I am concerned that when we swim and boat in the Nolichucky River, my family and I will be exposed to increased levels of radiological and chemical effluents that are carried downstream from the NFS plant. I am concerned that as a result, we may suffer adverse health effects. I am also concerned about the potentially adverse effects of increased radiological and chemical effluent from the NFS plant on the value of our property.

8 I am an avid canoeist and rafter. I frequently canoe and raft on various parts of the Nolichucky River. The waters just below the NFS-Erwin plant are very fine for both canoeing and white water rafting. However, I do not canoe or raft there, because I am concerned about the effects on my health from exposure to the chemical and radioactive effluents that NFS discharges from the plant. I am further discouraged from boating there by the prospect of increased discharges of chemical and radioactive effluent from the NFS plant. If it were not for these concerns, I would canoe and raft in the waters just below the NFS-Erwin plant.

9. The Nolichucky River supplies drinking water for the town of Greeneville and for Greene County. Although there is a well on our property, I frequently visit family members' and friends' homes and public facilities where I drink from the municipal water supply. I also consume fruits and vegetables that are irrigated with Nolichucky River water, I eat shrimp that are raised in Nolichucky River water, and I drink milk from cows that drink from the Nolichucky River. I am therefore concerned about the effects on my health of ingesting increased levels of radiological and chemical contaminants in the Nolichucky River, as a result of normal operation and accidental discharges from NFS's HEU downblending operation.

10. I am concerned that the increased levels of radiological and chemical effluents from the NFS Erwin plant will affect my health during normal operation of the facility, and also during floods. The Nolichucky River is periodically subject to severe flooding. The most recent severe flood, which occurred in August of 2001, did extensive damage to life and property along the river. I am concerned that such flooding may result in unplanned discharges of effluent from the NFS-Erwin site that may affect my health and the health of my family. I am also concerned that during a flood, our property may become contaminated by radiological

discharges from the NFS plant. This would adversely affect both my health and my family's health. It could also adversely affect the value of our property.

11. I am a member of the Friends of the Nolichucky River Valley, which has submitted a hearing request in this proceeding. I have authorized the Friends of the Nolichucky River Valley to participate in this proceeding on my behalf, in order to represent my interests in ensuring that the NRC's decision on NFS's license amendment application includes adequate measures for the protection of my health and welfare, my family's health and welfare, and the quality of the environment in which we live.

Trudy L. Wallack

Dated: 11/25/02

Exhibit 4

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE PRESIDING OFFICER

In the matter of	)	
Nuclear Fuel Services, Inc.	)	Docket No. 70-143
(Materials License SNM-124)	)	

DECLARATION OF PARK OVERALL

Under penalty of perjury I, Park Overall, declare that:

1. My name is Park Overall. My principal residence is 33150 Drill Road, Agua Dulce, California.

2. I have a fifteen-acre farm in Tennessee, at 1374 Ripley Island Road in the town of Afton. I reside at my Tennessee residence during part of each year, sometimes for as long as two months.

3. My farm lies on the banks of the Nolichucky River. The Nuclear Fuel Services ("NFS") Erwin plant lies about 31 river miles upstream.

4. I am aware that NFS has filed the first in a series of related license amendment applications to the U.S. Nuclear Regulatory Commission ("NRC"), that would allow NFS to downblend high-enriched uranium ("HEU") at its plant in Erwin, Tennessee. According to an Environmental Assessment prepared by the Staff of the U.S. Nuclear Regulatory Commission in June of 2002, the downblending operation would result in increased discharges of radioactive contaminants to the municipal water supply in Jonesborough. Table 5.1 of the EA shows that levels of radiological contaminants in drinking water would increase in the following proportions: uranium (16.6%), thorium (210,000%), and plutonium (5.8 million %). At page 5-6, the Environmental Assessment states that the "receptor" used for the purpose of estimating these contaminant levels is the nearest point of water use, *i.e.*, the Jonesborough Water Plant. The Jonesborough Water Plant is located on the Nolichucky River, 13 km (8 miles) downstream from the Erwin plant.

5. As described in Section 3.9 of the Environmental Assessment, operation of the NFS facility has resulted in radiological and nonradiological contamination of soil and groundwater. This causes me to be concerned that NFS does not have sufficient control

of its operation to ensure that radiological and chemical effluents from the proposed downblending operation can and will be contained properly.

6. When I was a child, I swam and boated in the Nolichucky River. I don't do that any more, because the river has become heavily sedimented over the years. If the water quality in the river were not so degraded and unpleasant, I would continue to swim and fish there to this day.

