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Released DOE Documents by Court Order Show Significant Hazard in the Event of an Advanced Test Reactor Accident

The likely-hood and magnitude of an Advanced Test Reactor (ATR) nuclear accident is far greater than DOE is willing to admit to the downwind public. It took five years of litigation against the Department of Energy (DOE) and a ruling by the Federal District Court of Wyoming to force DOE to release about 1,400 pages of formerly secret/classified internal reports. [1]

These DOE reports document fundamental ATR safety system vulnerabilities and the huge amounts of radiation that could be released in the event of an accident. Reactor explosion and radioactive emissions 738 million times over EPA regulatory limits are examples of the most shocking revelations. The ATR is an antiquated 40-year-old nuclear reactor built in the 1960s that is long past is 20-year design life. Yet, DOE intends to continue ATR operations through 2040.

Real Risk of ATR Explosion Acknowledged

DOE's reports disclose the potential for the ATR reactor to explode during various accident scenarios. "**The double rupture results in an expulsion of high temperature, high pressure loop water into the relatively low pressure (reactor vessel pressure) flux trap annulus …which will very rapidly void the [reactor vessel] flux trap annulus."** [2]

The above cold/technical description – literally means the explosion will blowout all of the reactor core coolant – leading to reactor fuel meltdown and significant uncontrolled radiation emissions. This revelation of an ATR explosion likely will strike the downwind public as shocking. However, in historical context, this disclosure is only a continuation of a long tradition of a heavily insulated/ self-regulated nuclear institution - on a classified secret mission unconcerned about anything else.

The Idaho National Laboratory (INL), originally called Idaho Reactor Testing Station, has had forty two reactor meltdowns in its more than six decade history of operations. Sixteen of these meltdowns were "accidents." The remaining twenty six were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation releases. Based on Centers for Disease Control's final INEEL report these releases between 1952 and 1992 were **10,848,480 curies**. [3] These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Moreover, the radiation burden already imposed from past and current INL operations would only be more catastrophic if there were a major ATR accident.

The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is

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[1] Keep Yellowstone Nuclear Free, Environmental Defense Institute and David McCoy v. U.S. Department of Energy, in U.S. District Court for the District of Wyoming (06-CV-205-D).

[2] 2004 Chapter 15 Severe Accident Analysis – Upgraded Final Safety Analysis Report for the Advanced Test Reactor, page 15.12-8.

[3] Final Report; Identification and Prioritization of Radionuclide Releases from the Idaho National Engineering Laboratory; Centers for Disease Control and Prevention; Department of Health and Human Services; October 8, 2002; Risk Assessment Corporation, page 53. This report is part of CDC's INEEL Dose Reconstruction Project.

applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-Roding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

According to Boyd Norton, manager of the SPERT tests in the early 1960s notes, "These reactors are, essentially, stripped-down hot-rodders; they had no radiation shielding and no elaborate safety systems. Sitting as they were, in the middle of more than nine hundred square miles of desert, there wasn't much concern over such things. Not back then." [Norton] [4] Compared to current commercial nuclear power reactors, the ATR falls in the category of a "stripped down reactor because it lacks the sealed concrete containment dome required to limit accident radiation release to the environment.

DOE's Safety Analysis Report continues; "Destructive reactivity transient [meltdown] tests (SPERT-ID) and the SL-1 accident (AEC 1964) have indicated that a vapor **explosion is a possible phenomenon** for severe reactivity transients in plate-fueled reactors. [See discussion below on SPERT and SL-1]. The postulated mechanism for the vapor explosion is that the rapid power rise in the fuel plates causes melting and high temperatures in the fuel core of the plates, which results in jets of high temperature molten material being ejected through the weakened cladding into cold coolant channels. **The high temperature material breaks up into small droplets in the coolant, and the resulting large surface area provides for a very rapid generation of steam known as a steam explosion.** The normal pressure limiting mechanisms such as ESF [emergency safety feature] relief valves or other means of transferring water out of the reactor vessel are unable to respond fast enough to accommodate the rapid steam generation and therefore, very high transient pressures **may result in reactor vessel damage."**

"Analyses were performed for a bounding flux trap voiding accident at the ATR. … The analyses calculated that the consequences of this very low probability event are a very rapid positive ramp insertion of reactivity…which results in a peak transient power of about 900 MW in 62 ms [mili-seconds] (Nielson 1990). This extreme transient power is predicted to result in rapid melting of 1.7% of the core…A vapor explosion is postulated to result from the expulsion of the molten fuel into the coolant channels. **The consequences of the postulated vapor explosion are core-wide damage**." [5]

