April 19, 2012
Defense Nuclear Facility Safety Board
Peter S. Winokur, Chairman
625 Indiana Ave.
NW, Suite 700
Washington, D.C. 20004-2901

Dear Chairman Winokur,

Citizen Action New Mexico, Concerned Citizens for Nuclear Safety and Registered Geologist Robert Gilkeson and Tami Thatcher appreciate very much the time and effort taken by the Board and Staff to review the safety basis, instrumentation, control systems and quality assurance program of the Annular Core Research Reactor ("ACRR") at Sandia National Laboratories ("Sandia").

We would appreciate the opportunity to receive and review the additional DNFSB issues raised in a separate letter regarding quality assurance and software quality assurance that were or will be addressed in a DNFSB separate report.

We view the DNFSB report as a strong indication that the ACRR should be in a shutdown mode until such time as the reactor can be brought into compliance with numerous regulatory provisions cited by DNFSB:
10 C.F.R § 830, NRC Regulatory Guide 1.70, DOE Standard 3009-94, DOE's Office of Health, Safety and Security in Safety Bulletin 2011-02, American National Standards Institute (ANSI)/American Nuclear Society (ANS) 15.15, DOE Order 420.1B, DOE Standard 1195, ANSI/International Society of Automation (ISA)-84.00.01-2004, NUREG-1537 (safe harbor for nuclear reactors).

Citizen Action would appreciate information from the DNFSB regarding the authority to of the DNFSB to make a recommendation for or to order the shutdown of the ACRR. It would seem that the public is currently left vulnerable to DOE/Sandia/Lockheed-Martin Corp. willingness to proceed with ACRR operations despite the glaring safety deficiencies brought to light by the DNFSB as early as 2004. If DNFSB does not have such authority, isn't the public left in the situation of the Nuclear Fox watching the Plutonium Henhouse no matter how unsafe an operation may be? This is precisely the situation that has led to many major industrial accidents in the last decade including the Fukushima reactors.

Citizen Action requests review an earlier remaining concern from our letter of March 2010 that Sandia does not intend to upgrade the building housing the ACRR to seismic safety standards:

> "According to the conclusions of a January 7, 2005 Sandia White Paper Analysis written by the Nuclear Reactor Facilities Department (Attachment D to the March 3, 2005 letter of Linton Brooks to John T. Conway of DNFSB) an upgrade for the Highbay Reactor Room and components has not been accomplished and would require major redesign and reconstruction (p.2):
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> > 'Another conclusion of this assessment was that the Active Confinement System safety function (which would be accomplished by [systems and safety components] SSCs associated with the ACRR Highbay (Bldg. 6588, Room

10) and the Highbay Ventilation System could not be transitioned to Safety Class. One major issue is the seismic qualification of the Highbay itself. In order to provide active confinement, it is necessary that the Highbay survive a design basis earthquake (DBE). The DSA currently states that the structure would not likely survive such an event. In addition, the Highbay Ventilation System (HBVS) ductwork , filters, and fan must also continue operating following a DBE. Thus, transitioning to Safety Class status would involve major redesign and reconstruction of the Highbay and the HBVS.'

"Nothing in documents reviewed by Citizen Action indicate that major redesign and reconstruction were/are accomplished for the ACRR."

With respect to any modifications that may be intended for the ACRR, we believe compliance with two Executive Orders is necessary:

a. Executive Order (E.O.) 12699, Executive Order for Seismic Safety of New Federal Buildings, signed by the President on January 5, 1990, requires each Federal agency responsible for the design and construction of new buildings to ensure that buildings are designed and constructed in accordance with appropriate seismic design and construction standards.

b. E.O. 12941, Executive Order for Seismic Safety of Existing Federal Buildings, signed by the President on December 1, 1994, mandated the seismic safety of existing Federally-owned or leased buildings by adopting RP4, Standards of Seismic Safety of Existing Federally-owned or Leased Buildings. These standards, developed by the Interagency Committee on Seismic Safety in Construction (ICSSC), were adopted as the minimum level acceptable for use by Federal departments and agencies in assessing the seismic safety of their owned and leased buildings and in mitigating unacceptable seismic risk in those buildings.