7. I hope that one day the sedimentation of the Nolichucky River will be cleaned up. In that event, however, I am concerned that I will still be unable to swim or fish there because of radiological and chemical contamination that is carried downstream from the NFS-Erwin plant. This contamination includes effluents from normal operations of the proposed HEU downblending operation, as well as accidental releases. I am also concerned about the effects of increased pollution from the NFS-Erwin Plant on the quality of my drinking water, because the town of Afton gets its water from the Nolichucky River, where NFS discharges liquid effluent. I am concerned that additional normal or accidental effluent discharges from the NFS-Erwin Plant to the Nolichucky River may have a detrimental effect on Afton's water quality. I am also concerned about the effects of an increase in the NFS plant's effluent to the Nolichucky River on my property values. Finally, I am concerned about the impacts of increased pollution from the NFS-Erwin plant on wildlife and plants in the area, which I enjoy.

8. I am a member of the Tennessee Environmental Council, Oak Ridge Environmental Peace Alliance ("OREPA"), and Friends of the Nolichucky River, which have requested a hearing in this proceeding. I have authorized those organizations to represent my interest in ensuring that the NRC's decision on NFS's license amendment application includes adequate measures for the protection of my health and welfare and the quality of the environment in which I live.

Park Overall

Date: 11/22/02

Exhibit 5

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE SECRETARY

In the matter of	)	
	)	
Nuclear Fuel Services, Inc	)	Docket No 70-143
	)	
(Materials License SNM-124)	)	
	)	

DECLARATION OF CHRIS IRWIN

Under penalty of perjury I, Chris Irwin, declare that:

1. My name is Chris Irwin. I live at 2131 Riverside Drive, Knoxville, Tennessee

2 I am a former river guide on the Nolichucky River I continue to boat and hike along the Nolichucky on a regular basis, but I restrict my activities to the area upstream of the Nuclear Fuel Services ("NFS") Erwin plant. I would boat and hike in the area downstream of the Erwin plant, but I am concerned about the effects on my health of radioactive and chemical effluents that NFS emits from the plant. If NFS is allowed to increase its radioactive and chemical effluents from the plant, this will discourage me even further from hiking or boating downstream of the Erwin plant

3. I am a member of Oak Ridge Environmental Peace Alliance ("OREPA"). I have authorized OREPA to represent my interests in this proceeding.

Chris Irwin

Date AUG 7 2002

Nuclear Terrorism:
The Danger of Highly Enriched Uranium (HEU)

by Jeffrey Boutwell, Francesco Calogero and Jack Harris

"It's not a matter of *if*; it's a matter of *when*."

Gen Eugene E. Habiger
former commander
US Strategic Air Command

The horrifying September 2001 terror attacks in the United States that took the lives of more than 3,000 people have greatly increased the concern of the international community over the risks of a nuclear terrorist attack. The scale of the planning, resources and dedication to a cause that characterized the September 11 attacks on the World Trade Center and the Pentagon make clear that groups and individuals do exist who would not hesitate to use a nuclear explosive device in furtherance of their aims, whatever these may be.

We believe that the explosion in a major urban area of even a crude nuclear device, for the first time as a hostile act since Hiroshima and Nagasaki in 1945, would be an unparalleled disaster for the international community. Over and above the death, destruction and psychological trauma that such an explosion would cause, a nuclear threshold would have been crossed that could lead to great international tension and instability, and perhaps even the further use of nuclear weapons against humanity.

This is the risk that the world now faces. As explained below, we believe that it could be a relatively easy matter for a terrorist organization to assemble and then detonate a nuclear explosive device in one of the world's major cities. With access to the appropriate material, it is indeed easy to assemble a nuclear explosive device in a residence or workplace in the downtown section of a major city and then explode it with horrifying consequences.[1]

To be sure, there are many ways that terrorists can wreak death and destruction, including through the use of chemical and biological/ bacteriological agents, radiological materials, and the hijacking of airliners and using them as missiles to destroy skyscrapers, or perhaps civilian nuclear power plants. The question of which option may be "easier" than another is immaterial, as the answer will largely depend on the specific competencies and capabilities (including access to key materials) available to the terrorists, as well as their personal histories and contacts.

What does seem beyond doubt is that acquiring the capability to explode a nuclear device — the "absolute weapon" – must certainly be very appealing for any terrorist group seeking to cause major damage to society and the governmental and social institutions they oppose. Such a capability is likely to confer on its possessors a great feeling of power, not to mention its value as an effective instrument for blackmail or retaliation. And the scale of damage caused by exploding one or more nuclear devices — in terms of death, injury and suffering, of immediate physical destruction and lasting economic impact, and of psychological trauma – is certain to be horrendous.[2]

Assembling a nuclear device

Despite the fact that 30,000 nuclear weapons still remain in the arsenals of the major nuclear powers (more than 28,000 of these in the US and Russia alone), we believe it is unlikely that a subnational terrorist group will obtain an actual nuclear warhead. These instruments of mass destruction — wherever they exist — are

Jeffrey Boutwell is Executive Director of the Pugwash Conferences on Science and World Affairs. Formerly he was program director for international security studies at the American Academy of Arts and Sciences, and a staff aide on the National Security Council during the Carter Administration. He has a Ph D. from the Mass Institute of Technology and has written widely on international security issues.