ATR Reactor Loss-of-Coolant Accident

One of the leading ATR vulnerabilities is a "loss-of-coolant accident" (LOCA). There are numerous ATR operating systems that can lead to a LOCA. For instance the reactor coolant system relies on commercial and backup diesel generators to run the reactor coolant pumps. DOE's internal reports states:

"Long-Term Complete Loss of [coolant] Flow; **The probability that both diesel and commercial power will fail simultaneously is relatively high**. However, the probability of restoring one or both sources within 30 minutes is also relatively high. If the battery-backed power is a complete loss of [coolant] flow in less than 30 minutes is **beyond design basis**; the complete loss of flow after 30 minutes is estimated to be a Condition 4 event." [Emphasis added] [6] **Yet, as cited below, an ATR meltdown can occur within 3-5 seconds !**

Released DOE reports also show huge radioactive releases in the event of an accident that DOE does not want the public to know about. For instance the following report states:

"ATR and ATRC Radiological release scenarios that have the potential for being classified as operational

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[4] EDI Citizens Guide to INL; pg. 19; See for a detailed accounting of INL reactor accidents; available on EDI website. http://environmental-defense-institute.org

[5] 2004 Chapter 15 Severe Accident Analysis – Upgraded Final Safety Analysis Report for the Advanced Test Reactor, page 15.12-8. Hereinafter referred to as "SAR"

[6] SAR; page 15.3-4.

emergencies; ATR/ATRC Accident Fission Product Release Downwind Dose (in Rems at 30 meters, 2.5 hours) Scenario;"

"Total Effective Dose Equivalent (whole body dose); **7,380,000 rem; Rem/Hour; 516 R/h.**" [7]

This is 738 million times over current EPA radioactive emission limits of 0.01 rem/yr.

Updated EPA Title 40 Protection of Environment (40 CFR 61.92 Standard) states: "Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive **in any year** an effective dose equivalent [whole body] of **10 mrem/yr [0.01 rem/yr]."**

The above ATR critical safety system vulnerabilities disclosure statements in DOE's reports as the "likely" extreme hazard continue: "The ATR has three reactivity control systems which are used to control and shut down the reactor. These systems are: 1.) Outer shim control cylinders; 2.) Neck shim rods; 3.) Safety rods (activated by the primary pump system)….The safety rods [also called control rods] are the only reactivity control elements modeled in the analysis to terminate power transients [reactor power spikes]….Full withdrawal of the safety rods requires about **20 minutes** when the timer is controlling the withdrawal….Perturbations [spikes] of the neutronic [sic] [radioactive] balance in the reactor core will result in an increase or decrease in reactor power….Larger perturbations [spikes] will result in a **reactivity initiated accident since the regulation rod cannot compensate for the insertion.**" [Emphasis added] [8]

The above quote discloses the uniquely complex reactor power control systems (each of which has their own vulnerabilities – discussed below. This degree of design complexity is not allowed in commercial nuclear power reactors because it's too difficult to control and too prone to a major accident. Additionally, the **20 minute time** required for the safety rod insertion radically contrasts to the 3-5 seconds for power excursions discussed below. This is in contrast to commercial power reactors have relatively simple power control systems, but since the DOE is self-regulated, no outside independent regulator (i.e. Nuclear Regulatory Commission) has jurisdiction.

Note below; In a ATR fuel melt-down; "The initial temperature of the relocating material [molten ATR fuel debris] was assumed to be 1250 K [Kelvin] [976.84 Celsius], a conservative estimate for [fuel] melt held up in the core a few seconds after melting within **3-5 seconds of scram**." [9] This time difference between **20 minutes** for safety rod insertion and the **3-5 seconds** for fuel melt represents a crucial hazard/deficiency in the ATR safety systems ability to respond to reactor power excursions/transients/power spikes.

DOE's report continues; "Radioactive Release from a Subsystem or Component; The pressurized water loop facilities contain tests with a significant inventory of radioactive material. The radioactive material contained in the tests could be released wither by failure of the loop piping or by dropping of a test out of the cask during handling…**whose failure would result in the uncontrolled release of radioactivity to the environment under transient conditions… A loss of flow or a loss of coolant accident (LOCA) in the experiment loop could result in melting of the test.**" [Emphasis added] [10]

Many of DOE's radiation dose assessments are based unreal ATR power levels. For instance DOE uses 200 **KW (200,000 W)** in one maximally exposed individual at INL, however, this is a thousand times below the 250 **MW (250 million)** to 431 **MW (431 million W.)** power levels reported below.

DOE's released Emergency Management Hazards Assessments justifiability covers the ATR coolant

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[7] Emergency Management Hazards Assessments for Reactor Technology Complex (HAD-3, 2004), pages 32 and 34, Table 6. Hereinafter referred to as "HAD-3."

[8] SAR; Page. 15.4-1.

[9] SAR; Page. 15.12-17.

