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I thank the members of the Commission for the opportunity to appear before you today. While my remarks today are broadly reflective of NRDC's views on these matters, my employer has not reviewed these remarks and therefore I speak today on my own behalf, and that of my partners in the Nuclear Weapons Complex Consolidation Policy Network that prepared the April 2009 report previously provided to the Commission.

Your task is daunting, and if the past is prologue, failure to effect meaningful reform seems the likeliest outcome. Over the quarter-century since the fall of the Berlin Wall and end of the Cold War era, there have been dozens of official and non-official efforts to restructure and reform the Department of Energy. But none have had any real consequence since the decision was made in the early 1990's to shutter the Department's fissile material production and certain other facilities related to warhead production, and undertake a massive environmental restoration effort. Even that huge and costly program can claim only a few successes, while the toughest tasks – such as HLW waste tank closures at SRS and Hanford – still lie ahead, despite the relentless expenditure of some 5-7 billion dollars annually on the problem for two decades.

Now that I am on the cusp of retirement, I find it sobering to look back and reflect on the fact that for my entire professional life, the GAO, the IG, Congressional, and independent investigators have been issuing critical reports on the Department's poor management of large technology development and facility construction project, most often associated with its Defense Programs, but also with the Offices of Science, Nuclear Energy, and Environmental Management.

Does anyone here today remember the Mirror Fusion Test Facility at Livermore? It took 9 years and at least $800 million in current dollars to build – DOE officials cut the ribbon on opening day in February 1986 , but it never operated, not even for a day. While shifting political ideologies in Washington played a role in that decision, in reality the facility's scientific premise was deeply flawed, and it should never have been built. But it was built.

Fast forward 23 years. Its 2009, and Livermore has another big laboratory fusion machine at the ready—the National Ignition Facility (NIF)—which has taken 12 years to build and costs $5.5 billion, seven times as much as MFTF. The long-promised fusion ignition campaign begins, runs for three years, and ends in abject failure – achieving a capsule output of less than 1 percent of the 1. 8 MJ of laser energy deposited in the target and believed necessary for ignition, and even

that number could well be wrong and was known to be highly uncertain at the time DOE committed to construction way back in 1997. Livermore has finally admitted what external critics had known all along – that the scientific understanding and computational modeling underpinning the case for ignition on the NIF were inadequate. And yet the Department's mechanisms for internal and external peer review were so flawed, and the institutional log-rolling culture so strong, that the NIF was built anyway, inflicting large cash and opportunity costs on NNSA's stockpile stewardship activities, other energy research, and indeed on the whole Department.

Ever since the demise of the Cold War, the nuclear weapons side of DOE and its laboratories have been a seemingly inexhaustible source of bad ideas and costly mistakes. In the late 1980's, Defense Programs and Livermore proposed construction of a hazardous multi-billion dollar, copper-vapor laser Special Isotope Separation facility in Idaho to clean-up DOE's fuel grade plutonium inventory to weapons grade, despite the fact that the Department had all the weapons material it could possibly need, and the Cold War was already winding down. Livermore had secretly developed and built a pilot plant during the Carter and Reagan administrations, but strong Congressional and popular opposition to SIS on cost, safety, and nonproliferation grounds, and the ongoing operational implosion of the existing weapons complex, induced Secretary Watkins to cancel it.

But the Department hardly learned from this mistake. The ensuing decades saw the New Production Reactor (NPR), then the Accelerator Production of Tritium (APT), followed by the Modern Pit Facility (MPF) – all unnecessary multi-billion dollar projects that fortunately were cancelled before construction, although billions were wasted on R & D and project design efforts. Los Alamos did manage to blow through at least $3 billion in ten years trying to reestablish a capacity to produce 20 pits per year at its TA-55 facility. There was also fantastic waste in the early years of the ASCI program – for example the hundreds of millions LANL spent on its physically huge power hungry ASCI Q machine in the early 2000's.

In May 2002, the *LANL Daily News Bulletin* actually boasted that the full Q machine required "an unobstructed 43,500-square-foot computer room (about three-fourths the size of a football field) that is cooled by 130,000 gallons of circulating chilled water – a full 3,600 tons of cooling capacity, or enough to cool more than 500 homes. The electrical system brings 7.1 megawatts of power (expandable to 30 megawatts) into the structure along more than 200 miles of wire. There are more than 1,350 miles of fiber optic cable with approximately 20,000 individual fiber optic terminals."