Francesco Calogero is professor of theoretical physics at the University of Roma 1 "La Sapienza". He served from 1989 to 1997 as Secretary General of the Pugwash Conferences and from 1997 to 2002 as Chair of the Pugwash Council. He served for 10 years (1982-1992) on the Governing Board of the Stockholm Peace Research Institute (SIPRI) and is the author of numerous articles and essays on nuclear weapons.

Before taking early retirement, Jack Harris worked for 35 years in the UK's nuclear power industry and for this work was elected to Britain's National Academies of Science and of Engineering He is the co-recipient of the Royal Society's 'Esso' Gold Medal for Energy Conservation, for studies leading to more efficient utilization of nuclear fuel. He is the former editor of *Interdisciplinary Science Reviews*, and the Vice Chair of British Pugwash

by and large effectively protected against theft and diversion. By contrast, we believe it would be much easier for a terrorist group to obtain, and then smuggle to the target area, the key material necessary to manufacture, on site, a nuclear explosive device.

Most people assume that it is quite difficult to manufacture a nuclear explosive device. This may be true if the basic fissile material is plutonium, whose adaptation to a weapon was the main challenge of the nuclear weapons design effort at Los Alamos during World War II. Plutonium has made possible the construction of the compact nuclear weapons which dominate national nuclear arsenals. But if a sufficient quantity of Highly Enriched Uranium (HEU), the material used in the Hiroshima weapon, were available, a small group of terrorists might be able to manufacture a nuclear explosive device which would have a substantial probability of producing a nuclear explosion comparable to that which destroyed Hiroshima.

While many people around the world already possess the technical competence necessary for building such a nuclear explosive device, a terrorist group need not have access to such individuals, or even themselves be highly-trained scientists or engineers. A team of terrorists with sufficient knowledge of physics, explosives and machining could, having gathered information available in open and easily available sources, construct a crude nuclear bomb that would have a high probability of exploding with a sizable nuclear yield. Moreover, unlike plutonium, HEU poses no significant health hazards, other than accidental criticality, in the process of building such a device.[3]

By assembling a nuclear bomb in a residence, garage or workshop in the middle of a major city, possibly from components previously manufactured elsewhere, the terrorists would not have to worry about being detected trying to smuggle an entire device into the target country. After a period ranging from hours to months, the device would be ready. The terrorists could then detonate the nuclear bomb by remote control, or by a timer, allowing them ample time to get away.

PHOTO: MITSUO KISHIDA

The ruins of Hiroshima smolder one day after the atomic bomb called "Little Boy" was dropped Aug 6, 1945. The skeletal remains of a domed building, center, now called the Atomic Bomb Dome, have been preserved as a memorial

Because of the likely crudeness of its design and construction, it might be difficult to provide any reliable a priori estimate of the final yield of such a device. Nonetheless, it is possible that its destructive power would be similar to that of the Hiroshima weapon (approximately 13 kilotons), and the number of fatalities (both short and long-term) could approach — or exceed — 100,000, especially if the bomb was exploded in a city with high population density like Hiroshima or the central urban area of a modern city.[4] Even if the terrorist bomb had an explosive yield only one-tenth that of Hiroshima, around one kiloton, the fatalities, casualties, and overall social, economic, and psychological impact of the blast would still dwarf any previous terrorist action.

Highly enriched uranium (HEU)

The biggest obstacle to manufacturing and detonating such a device is the difficulty of acquiring the basic "raw material" of such a bomb, weapons-grade Highly Enriched Uranium (HEU).

Uranium is an element that is widely present in nature, even as a tiny fraction of sea water. Yet natural uranium consists mainly of the isotope U-238 (some 99.3 percent), while the material needed to sustain the chain reaction of a nuclear bomb is the fissile isotope U-235, which only accounts for 0.7 percent of natural uranium. In order to produce weapons-grade HEU, the amount of U-235 in the uranium

"The unleashed power of the atom has changed everything save our modes of thinking and we thus drift towards unparalleled catastrophe."

Albert Einstein
24 May 1946

"Most people seem unaware that if separated U-235 is at hand it's a trivial job to set off a nuclear explosion, whereas if only plutonium is available, making it explode is the most difficult technical job I know."

Luis W. Alvarez, a key participant in the construction of the first US nuclear weapons and recipient of the Nobel Prize in Physics, 1987; see Luis W. Alvarez, *Adventures of a Physicist* (Basic Books, 1988) p. 125.

needs to be increased to 90 percent or above. However, any enrichment above 20 percent, the definition of highly-enriched uranium (HEU), is considered weapons-useable.[5]

The amount of highly-enriched uranium needed to make a bomb will depend, in the end, on the degree of enrichment and on the design of the explosive device itself (i.e., the skill of the manufacturer). For a primitive nuclear device, however, 100 kilograms of weapons-grade HEU would certainly be more than enough (we shall use this quantity as the notional unit in the discussion below, to also take account of possible losses in the process of construction).

