DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 11, 1999

The Honorable Bill Richardson
Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Richardson:

On August 11, 1999, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286a(5), unanimously approved Recommendation 99-1, which is enclosed for your consideration. Recommendation 99-1 deals with the safe storage of fissionable material called "pits."

42 U.S.C. § 2286d(a) requires that after your receipt of this recommendation, the Board promptly make it available to the public in DOE's regional public reading rooms. The Board believes the recommendation contains no information that is classified or otherwise restricted. To the extent this recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2161-68, as amended, please arrange to have it promptly placed on file in your regional public reading rooms.

The Board will also publish this recommendation in the *Federal Register*.

Sincerely,

John T. Conway
Chairman

Enclosure

c: Mr. Mark B. Whitaker, Jr.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD
RECOMMENDATION 99-1 TO THE SECRETARY OF ENERGY
Pursuant to 42 U.S.C. § 2286a(a)(5)
Atomic Energy Act of 1954, As Amended.

Dated: August 11, 1999

Fissionable components are at the heart of all nuclear weapons, and have therefore been of central importance to that part of the nation's defense posture that relies on nuclear deterrence. Most of the defense nuclear programs of DOE and its predecessor agencies have been devoted to production of the fissionable material for these components and the working of this material into weapons parts. Most fissionable material in nuclear weapons is in components called "pits," which are the primary parts of the weapons, and which have geometrical forms, dimensions, and other features which are highly classified. Pits are predominantly made of plutonium metal which by itself would corrode in an air atmosphere, causing a possibility of dispersion of this hazardous material. Therefore, pits normally have a corrosion-resistant cladding, and where possible they are kept in an inert atmosphere. The design purpose of pits and their constituent material leads them to have singular importance, both from the standpoint of national security and that of safety. In particular, when pits are stored by themselves, not incorporated in a nuclear weapon ("stand-alone" pits), special attention is required to avoid any undue risk.

Most plutonium pits in this country were formerly made at the Rocky Flats Plant of the Department of Energy, situated between Boulder and Golden, Colorado. When manufacture of new pits was ended in 1989, a number of previously made but still unused pits existed outside of completed weapons, along with some others that had been manufactured but that required rework. Also, when weapons are dismantled, their pits are stored as stand-alone pits. In the following, the term "pits" will be reserved to those components not incorporated in nuclear weapons.

The number of stand-alone pits continues to grow as more nuclear weapons are dismantled in accordance with international agreements and national policy, and it is now in excess of 10,000. Most of the nation's pits are stored at this time at the Pantex Plant of the Department of Energy, near Amarillo, Texas, under conditions considered to be secure and also safe for the time being.

Current plans envisage three principal destinies for pits stored at Pantex. Some pits are to be retained in a strategic reserve, in case a decision should be made to use them in nuclear weapons at a future time. Other pits regarded as surplus to any conceivable future defense mission are to be converted from metallic form to a plutonium oxide, which is to be added to depleted uranium oxide. The combination is to serve as the fissionable material in mixed oxide fuel in certain commercial nuclear reactor plants. Plutonium from some surplus pits that will be difficult to use in this way will be disposed of.

Numerous decisions must still be made to convert such tentative plans to reality. The most basic ones would establish where certain actions and processes are to take place. They are:

1. Where is the strategic stockpile of pits to be stored?
2. Where is the conversion of metallic plutonium to plutonium oxide to take place?
3. Where is the manufacture of mixed oxide fuel to occur?
4. Where will surplus pits awaiting disposition be stored?

Current actions of DOE are consistent with storage of pits for the strategic stockpile at the Pantex Plant. Pits destined for conversion to plutonium oxide and subsequent incorporation in mixed oxide fuel must be processed into feedstock prior to fuel manufacture. DOE has announced in its Record of Decision following an Environmental Impact Statement that Savannah River is the preferred site for this conversion to feedstock. For this to take place, pits in the latter category must be shipped to the Savannah River Site from their present location at the Pantex Plant at Amarillo, Texas.

Almost as basic are decisions still awaited regarding the structures in which both medium-term and long-term storage will take place, and the nature of the storage itself including the containers that will be used for shipping and storage. For most of the pits now in storage at Pantex, the outer metallic cladding is the only reliable containment. Although the cladding of pits has rarely failed or been breached, most pits have been protected throughout their existence by the sealed atmosphere within a nuclear weapon, limiting their exposure to incompatible or corrosion-producing materials. However, most pits at Pantex are now in AL-R8 containers with a normal atmosphere, along with celotex packing material that is a potential source of moisture and chlorides. The containers are not tightly sealed, and they are kept in magazines with an atmosphere that communicates with the outside air through a normal ventilation system. The AL-R8 container is used for storage, but not for shipping pits. It is regarded as noncertifiable for shipping.

Furthermore, inspection, cleaning, and other operations associated with dismantlement of nuclear weapons makes use of chemicals that could conceivably initiate corrosion or otherwise damage a pit in the long term. The condition of pits following dismantlement is not well documented, and some long-term modes of possible degradation are not well understood. Some types of pits must be kept cool.

In 1992, as the forthcoming size of the inventory of pits came to be realized, DOE began to plan for measures to better protect them. A surveillance program was instituted. A plan was developed to place pits in sealed stainless steel containers called AT-400A, each having a sealed stainless steel insert holding a pit in an inert atmosphere. The AT-400A would have fully protected its enclosed pit, and would have been certifiable as a shipping container. As plans developed, repackaging of pits was to start in 1995 and was to have been completed in five years. However, this repackaging never became a reality. The Pantex contractor found the final weld

seal on the AT-400A's insert to be very difficult, and the cost of the AT-400A was concluded to be too high. Use of the AL-R8 continued.