We additionally stated (March 2010) concerns for the ventilation system:

"The latest indication from a letter dated August 31, 2009 from DOE Administrator Thomas P. D'Agostino to John E. Mansfield DNFSB Vice Chairman indicates this is not accomplished. The letter states in pertinent part:

'This letter and its enclosures comprise Deliverables 8.6.3 and 8.6.5 for Annular Core Research Reactor (ACRR) at Sandia National Laboratories (SNL), Albuquerque, NM.

'The evaluation concludes that the ACRR ventilation systems were neither designed nor required to prevent exceeding the evaluation guideline (EG) for the analyzed accidents. Though the systems are typically operated in support of ACRR operations, they are not credited in the ACRR accident analysis to function during normal, abnormal, or anticipated accident conditions to prevent or mitigate exposures. While the ventilation systems would have an impact on normal, abnormal or anticipated accident conditions, major facility modification or construction of a new facility would be required to be able to take credit for the

function in the Safety Analysis. Therefore, the costs associated with modifying/upgrading the ventilation systems to meet the criteria for creditable active confinement ventilation systems would be difficult to justify." (Emphasis supplied).'"

Citizen Action requests that the DNFSB examine whether Sandia National Laboratories has conducted any recent comprehensive seismic analysis or determined the Design Basis Earthquake that could occur at the ACRR. Citizen Action believes that a comprehensive study of earthquake potential at Sandia is long overdue and should be ordered not only for the ACRR but for many other buildings that are decades old and may threaten the workers, public health and the environment. For example, an earthquake occurred in 1947 on the Tijeras fault system that is near to the ACRR and other facilities. http://geoinfo.nmt.edu/publications/bulletins/160/downloads/06abbot.pdf (at p.116).

We indicated the many regional fault systems in our March 2010 letter:

"This site is riddled with regional fault systems: the Sandia, West Sandia, Manzano, Tijeras, Coyote and Hubbell Springs faults. An earthquake in the Albuquerque area has the potential for human injury and building damage throughout the region. Sandia buildings and structures vary in their capabilities to withstand earthquake forces. Facilities in TA-I could release chemical materials in a plume with exposure of as many as 5,300 persons at 3,800 feet. TA-V would be the predominant source of release of radioactive materials. (1999 Sandia Site-Wide Environmental Impact Statement). Sandia's Site-Wide Environmental Impact Statement is ten years out of date. Human exposures would now be higher after 10 years of rapid population growth in Albuquerque.

"Probable future earthquake potential has been estimated to have large magnitude with surface-rupturing potential. (See e.g. *Paleoearthquakes and Eolian-Dominated Fault Sedimentation along the Hubbell Spring Fault Zone near Albuquerque , New Mexico*, Bulletin of the Seismological Society of America, June 2003; v. 93; no. 3; p. 1355-1369). The earthquake potential from these various fault systems is not adequately described in the documents presented by Sandia to the DNFSB. DOE/NNSA/SSO have failed to provide resolution to the unresolved safety question for earthquakes. DOE Orders and standards are not being met."

Recent reports from the DOE Office of Health Safety and Security have raised concerns over employee exposures to beryllium at the Z Machine nuclear reactor in 2010 and 2011. http://www.abqjournal.com/main/2012/03/09/north/sandia-staff-exposed-to-hazards.html - "Sandia Labs employees have been exposed to excessive levels of hazardous materials five times since 2010, a series of incidents that has drawn the attention of federal safety monitors. The most serious issues involved exposure to potentially dangerous levels of beryllium, a metal used in nuclear weapons work."

Again, Citizen Action deeply appreciates your careful review of these safety issues.

Sincerely,

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Is the Department of Energy's ACRR Nuclear Reactor Safe?

April 3, 2012

By Tami Thatcher, a former nuclear reactor safety and risk analyst for the Advanced Test Reactor at the Department of Energy's Idaho National Laboratory.

The safety of an operating nuclear reactor at Sandia National Laboratories ("SNL" or "Sandia") is called into question by a February 2012 report of an independent safety board established by Congress, the Defense Nuclear Facilities Safety Board ("DNFSB"). Sandia's Annular Core Research Reactor ("ACRR") is one of 150 Department of Energy ("DOE") hazard category 2 facilities and one of the four remaining reactor facilities in the DOE. Responding to Japan's Fukushima nuclear accident the DOE claims it has a rational, systematic, and rigorous framework to ensure the safety its nuclear facilities. Aware of the public's fears, DOE represents its nuclear reactors to be benign and inherently safe.