Smuggling such an amount of weapons-grade uranium (especially in an oxide form, which, as a powder, is easier to both steal and transport) into the target city would likely be no more difficult than smuggling a similar amount of cocaine or heroin, as HEU can be hand-carried with no risk of radiation, and the 100 kilograms could be separated out into, say, half a dozen to a dozen one-liter cartons similar to those used for milk.

Enriching uranium for nuclear weapons is a difficult and expensive technological feat, which only a few states have mastered.[6] The Iraq of Saddam Hussein, for example, tried to produce HEU in the context of a clandestine program to acquire nuclear weapons (in violation of the nuclear Non-Proliferation Treaty to which Iraq was a Party), but after spending billions of dollars, it appears to have managed to produce only gram quantities of HEU.

It is important to note that, in addition to being used for nuclear weapons, weapons-grade uranium also serves as the fuel for the reactors of nuclear-propelled submarines and some Russian ice-breakers, as well as for various small scientific research reactors around the world. There are, however, plans for phasing out some of these uses of HEU (particularly in research reactors), although it is unlikely they will be fully implemented soon.

In terms of using uranium to produce electrical energy, nearly all the world's civilian nuclear power reactors use as fuel Low Enriched Uranium (LEU), in which the concentration of U-235 has been increased from 0.7 percent to around 3-5 percent. Even this modest enrichment of uranium, however, is difficult and expensive, and it is very important to understand that the cost of producing LEU containing a given quantity of U-235 is not that much less than the cost needed for producing HEU containing the same quantity of U-235, even though the proportions of U-235 present are vastly different (3-5 percent compared to 90 percent or more).[7] In short, the cost of producing LEU is a substantial fraction of the cost to produce HEU, and by the same token (also a point that will become important below), if one de-enriches HEU to LEU, only a minor fraction of the separative work gets wasted.

There is, of course, no free market in highly enriched uranium, and the sale and transfer of LEU is carefully safeguarded. But the quantity of HEU that exists in the world is exceedingly large due to the excessive accumulation of this strategic material during the Cold War, especially in the United States and the former Soviet Union; hence the high risk that some of it might be stolen or sold illegally on the black market.

Eliminating HEU

Of concern for several years now has been the very large quantity of HEU in the former Soviet Union (now mostly in Russia), which amounts to well over 1,000 metric tons (*one million* kilograms: enough for more than 10,000 easy to construct nuclear explosive devices). Given the economic difficulties affecting Russia and the Russian nuclear complex (operated by the Ministry of Atomic Energy, *MinAtom*), there are special concerns about this material being adequately secured against theft or diversion to third parties, be they states or subnational groups.

Beginning in the early 1990s, substantial efforts were initiated to improve the safeguarding of this fissile material, via the US-Russian Cooperative Threat Reduction Program. Since then, the US financial contributions have run into billions of dollars. The other G7 countries have made useful, though marginal, contributions to this endeavor. Recently, however, the

G7 (now G8, including Russia) countries have proposed additional contributions under a new program entitled "10+10 over 10".[8] This would involve the USA contributing $10 billion, to be matched by another $10 billion contribution from the remaining G7 countries, with all the funds being allocated over a ten year period. These decisions are to be welcomed, but the 10 year time scale is overly long. Were the $20 billion allocated instead to a crash program extending over just three years, this would be a more appropriate match to the scale and urgency of the problem. There are, moreover, additional fears that domestic politics and commercial considerations could delay the US Congress actually allocating the money. The complexity of the European Union decision-making process and its bureaucracy is another cause for concern.

The focus of the above programs is on strengthening the so-called *Material Protection, Control, and Accounting* (MPC&A) procedures at dozens of nuclear facilities throughout the former Soviet Union. An additional concern is preventing the outflow, or brain drain, of experts on nuclear weapons technology to states of concern suspected of seeking to acquire nuclear weapons.

Quantities of HEU also exist in other countries, especially in the states that possess nuclear weapons (certainly in the United States, United Kingdom, France, China, and Pakistan) or, in the case of South Africa, that once did. Most of these HEU stockpiles are small compared to those in Russia and the US (although still large in terms of the number of nuclear explosive devices that might be manufactured with them). In order to minimize the risk of theft or diversion of HEU from these countries, there must be constant monitoring and intelligence to ensure its safety, especially as HEU when being processed is less susceptible to precise accounting and easier to steal.