But Blue Gene/L, privately developed by IBM between 1999 and 2004 at a cost of $100 million, instantly made obsolete all the massively parallel machines that Defense Programs had spent some $4.75 *billion* frantically buying for the weapons labs in the first 8 years of its Advanced Strategic Computing Initiative (1996 – 2004).

You might be tempted to conclude that all this is ancient history. But as William Faulkner famously wrote, ""The past is never dead. It's not even past." Certainly never more true than at

the Department of Energy. Today the old Atomic Energy Commission lives on in massive, ever more costly nuclear projects like the $ 6 billion CMRR-Nuclear Facility at LANL, the $7.7 billion MOX Fuel Fabrication Facility (MFFF) at SRS, the $11 billion Uranium Processing Facility at Y-12, and the $13.5 billion Waste Treatment Plant at Hanford. Longtime observers of DOE can be forgiven for thinking that every day is "Ground Hog Day" at the NNSA.

So, now that I have convinced you Sisyphus had it easy compared to what you are attempting to do, let me suggest a path whereby you might just be able to push the boulder partway up the mountain, without it rolling back down again, as it has so many times before.

As indicated in the summary and detailed reports I have previously furnished to the Commission, the beginning of wisdom in this area is to acknowledge that the nuclear weapons side of DOE is both too large, and mostly irrelevant, to what must be the Department's central preoccupation—supplying this country and the world with environmentally sustainable, economically viable clean energy technologies, and accomplishing this with sufficient dispatch to stave off truly disastrous climate destabilization. As I'm sure you realize, even in the best scenario of a rapid clean energy transition, we, and particularly arid and low-lying developing nations, are going to have to cope with already baked-in, and most likely severe consequences from GHG accumulation in the atmosphere.

Thus the need is absolutely imperative for DOE's laboratory system to reorient itself from nuclear arms racing, pursuing elusive elementary particles, and chasing an ever receding dream of fusion energy with ever larger and implausible machines, to run at full strength in the race we are actually in, which is a dire and near-term struggle to stabilize the global climate and create an environmentally sustainable economy that no longer poisons and depletes the very natural resources on which all life on this planet depends.

I cannot emphasize this basic point enough. In an era of low economic growth, mounting economic inequality, already massive government indebtedness, and widespread political distrust of government, the DOE cannot continue the costly race to nuclear Armageddon AND win the race to save the climate at the same time. We ARE resource constrained. We *MUST* make rational choices between objectives in order to have any reasonable expectation of marshalling the resources we need to both prevent and adapt to climate change

The Commission already has our complete set of 2009 recommendations for transforming the weapons complex, which remain generally valid today and are predicated on moving toward a nominal 500 warhead stockpile as an interim waypoint, thereby laying the basis for multilateral engagement to further reduce and ultimately eliminate reliance on nuclear deterrent strategies to ensure our security and that of other nations. But many of our recommendations involving the weapons laboratories do not depend on moving to a dramatically smaller stockpile than we have today.

Let me highlight a few of those immediately actionable reforms:

(1) Redefine the weapons lab technical paradigm for "Stockpile Stewardship"

Shift the technical paradigm for sustaining a nuclear deterrent stockpile from today's dynamic experimental and explosion-simulation strategy—predicated on expanding the universe of U.S. nuclear weapons knowledge while constrained by a test moratorium—to an engineering-based surveillance and component replacement only-when-needed. The sole object of this changed emphasis would be to maintain confidence in the residual nuclear deterrent force as we seek progress toward a nuclear weapons-free world. The NNSA's current "Stockpile Stewardship" strategy builds toward a certification capability for new warhead designs, and major warhead design changes, without nuclear testing. This requires a combination of non-nuclear experiments and computer simulations that depends on a massive and costly "nuclear weapons science" infrastructure at the laboratories. But this effort to advance the frontiers of nuclear weapons science is not technically required to achieve the more limited goal of maintaining an adequate level of confidence in the performance of stockpiled nuclear weapons designs that were previously certified by underground nuclear explosive tests.

Since at least 1978, however, when three of the nation's most respected nuclear weapons scientists—Norris Bradbury, J. Carson Mark, and Richard L. Garwin—wrote a letter to then President Carter advising him of it, there has existed a more economical, less complex, technically sound, engineering-based strategy for sustaining confidence in the nuclear weapons stockpile. Some of its advocates now call it "Curatorship," to distinguish it from the current dynamic and technically aggressive paradigm of "Science-Based Stockpile Stewardship."