A very brief history: In 2001, after the DNFSB's insistence, the DOE established the nuclear safety management rule, 10 Code of Federal Regulations 830. The rule, which addresses quality assurance and safety basis requirements, basically requires that hazard controls be established to ensure adequate protection of workers, the public, and the environment. DOE contractors, such as Sandia's Lockheed-Martin, were required to submit for DOE approval a safety basis meeting the requirements in 10 CFR 830 by 2003. The rule described expectations for the safety basis and acceptable methods for implementing the requirements. Yet, allowing DOE to decide if the contractor is meeting the rule's requirements has allowed DOE to provide the illusion of adopting stringent requirements while still allowing it to operate without actually providing adequate hazard controls. The consequences of routinely accepting very inadequate safety basis documents are seen in the DOE investigation report for the recent plutonium contamination of 16 workers at Idaho National Lab (INL), the DNFSB letters regarding Sandia National Lab (SNL).

In 2002, the DNFSB issued a letter to the Department of Energy raising several issues related to the implementation of safety and hazard analysis methodology at DOE defense nuclear facilities. "The identification and selection of an appropriate control set is one of the most important cornerstones of nuclear safety. . . The Board has identified a number of instances where input parameters and assumptions used in performing analyses have not always used bounding or physically limiting conditions. Consequently, the resulting safety analyses are not representative of the bounding consequences of the associated accident. The use of bounding inputs is pivotal in the approach to estimating the unmitigated

consequences of postulated accidents and determining the need for safety-class controls for protection of the public."

In 2004, the DNFSB found adequate safety basis documents were lacking for all of Sandia's nuclear facilities. In 2005, DOE wrote to the DNFSB, stating that "SNL has taken the insights provided by the DNFSB as an opportunity for a review of SNL safety basis processes. As a result, SNL . . . understands and accepts the issues raised by the DNFSB including the Board's concern related to fundamental underlying issues with SNL safety bases. . ."

Again, in a February 2012 letter, the DNFSB found that SNL's ACCR still has fundamental safety problems. The DNFSB stated that: "The board is concerned that the safety analysis is not bounding and that some safety systems may not be reliable enough to perform their safety functions. . .The [documented safety analysis] does not evaluate operations and accidents using reasonably conservative or bounding values for these materials. . . the Board's staff noted several non-conservative assumptions applied to calculations of dose consequences."

In response to the Board, the contractor for the ACRR issued two "Potential Inadequacy in the Safety Analysis" occurrence reports for problems with control rods and possible simultaneous failure of computer and operator controlled reactor shutdown. DNFSB required DOE to embark on a complete review of the accident analyses for the ACRR facility. While this may be seen as a positive step, DOE's pattern and practice is to approve a contractors' statistical analyses that make it seem less likely that a reactor accident will cause serious worker and public health consequences.

The Nuclear Regulatory Commission ("NRC") that regulates commercial nuclear power reactors (but has no authority to regulate SNL's ACRR) prescribes in detail the information and analysis that a facility must present in its safety document submissions. NRC then reviews these submittals using an army of qualified people. In contrast, the review for DOE facilities may suffer from a conflict of interests. The contractor cobbles together a safety basis that will satisfy a few DOE reviewers. The review may provide a rosy safety outlook that allows maximum operational flexibility with minimal cost.

Well, why does this matter? The Annular Core Research Reactor (ACRR) is a small research reactor with a hazard category 2 designation for "A nuclear facility with the potential for significant on-site consequences." It only runs intermittently thus it does not build up a large inventory of fission products. There is only a small

decay heat compared to commercial reactors. The ACRR relies on a pool of water for cooling rather than having the risk of the loss of forced flow cooling.
Well, first let's look at the hazard category designation. The 10 CFR 830 rule applies to Hazard Category 1, 2 and 3 DOE nuclear facilities. Hazard category 1 facilities are those "with the potential for significant off-site consequences." From DOE summary dated May 13, 2011, there are two hazard category 1 reactors: the Advanced Test Reactor at INL and the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL). The ATR is a 250 Megawatt (MW) (thermal) materials testing reactor with roughly 1 billion curie inventory of fission products such as Iodine-131, Cesium-139, Strontium-90, Plutonium-239 and many other fission products. The ATR operates without a containment structure that could prevent the release of radiological contamination in the event of an accident, instead having what DOE calls a "confinement" that slows the release of airborne contamination by a few hours. While the ATR operates at low temperatures and pressures, it operates in unique configurations with high power densities using highly enriched uranium fuel. Intricate analytical computations are performed for each reactor cycle every few weeks to compute complex nonsymmetrical power distributions. Overheating fuel could rapidly melt a large portion of the core despite successfully inserting control rods and providing continued cooling.