Clearly, an effective strategy for decreasing the risk of nuclear terrorism is to eliminate totally the basic raw material — HEU — needed for the easy manufacture of nuclear explosive devices. From a practical point of view, it is

Hiroshima

enough to de-enrich HEU to less than 20 percent U-235, so that it cannot be used to produce a nuclear explosion. This is a straightforward task, the reversal of which is extremely difficult — in fact, for any terrorist group, quite impossible. Moreover, because both the US and Russia now have much more HEU than they can possibly use for their nuclear arsenals - which are fortunately in the process of being reduced — it has been politically possible to agree to move in this direction.

A 1993 HEU deal between the US and Russia called for Russia to de-enrich a substantial quantity of its weapons-grade uranium, 500 metric tons, and sell the resulting LEU to the US. This was an important achievement, but the mechanisms of its implementation were seriously flawed, inasmuch as they transformed a development motivated by well justified security concerns into a commercial deal, whose cumbersome implementation then undermined the initial security objectives. This evolution from security to commercial priorities began when the first Bush Administration announced that the deal would entail "no cost to the American

"The most urgent unmet national security threat to the United States today is the danger that weapons of mass destruction or weapons-usable material in Russia could be stolen and sold to terrorists or hostile nation states and used against American troops abroad and citizens at home."

Howard Baker and Lloyd Cutler, January 2001
See endnote 11

taxpayer". Motivated no doubt by the need to sell the $12 billion program to an unsympathetic Congress, the Bush and then the Clinton administration proposed that Russia de-enrich its weapons-grade HEU to reactor-grade LEU, sell the LEU so obtained to the US, which then would re-sell it to electrical utilities as fuel for nuclear reactors, thereby recouping the funds paid to Russia.

Unfortunately, commercial considerations became so dominant in determining the specific terms of this agreement that its implementation was stretched out over a twenty year period (in order not to deflate the market price of LEU). This is an absurd time scale given the tremendous dangers associated with the presence of large quantities of inadequately guarded HEU in Russia.

Matters were then made much worse by assigning the implementation of the agreement to the United States Enrichment Corporation (USEC), an institution that clearly had no fundamental interest in importing enriched uranium from Russia's Ministry of Atomic Energy (a major market competitor), and which was moreover simultaneously transformed from a US government agency into a private company that, as such, would be more tempted to put profit motives above national and international security considerations. As a consequence, the HEU Deal (which the USEC trumpeted as "Megatons to Megawatts") was much hampered and its implementation delayed, especially given the pressures of a worldwide decline in demand for LEU. Not surprisingly, the deal has had to be rescued more than once by US government intervention, and almost ten years after the original agreement, the LEU transferred to the US corresponds to less than 150 tons of Russian HEU (less than 30 percent of the target amount of 500 tons, and only 10-20 percent of all the HEU in the former Soviet Union).[9]

It is clearly necessary and urgent that the HEU agreement be revisited by the Bush Administration, in the light of the much greater urgency in preventing the risk of nuclear terrorism that should prevail after September 11, 2001. But this will not be enough. Attention needs to be paid as well to the risk implicit in the existence of the enormous stocks of excess weapons-grade uranium in Russia (and also in the US), the size of which will increase in coming years because of additional reductions in US and Russian nuclear forces. The goal must be to eliminate this dangerous material as quickly as possible.

A supplementary strategy

In addition to the importance of accelerating the implementation of the US-Russia HEU deal described above (possibly by-passing the USEC altogether), serious consideration needs to be given to *supplementary initiatives* aimed at bringing about the elimination of as much HEU as possible, as quickly as possible.

One strategy for achieving this goal would be to subsidize its de-enrichment. The greater the financial inducement for Russia, and specifically *MinAtom* - the institution in Russia that is responsible for the oversized and now underfinanced Russian nuclear complex (including both military and civilian installations) - the greater the incentive to proceed in this direction at the fastest possible rate to retrieve all available HEU. A secondary advantage of this approach would be to infuse funds into the *MinAtom* operation, funds which might contribute to preventing catastrophic developments resulting from the overall decay of this crucial institution.

The plan might be based on offering *MinAtom* an immediate cash payment for every quantity of HEU that is de-enriched, to say, below 20 percent (namely, low enough to exclude any possibility of explosive use). At a price of perhaps US $10 for each gram of high-grade HEU that is eliminated, $10 billion would be needed for the elimination of the approximately 1,000 tons of HEU remaining in Russia. (Of course, Russia would retain some HEU in its down-sized nuclear arsenal.) For the scheme to work, enough transparency should be provided by *MinAtom* to enable the outside world to verify, first of all, that the production of new HEU has definitely stopped, and secondly, that the de-enriched HEU is properly measured,

accounted for and safeguarded (possibly by the International Atomic Energy Agency). Payments to *MinAtom* could be considered no-interest loans, to be repaid by Russia when material gets further de-enriched and treated to qualify as marketable LEU for sale to utilities worldwide for the production of electricity. (At current market prices, it is conceivable that Russia might earn twice as much money from the sale of LEU as it would have to repay for the no-interest loans obtained for the immediate de-enriching of HEU to below 20 percent, though such estimates must remain tentative given the uncertainty about future market prices for LEU.)