Under Curatorship, a strict change control process would hold changes to the existing stockpile to the absolute minimum required to keep a weapon safe and reliable, based on a weapon's historical parameters for those characteristics that were previously deemed acceptable. Changes would be made only when a part ages in a way that would make its performance unacceptable. Obviously, this policy is predicated on the political and strategic presumption—which must come from the White House—that nuclear weapons will not be assigned new or significantly modified military missions requiring major weapons modifications or entirely new designs. This is in fact became the ostensible announced policy of this President and Administration, but the Administration has failed to take the necessary steps to ensure that this policy change is reflected in the actual stewardship protocols, budgets, and programs of the NSSA laboratories.

(2) Establish an Independent "Nuclear Weapons Certification Board"

An independent, presidentially-appointed "Nuclear Weapons Certification Board" should be established to review the certification of each warhead design in the stockpile on a three year cycle. All proposed changes to nuclear weapons designs would have to be reviewed and approved by this Board to ensure that these changes are technically conservative, consistent with the given weapon's curatorship/ remanufacture strategy,

and will not contribute to erosion in confidence that could prompt nuclear tests in the future. Proponents of any warhead change would have to convince this independent change control board of the necessity for the change. Such a part would be replaced with a new part as close as possible to the original design, or the substitution of the new part would have to be shown not to affect the nuclear performance characteristics of the system. Replacing entire warheads or nuclear explosive components in the stockpile would be pursued only when aging or other defects that threaten their reliability or safety could not be addressed by replacing individual parts.

(3) Redirect weapons lab science-based stewardship "campaigns" from prospective circumvention of an in-force test ban treaty to a sole focus on maintaining the existing nuclear weapons stockpile.

NNSA's current costly and deliberate program for the advancement of knowledge in "nuclear weapons science," including the further refinement of design codes, should be reviewed for consistency with US treaty obligations and nonproliferation objectives, and then redirected toward sustaining a much reduced nuclear arsenal. The NNSA program should not be shaped as a means for circumventing a future Comprehensive Test Ban Treaty (CTBT), whose *fundamental global purpose, after all, is to constrain the advancement of nuclear weapons knowledge*.

(4) Review the proliferation implications of weapons lab programs in radiation-driven ICF and other High Energy Density Physics (HEDF) programs.

The record shows that some significant fraction of this new "nuclear weapons science" inevitably leaks out through international technical meetings, scientific publications, secret technical cooperation, licit and illicit technology exports, and espionage, thereby encouraging the proliferation of both atomic and thermonuclear weapons. The maintenance and continued application of existing classified nuclear weapons codes, and any refinements resulting therefrom, should be allowed. However, as a compelling nonproliferation example to others, all High Energy Density Physics (HEDF) facilities, should either be shut down, or used only for unclassified and technically meritorious civil science purposes. The latter should occur *only* if these purposes can be identified and obtain funding on their merits in a fair, peer-reviewed competition with other scientific research priorities, an outcome that frankly seems doubtful.

(5) End subcritical testing (i.e. neutron multiplication experiments that do not achieve a self-sustaining chain reaction with fast neutrons alone) in both the below- and above-ground environments.

Conduct hydrodynamic tests, or static high pressure tests, only to investigate documented problems in existing warheads, and refrain from constructing any new hydrodynamic test facility beyond the existing dual-axis DARHT capability at Los Alamos.

(6) Terminate the quest to certify new nuclear weapon designs by means of end-to-end integrated supercomputer simulations of nuclear weapons performance.

End NNSA-sponsored development and procurement of state-of-the-art computing facilities primarily intended for nuclear weapons-simulation activities. The technical demands and funds of NNSA's nuclear weapons program would cease to drive the development of supercomputing capability. In the future the leading edge of this market should be driven by more socially useful concerns, such as climate change and severe weather modeling and forecasting, earthquake prediction, energy research, drug discovery, transportation planning, and economic modeling.

(7) As recommended in 1995 by the Galvin Commission, phase out nuclear stockpile support activities at LLNL and shift any remaining essential stockpile work to Los Alamos, and consolidate "non-nuclear" stockpile support activities (engineering, design integration, surveillance, evaluation, and testing) at Sandia-NM.