In comparison, the ACRR, the 2 or 4 MW (thermal) pool-type research reactor at SNL, designated as Hazard Category 2 has "the potential for significant on-site consequences." It operates with no containment structure or protective ventilation system. In 2005, the DOE sent a letter to the Defense Nuclear Facility Safety Board ("DNFSB") detailing its responses to these and other safety vulnerabilities noted by the DNFSB. The DOE letter discussed various interim limits imposed on operation at that time. The limits included limiting reactor power to 2.0 MW (vs. 4.4 MW), 3 grams of weapon grade plutonium-239 which would be vaporized in the core (vs. 7 grams), and total facility plutonium inventory of 1.5 kg (vs. 21 kg).

During an accident at the ACRR, workers and others could suffer much higher radiation doses than the allowable annual dose of 5 rem. Sandia is the only DOE facility that operates on a military base. Kirtland Air Force Base has more than 20,000 nearby personnel and is within the urban setting of Albuquerque. The 2005 DOE letter included estimated accident dose consequences at 3000 m and 1350 m from the facility, ranging from 13 rem for design basis events to 40 rem from a beyond design basis event at 3000 m. The analysis noted that in several accidents, 90% of the doses from an ACRR accident were from the 3 grams of weapon grade Plutonium and only 10% from the ACRR core. Because many of the accident consequences are dominated by the Plutonium used in most experiments, DOE's

emphasis on the short operating cycles with little build up of fission product inventory is basically irrelevant to radiation exposure.

Perhaps the DOE and DNFSB should rethink whether or not the ACRR poses the potential for significant offsite consequences and should instead be designated as a Hazard Category 1 nuclear reactor. The 2012 letter from the DNFSB cites the current administrative limit for plutonium being in the central cavity of the core as 10 g when vaporization of the fuel is expected. And when vaporization is not intended, a stunning 9,600 g of plutonium-239 is allowed in the reactor. (The plutonium bomb dropped on Nagasaki, Japan in 1945 contained 6,200 g of Plutonium.) In addition, the facility is authorized to store 20,600 g of plutonium-239 along with a moderate amount of explosives creating an even greater potential for accidents aside from reactor operations. The reactor is in a building that Sandia admits cannot withstand the regional earthquake. The reactor is subject to airplane crashes since it is near the shared runway for Kirtland Air Force Base and the Albuquerque International Sunport.

"What's a little plutonium among friends?" Plutonium particles dispersed in a reactor accident at the ACRR would be carried offsite by the wind for distances that depend on the weather. The plutonium that lands can be re-suspended in the air when the wind blows again and will remain carcinogenic for tens of thousands of years. Much of the plutonium that a person does inhale will be with them for the rest of their life causing chromosomal aberrations and increasing the risk of cancer, as the excretion rates for plutonium-239 are very low.

While DOE neatly performs dose estimates for passage of an airborne plume that are contrived to look fairly benign, the costs of long-term evacuation of areas down wind and of cleaning up the soil with Pu-239's 24,000 year half-life are not assessed by DOE. And the doses to the public and long-term health effects to generations who inhale the released plutonium for the many thousand of years won't be the DOE's problem.

While the DNFSB appropriately takes an interest in the ACRR safety analysis and various operational problems such as reliability issues with the reactor protection and control systems, the question is, will anything actually improve at the ACRR? The DNFSB has no authority to shut down an unsafe DOE reactor unlike the Nuclear Regulatory Commission that can shut down unsafe commercial reactors.

For the ACRR, decades of secrecy and flawed safety analyses have probably occurred for a good reason: an honest assessment would yield a picture of

unacceptably high human health and economic consequences for troops, workers and the public on a military base in a surrounding dense urban setting. How safe is the ACRR? The DOE doesn't think its neighbors have the right to know.

References:

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