The main contributor to the plan would likely be the United States, though it is to be hoped that other industrial nations (the European Union countries, Japan, Canada, etc.) would contribute as well to reducing and ultimately eliminating the large excess stocks of HEU in Russia. Russia would certainly respond positively to such an offer, as would other former Soviet Union countries possessing much smaller stocks of excess HEU at nuclear research institutes.

In negotiating such a deal, conditions might be set for the way such funds are utilized by the countries receiving them. For example, Russia might use its funds, in part, for agreed measures of nuclear disarmament and/or the elimination of its enormous stocks of chemical weapons as called for by the Chemical Weapon Convention, a commitment Russia is having difficulty meeting because of its cost. All such conditions, however, should take a back seat with respect to the main goal of eliminating as much HEU as quickly as possible. It should be noted that allocating funds directly for the elimination of HEU is, in the long term, more cost-effective than devoting resources to upgrading its physical security, which of course requires continued additional investments over time.

Another strategy could be based on the principle of a "debt for security" swap, where creditor nations offer to transform Russian debts to non-interest-paying loans. Currently, Russia owes Germany over $26 billion, and Italy some $6 billion, out of a total debt of $71 billion.

Global stocks of nuclear weapons and nuclear materials

Country	Total nuclear weapons[3] (including those in reserve)	HEU (metric tonnes)[4]	Separated plutonium (metric tonnes)	
		Military[4] (1994)	Military[4] (1994)	Civilian[5] (2000)
US	~9,000	580–710	85	0
Russia	~20,000	735–1365	100–165	34
UK	<200	6–10[2]	7.6	78 1
France	~350	20–30	3 5–6 5	82 7
China	410	15–25	2–6	0
India	30–35[1]	0	~0 3	0
Pakistan	30–52[1]	0 6–0 8	0.001–0 01 (end 1999)	0
Israel	60–100	0	~0 4	0
South Africa	0	0 4	0	0
North Korea	0	0	~0.03	0
Germany	0	0	0	7.2
Japan	0	0	0	5 2
Other European	0	0	0	4.5
Total	30,085–30,152	1360–2140+ ~20 civilian	200–270	~200

[1] Estimates based on the amount of nuclear material these states are believed to possess

[2] 21 9 tonnes as published in the *Strategic Defence Review* 1998

[3] Carnegie Endowment for International Peace. http //www ceip org/files/nonprolif/numbers/default asp

[4] Federation of American Scientists *Public Interest Report* Vol 54, No 6

[5] Based on national declarations to the International Atomic Energy Agency (Infcircs549 http.//www iaea org/worldatom/Documents/Infcircs).

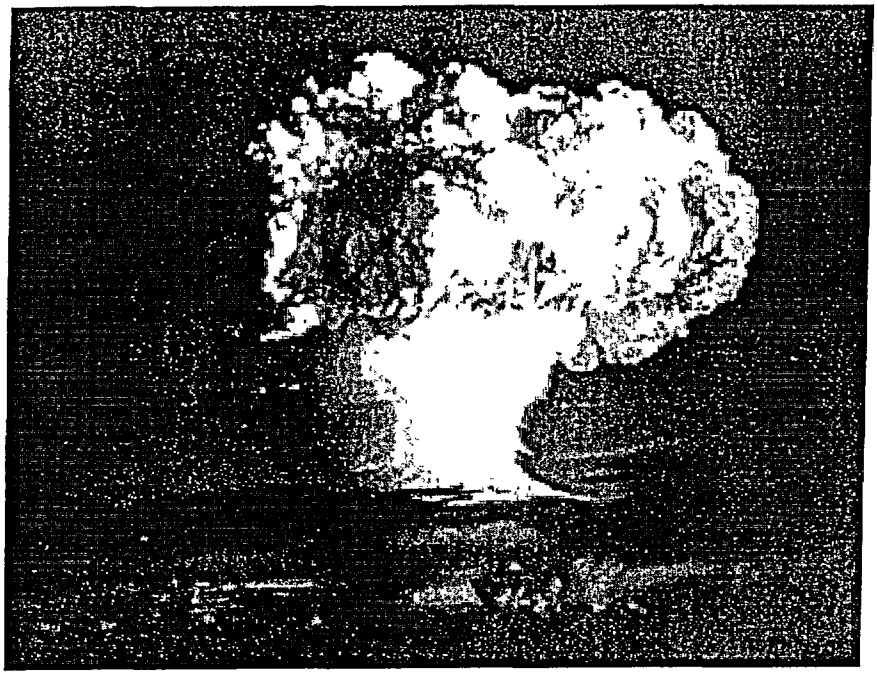
Source. Nuclear Terrorism, Parliamentary Office of Science and Technology, Number 179, July 2002

Both western countries and Russia might find it attractive to finance the elimination of HEU through this type of forgiveness of debt.[10]

Tragically, policymakers and the public have thus far demonstrated insufficient interest in, nor even awareness of, the very real dangers posed by the large quantities of HEU that might become available to terrorist organizations or others. Far greater political will and leadership will be necessary, particularly in the United States but also in Europe, Japan, Canada, and other countries, if we are to eliminate the tremendous risk of nuclear terrorism.