The design laboratories have stated in letters to DOE and to Pantex in 1995 and 1997 that pits, when in AL-R8 containers for an extended period, face a possibility of corrosion. They recommended that no pits should be stored an appreciable period of time in these containers. Further, they stated that if pits are to be stored in AL-R8s for more than five years, aggressive surveillance should be applied and humidity control should be used.

DOE has since pursued a course intermediate between continued use of the AL-R8 alone and introduction of a totally new container such as the AT-400A, and has developed a design of a stainless steel pit container with a bolted, flanged closure, to be an insert for the AL-R8. Some materials compatibility problems have been attached to the design, but these seem surmountable.

The Board has been actively following the development of plans for pit storage, and has discussed the issues with DOE and the Pantex contractor on numerous occasions during the years since 1992. On December 31, 1997, the Board sent to the Assistant Secretary for Defense Programs a comprehensive review of the matter, defining a number of steps believed to be necessary for conduct of an adequate program, and stating that it may be prudent to assign overall responsibility for the endeavor to a senior line manager within DOE to ensure success. No formal reply to the letter was made, although the issue was pursued during briefings of the Board, including some at Pantex. The next written communication on the matter occurred in a letter from the Deputy Assistant Secretary for Military Application and Stockpile Management, DOE, on October 14, 1998. The letter informed the Board that proposed use of the AT-400A container had been abandoned in favor of the AL-R8 with a sealed insert.

On November 6, 1998, a letter from the same source transmitted a copy of an Integrated Pit Storage Program Plan (IPSPP) which included up-to-date plans for interim storage of all Pantex pits (an earlier version of the IPSPP had been furnished the Board in January 1998, but that had been withdrawn). The Board responded on March 12, 1999, finding that the IPSPP did not adequately address the concerns stated in its letter of December 31, 1997. The IPSPP continued to be focused on short-term goals and did not take into account the need for informed decisions to be made regarding critical elements of the pit management system, such as the selection of pit packaging and storage facilities and preparation for eventual shipment to disposition facilities.

On April 15, 1999, the Assistant Secretary for Defense Programs responded in a letter agreeing that the IPSPP does not fully address all pit life-cycle issues. He stated that the Plan was intended to ensure safe storage in the near-term. He also promised to form a multi-disciplinary team in the summer of 1999 to identify appropriate issues and develop the desired end-states, to assign, subject to higher approval, the responsibilities for their achievement, and to identify the resources. The IPSPP would be modified accordingly.

The rate of repackaging of Pantex pits is not well predictable, but one estimate places corresponding completion of the task at no sooner than the year 2008. The Pantex contractor is seeking a means to operate two shifts within present budgets, which could mean a completion date approximately in the year 2006. Startup of a second repackaging line might speed the process by about two years. Since the original plan was to repackage all pits in AT-400A containers by the year 2000, even the most intensive of these possibilities would amount to a long delay during which pits would reside in present AL-R8 containers in conditions regarded by the design laboratories as undesirable.

There are some safety questions regarding the present design of the AL-R8 system with the sealed insert. The celotex in the outer container may constitute a chemical threat to the sealed insert because of questions of moisture and chlorides. The principal question relates to the carbon steel bolts used for the flanged closure of the sealed insert because these bolts may be more subject to corrosion, and their failure would expose the pit within to the conditions which had caused bolts to fail. The Board considers these design questions to be readily solvable.

Finally, the end product of the repackaging into the AL-R8 would be placement of all pits in containers unsuitable for shipping, and pits slated for conversion to mixed oxide for reactor fuel might not be available for repackaging in containers that could be certified for shipping until well into the 21st century. To conduct the necessary repackaging into shipping containers not yet even designed would subject personnel to additional radiation exposure. There are no present plans to avoid this situation.

Apart from possible effects of readily avoidable design problems of sealed inserts for AL-R8 containers, the Board regards the use of these sealed inserts for repackaging of pits stored at Pantex to be the basis for acceptable solution during the near term. Repackaging pits into the improved AL-R8 should adequately solve the problems that the design laboratories identified as attached to the existing system of storage. Inspection over time will tell how long such storage can be relied on.

On the other hand, the length of time foreseen for arriving at repackaging of pits into this acceptable state is not compatible with avoidance of safety problems identified by the design laboratories. The Board is also concerned regarding these potential problems. They are a legacy of past manufacture of nuclear weapons and are among the questions raised by the Board's Recommendation 94-1, which addressed the need for safe interim storage of these legacy materials.

Pits in the strategic reserve at Pantex have great value to national defense. These pits, manufactured at great cost and great effort by the Department of Energy and its forebears, are probably only second in importance to nuclear weapons in the military stockpile. In the nuclear weapons defense system, they are effectively irreplaceable. Their assured safe protection should be a vital component of national defense.

Furthermore, DOE's program plan for materials disposition is in peril regarding recycling excess pits into mixed oxide fuel, because there is no container suitable for shipping the pit[illegible]

the Pantex Plant to the Savannah River Site, and no plans exist for development of such a container.

To further the safety of pits at the Pantex Plant, the Board recommends that:

1. The remaining questions of materials compatibility affecting the possibility of chemical attack on closure of sealed inserts for AL-R8 containers be settled expeditiously;

2. Action be taken to accelerate the repackaging of pits into containers suited to safe storage for the near term;

3. A system of statistical sampling for continued integrity of containers and their sealed inserts for repackaged pits be put into effect suited to forecasting the horizon for need for further repackaging; and

4. The importance of the above measures be emphasized by defining them as the specific responsibility of a designated individual of the stature, position, and technical knowledge necessary for their accomplishment, and who is given the authority and resources required.

John T. Conway, Chairman