Terminate weapons lab use of the Nevada Test Site (NTS) and the Tonopah Test Range (TTR) for nuclear weapons research, development, testing, or production activities. All nuclear weapons-related activities at Sandia California should be phased-out, in concert with the phase-out of the nuclear stockpile support program at LLNL, including the following activities: nuclear weapon design and engineering, plutonium R & D, High Explosives R & D, Tritium R & D, Hydrotesting, and weapons environmental testing. If useful and credible non-weapons follow-on missions for Sandia California cannot be identified, close the laboratory and prepare the site for disposition and commercial redevelopment.

Let me turn now to the question of what to do about the non-weapons work currently performed – or not performed, as the case may be -- by the wider universe of DOE laboratories. Many previous observers have pointed to the simultaneous existence of both rigid "stovepipes" and considerable redundancy within this sprawling lab ecosystem.

Given the wide expanse of scientific and technical activities in which these laboratories engage, I am very far from being an expert on this issue, but rather merely a concerned observer who, like many others, has long been frustrated by the meager productivity and misdirection of effort in many of these laboratories, and DOE's inability to bring their technical resources to bear in developing solutions to the momentous challenge that lie within its purview. Since I found it very difficult to wrap my mind around the sheer breadth of the Commission's task, I constructed some spreadsheets of my own, as a kind of rough guide to the budgetary and programmatic universe you are considering. When I did this, a number of issues for consideration jumped out at me, and I will briefly attempt to summarize them:

1. First, in defense of the labs, let me say that their failures begin at the top, and are widely shared by successive Administrations, Secretaries, and Committee Chairman of both parties, who have allowed significant elements of DOE's laboratory base to become channels for non-strategic and ill-considered pork barrel expenditures. Incredible as it is to consider, the United States is probably the only advanced industrial country in the world still without even an

indicative national energy plan, showing how, when, where, and under what price and technology assumptions, essential portfolios of clean energy and efficiency resources can be developed and deployed to serve the future needs of each particular ISO, RTO, or regulated service territory in the nation, and how intelligent national policies and new technology can help to accelerate this process. So the self-described "energy laboratories" are mostly working in the dark, without even notional targets to shoot at.

2. With regard to the 10 laboratories entirely or largely supported by the Office of Science, three are built around large particle accelerator facilities -- but only one, Fermi Lab, is focused entirely on High Energy Physics. The other two derive most of their support from the Basic Energy Sciences and Nuclear Physics lines, on the apparent premise that their facilities can usefully be applied to make fundamental advances in materials science that will benefit future energy development. The Commission should test the validity of this premise, and consider whether it justifies the support of *three* national accelerator "user facilities". Since we really are in a near term race for the survival of the planet, or at least many of the species currently living on it, including our own, the Commission may want to assess the priority assigned to this type of research, as compared to more applied energy research devoted to capitalizing on already known material properties, and less costly means of uncovering new ones, that could be applied to improve clean energy systems.

3. Another feature of the current system that jumps out at you is the fractionation of critically important issue areas among many different laboratories, with no single laboratory clearly focused on and accountable for technical progress and tech transfer to industry in those areas. EE & RE, Electricity Delivery & Energy Reliability, and Nuclear Nonproliferation – critical areas all – suffer from this deficiency. Relatively small projects and pots of money are spread around the complex and wind up in places that seem to lack a connection to any larger strategic objective. Indeed, some labs seems to be using these accounts mainly to meet their payrolls and avoid layoffs as their historic core programs shrink.

For example, EE&RE funding flows to some 13 labs, and most of the paltry $180,000 million in Electricity Delivery/Energy Reliability funding is divided among 10 labs, including the three weapons labs and an Office of Science Lab (PNL).