Plutonium

A few remarks are needed about plutonium, the (only) other raw material out of which nuclear bombs are now made.



The mushroom cloud formed by the "Mike" thermonuclear test on November 1, 1952

While the availability of plutonium certainly poses a risk with respect to the possible acquisition of nuclear weapons by States, it does not pose a risk comparable to that of HEU for the possible clandestine manufacture of a nuclear explosive device by a subnational terrorist group. The reasons for this have to do with the far more demanding technological expertise required to manufacture a nuclear explosive device based on plutonium (including experimentation with very sophisticated conventional explosives and electronic equipment).

Moreover (albeit less importantly) handling plutonium entails much greater health hazards than does HEU, and transporting it clandestinely is more difficult (because of its more pronounced radiation signature). Hence, plutonium nuclear explosive devices are much less likely to fall within the competence of any subnational terrorist group, and in any case their yield is unlikely to be comparable to that of an HEU device.

The plutonium problem has received much more attention from analysts than the HEU issue because, from the technological point of view, what to do about plutonium is much more controversial. Despite the challenges posed by plutonium in terms of proliferation to states and safe and secure disposal,[11] it is Highly Enriched Uranium that presents the far greater nuclear terrorist threat, making it imperative that the world community devote immediate and substantial resources for strictly controlling HEU, with the goal of eliminating as much of this dangerous material, as quickly as possible.

Epilogue

The authors of a 1996 book, *Avoiding Nuclear Anarchy*, speculated on what would have happened had the terrorists in 1993 used a nuclear bomb at the World Trade Center instead of exploding several hundred kilograms of chemical explosives.[12] Basing their calculations on the detonation of about fifty kilograms of HEU - the size, incidentally, of a couple of grapefruits – they write that the result would have been a nuclear blast equivalent to the explosion of between 10,000 and 20,000 tons of TNT (about the yield of the Hiroshima bomb). This would have devastated a three-square-mile area covering the southern portion of Manhattan, including all of Wall Street reaching up to Gramercy Park. Depending on the timing of the attack, more than one hundred thousand people might die, with at least that many, if not more, seriously injured. Indeed, other estimates put the casualties even higher.[13]

Similar assessments most likely have been made, or could be made, for the effects of a comparable nuclear detonation in London, Delhi, Beijing or Moscow. If detonated near the Kremlin in Moscow, or the Forbidden City in Beijing, or the Indian Parliament in Delhi, or Westminster and Buckingham Palace in London,[14] the resulting deaths and injuries, not to mention the psychological trauma, would be a shock to the international system and could well destabilize relations among the nuclear powers.

The destructive potential described above is within the reach of small, determined groups of people. We cannot know what groups might attempt to inflict such horrendous suffering, for what purpose, or against which city or nation. What we do know is that the need to prevent such horrific acts exists now. And it is clear what can and should be done now, before it is too late.

Notes

[1] See, for instance, the following by Francesco Calogero: "Fast-track the uranium deal", *Bulletin of Atomic Scientists,* November/December 1997, pp. 20-21; reply to letter, *Bulletin of Atomic Scientists,* January/February 1998, p. 66; "The risk of Highly Enriched Uranium (HEU) for terrorism", paper co-authored with Giancarlo Tenaglia and presented at the 1999 Annual Pugwash Conference, Rustenburg, South Africa, 8-13 September, 1999, and at the 1999 Amaldi Conference, Mainz, Germany, 6-10 October, 1999 and published in the Proceedings of these meetings; "The risk of terrorist uses of nuclear explosions", Section 3.8 of Issues in Arms Control, Lectures given in the Academic Training Program of CERN, February 12-16, 2001, *CERN Report 2001-004,* ISBN 92-9083-187-1; "Nuclear terrorism", Proceedings of the Nobel Peace Prize Centennial Symposium, Oslo, December 6-8, 2001 (in press); "Memo on nuclear terrorism", proffered paper, Amaldi Conference 2002, Pontignano near Sienna, Italy, April 27-29, 2002; "Nuclear terrorism", letter in *Bulletin of Atomic Scientists,* May/June 2002, p. 5.