A similar situation prevails in the defense nuclear nonproliferation area, where $1.6 billion in funding is parceled out to 11 laboratories and no less than 9 field offices and sites, including DOE Washington HQ, which actually dings this important account to pay for $103 million in "legacy contractor" pensions. When broadly defined to include not just the problem of state-sponsored proliferation and access to fissile materials by subnational groups or international terrorists, but also the whole problem of building a reliable future structure to verify and enforce peaceful global nuclear energy use and nuclear warhead elimination in what looks to be an increasingly unstable future, "nonproliferation" has no lead laboratory devoted to systematically addressing both the specific technical and wider systems-design dimensions of a reliable nuclear control regime

Finally, there is clearly a problem with the Nuclear Energy account. For many years now, NE has been getting around seven or eight hundred million dollars (this year's request is for $863 million), and yet this consistent level of R&D support has had little impact on the commercial prospects or performance of the US nuclear industry. The many billions expended over such a prolonged period have yielded but one COL-licensed new large conventional LWR design, the AP 1000, but this was achieved only with federal loan guarantee support in a supportive regulated environment with accelerated cost recovery and a guaranteed rate of return on investment.

While the AP-1000 incorporates some safety improvements—but also introduces new safety concerns—al l the drawbacks of current generation reactors remain: low thermal-to-electric conversion efficiency; excessive thermal discharges, excessive consumptive use of scarce surface water resources, fuel rods subject to autocatalytic hydrogen production in a severe accident, massive fish kills in cooling intakes, very high capital costs for both new build units and power uprates, and of course, no licensed repository for nuclear waste. It is indeed arresting that DOE and the nuclear industry supposedly working together have failed to make headway on reducing these problems, which threaten to make low-carbon nuclear power irrelevant to America's energy future.

At least a partial explanation for this failure can be found in DOE's legacy lab structure and spending patterns for nuclear energy. Here the problem has been and remains an over-concentration of resources in a single remote laboratory, INL, and the misdirection of those resources to closed plutonium fuel cycle R &D that lacks a reasonably foreseeable economic basis, and further requires multiple policy and technical innovations in the management of proliferation and security risks to make its deployment minimally tolerable from the perspective of both international stability and homeland security.

Sustaining INL accounts for almost half, and the Idaho Operations Office for another quarter, of NE's total budget, and 71% of INL's funding from NE goes to cover "facilities management" and "site security." The last time I looked, there were no civil commercial power reactors in Idaho, none in the Pacific Northwest , none in the Inter-Mountain West, and just a handful west of the Mississippi. Why on earth is DOE's commercial nuclear power effort centered in Idaho? NE spreads the remainder of its funding among 8 national labs and headquarters, most of it in small amounts for "Nuclear Fuel Cycle R&D."

Other obvious inefficiencies include a proliferation of individual DOE operations and "site offices," including multiple offices located within the same geographic region – for example, the cluster represented by the Office of Science Chicago Office and individual site offices located at Argonne and Fermilab, and similar clusters in the Bay Area (Livermore, Berkeley, and Stanford) Oak Ridge, and Northern New Mexico, where there are four DOE offices. While these individual offices may serve different purposes and programs, some consolidation should be possible, to save money and reduce the "stove-piping" between programs.

In sum, DOE laboratory structure needs to be significantly reshaped to reflect the nation's and the world's real priorities:

-- deploying energy efficiency and clean energy systems on a modern reliable fault-tolerant grid to secure our economic future and help avert climate disruption;

-- deploying clean and efficient urban and inter-urban public transit systems and other mobility alternatives to combustion-engine vehicles;

-- helping ourselves and others adapt to the climate change that, despite our best efforts, we cannot prevent;

-- ensuring domestic and international security and nuclear safety in a world that may see the wider application of nuclear energy and the use of closed fuel cycles that pose new hazards and proliferation risks; and

-- moving toward a word without nuclear weapons by continually reducing our nuclear weapons stockpile and shrinking the infrastructure and human resources required to support, so that they may be freed for more productive tasks.

These imperatives suggest to me the need for at least four new lead laboratories, or perhaps constellations of laboratory parts under strong joint leadership—which in this networked age could well be virtual as well as physical entities—emerging from what remains viable in the existing lab ecosystem:

-- one focused on the design, development, and systems integration of clean energy resources, energy storage, and the future transmission and distribution grid;

-- another focused on transforming the public transit, freight transport, and personal mobility sectors of the economy, and systems analyses of viable pathways toward sustainable cities;

-- another focused on improved modeling and prediction of climate disruption, destructive weather phenomena, earthquakes, severe nuclear accidents, and other mega-hazards amenable to large-scale simulations , and the development of technologies and strategies for climate change mitigation;

-- and a fourth devoted to the suite of monitoring technologies, system concepts, and cooperative verification protocols required to ensure nuclear nonproliferation in what we hope can become an increasingly nuclear-disarmed world.