[2] Depending of course on the final yield of such a nuclear explosion, the scale of the damage is likely to be much larger than that achievable by any other means — with the possible exception of the widespread diffusion of a lethal and highly infectious pandemic disease such as might be caused by a particularly virulent strain of smallpox.

[3] See Al Narath, "The Technical Opportunities for a Sub-National Group to Acquire Nuclear Weapons", presented at the XIV Amaldi Conference on Problems of Global Security, Pontignano, Italy, April 2002; see the Accademia Nazionale dei Lincei website. Narath is a former Director of Sandia National Laboratory in New Mexico, the main laboratory in the US where nuclear weapon designs are finalized.

[4] See the paper by Richard L. Garwin, "Nuclear and Biological Megaterrorism," paper given at the 27th Session of the International Seminars on Planetary Emergencies, 21 August 2002, at www.fas.org/rlg/020821-terrorism.htm; a shorter version of the paper was published as "The Technology of Megaterror," *Technology Review,* September 2002.

[5] While both very expensive and technically demanding, the enrichment process is essentially accomplished by separating out the required quantity of U-238 so that the proportion of U-235 in the remaining uranium increases accordingly.

[6] See Frank von Hippel, "Recommendations for preventing nuclear terrorism," *FAS Public Interest Report,* vol. 54, no. 6 (Washington, DC: Federation of American Scientists, November/December 2001).

[7] It is easy to explain this apparent paradox. Every 1,000 atoms of natural uranium contain 7 atoms of U-235, and 993 atoms of U-238. To transform this material into LEU (enriched, say, to 3.5 percent) one must shed 800 atoms of U-238, so that one is left with 200 atoms, 7 of which are U-235, and 193 of U-238. Subsequently, in the next stage of separation, it will be sufficient to shed less than 200 atoms of U-238 to get HEU. Roughly speaking (the percentages are not exact), only an additional 20 percent of effort and cost is needed to produce HEU from LEU, from what was needed to move from natural uranium to LEU.

[8] The "10+10 over 10" initiative was agreed to during the G8 Summit, held 25-27 June 2002 in Kananaskis, Alberta, in Canada. Leaders of the G8 (Canada, the US, UK, France, Italy, Germany, Japan and Russia), adopted the "G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, and pledged to commit $20 billion over ten years to support projects, most initially in Russia, aimed at disposing of fissile material, destroying chemical weapons, dismantling decommissioned nuclear submarines, and securing employment for former weapons scientists. See the website of the Government of Canada; www.g8.gc.ca.

[9] For more on the failings of USEC, see Robert Civiak, "The need for speed," *Bulletin of the Atomic Scientists,* July/August 2002. In the same issue, see also Oleg Bukharin, "Making fuel less tempting", for information on less well-guarded HEU at Russian research reactors.

[10] This type of "debt for security" swap is being investigated and promoted by Maurizio Martellini of the Landau Center – Centro Volta, of Como, Italy.

[11] For recent analyses of the risks associated with the availability of nuclear-weapon materials, see: Matthew Bunn, John Holdren, and Anthony Weir, "Securing Nuclear Weapons and Materials: Seven Steps for Immediate Action" (Cambridge, Mass.; Belfer Center for Science and International Affairs, Harvard University, May 2002), and Howard Baker and Lloyd Cutler (Co-Chairs, Russia Task Force, U. S. Secretary of Energy Advisory Board), A report card on the Department of Energy's nonproliferation programs with Russia, final draft of 10 January, 2001, available at www.hq.doe.gov/seav.

[12] Graham Allison, Owen Cote, Richard Falkenrath, and Steven Miller, *Avoiding Nuclear Anarchy* (Cambridge, Mass.: MIT Press, 1996).

[13] See Garwin, "Nuclear and Biological Megaterrorism "

[14] J.E. Harris, "The threat of Nuclear Terrorism," Editorial, *Interdisciplinary Science Reviews,* vol. 24, no. 2, 1999, p. 81.

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I certify that on November 27, 2002, copies of REQUEST FOR HEARING BY FRIENDS OF THE NOLICHUCKY RIVER VALLEY, STATE OF FRANKLIN GROUP/SIERRA CLUB, OAK RIDGE ENVIRONMENTAL PEACE ALLIANCE, AND TENNESSEE ENVIRONMENTAL COUNCIL and REQUEST BY FRIENDS OF THE NOLICHUCKY RIVER VALLEY, STATE OF FRANKLIN GROUP/SIERRA CLUB, OAK RIDGE ENVIRONMENTAL PEACE ALLIANCE, AND TENNESSEE ENVIRONMENTAL COUNCIL TO HOLD PROCEEDING IN ABEYANCE PENDING SUBMISSION OF ADDITIONAL LICENSE AMENDMENT APPLICATIONS were served on the following by by first-class mail, and by e-mail and fax (exhibits only) if so designated:

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