[10] SAR; page. 15.7-1.

treatment accident consequences because these ATR operations pose significant hazards to the downwind public. DOE's report states;

"ATR Primary Coolant Treatment at TRA-605;

Thyroid - Total Effective Dose Equivalent; **15,400 rem**

Thyroid - Committed Dose Equivalent; **304,000 rem**" [11]

Again, EPA 40 CFR 61.92 standard is 10 mR/yr or 0.01 rem/yr.

ATR's Aging Systems Adds to Vulnerabilities

Additionally, this antiquated 40-yr-old ATR is accident risk in the aging factor and lack of crucial safety system material code certification. DOE's own **"**ATR Reactor Vessel Internals Lifetime Scoping Analysis" report states; "The ATR Aging and Life Extension Program has identified seven critical reactor vessel internal components requiring further evaluation to assess aging. These major components include the core support tank, flow distribution tank, reflector support tank, core reflector tank, inlet flow baffle, thermal shield assembly, and the in-vessel quadrant outlet flow pipe assemblies."

"The seven critical reactor vessel internal components are constructed from various materials. Some of these materials are ASME Code Section III approved and others are **not**. Briefly, the core reflector tank is mainly constructed of the aluminum alloy, while the reflector support tank is a sand casting using the aluminum allow. These two aluminum alloys are **not** ASME Code Section III approved materials. This means that allowable stress values and fatigue curves were not readily available in the ASME Code and had to be estimated. [12] Therefore, the above DOE (15.12-8) dubious claim to ATR reactor vessel being "restrained from excessive vertical movement" in the event of an explosion is **not credible**.

Also the above reference to the SPERT tests; included a series of three tests between 1962 and 1964. Other similar tests included SNAPTRAN between 1964 and 1966; and BORAX test in 1954. All of these tests – and there were scores of other tests - of actual reactors deliberately ran them to meltdown/explosion to assess the fuel type and reactor design operating parameters to meltdown/explosion. Millions of curies of radiation was released during these tests and are more fully described in EDI's *Citizens Guide to INL* available on EDI's website.

The above DOE reference to the INL SL-1 reactor accident – occurred in 1961 that killed three operators and seriously radiated scores of first responders and cleanup personnel.

Additionally, the above DOE claim of an ATR explosion is "improbable" is not supported by the preponderance of evidence, long history of ATR fuel failures and DOE's own documented history of reactor tests at INL.

DOE's report continues; "Radiological Analysis; …Since the large break LOCA [loss-of-coolant accident] event resulted in rapid and total core melt and consequences of the release of the fission product inventory analyzed consistent with Reg. 1.4 guidance, it was chosen as the appropriate bounding case." … "The

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[11] Emergency Management Hazards Assessments for Reactor Technology Complex (**HAD-3**, 2004), page 42 Table 10.

TEDE = Total Effective Dose Equivalent; or whole body that includes "internal" (dose received by a radiation source inside the body, e.g. an inhaled dust particle containing plutonium or ingested contaminated water); AND "external" (dose received by a radiation source exposure outside the body, e.g. from a gamma/alpha emitting radionuclides in soil or air).

CDE = Committed Effective Dose Equivalent; The dose value obtained by (1) multiplying the committed dose equivalents for the organs or tissues that are irradiated and the weighting factors applicable to those organs or tissues, and (2) summing all the resulting products. Committed effective dose equivalent is expressed in units of rem or sieverts.

[12] PG-T-89-011; This is a DOE/ID report gained by EDI in a previous FOIA request.

radiological limits of 10 CFR 100 (25 rem whole body, 300 rem thyroid) are assumed to be applicable to **both off-site personnel** and the evacuating personnel on-site." [13]

The above statements are grossly misleading for the following reasons;

1.) The controlling updated EPA Title 40 Protection of Environment (40 CFR 61.92 Standard) states: "Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of **10 mrem/yr [0.01 rem/yr]."**

2.) EPA Standards for Uranium Fuel Cycle Normal Operations to general public, 40 CFR 190.10 state: "The annual dose equivalent does not exceed **25 milli-rems** [0.025 rem] to the whole body, 75 milli-rems [0.075 rem] to the thyroid, and 25 milli-rems [0.025 rem] to any other organ of any member of the public as the result of planned discharges of radioactive materials, radon and it daughters excepted, to the general environment from uranium fuel cycle operations and to radiation from these operations." [14]

3. NRC 10 CFR 100.11 states in part; "However, **neither its use** … as set forth in these site criteria guides are intended to imply that these numbers constitute acceptable limits for emergency doses to the **public** under accident conditions." Additionally this NRC guidance is for a "**once in a lifetime** accidental dose for radiation workers…" The fact is ATR/RTC personnel receive regular radiation doses that must necessarily be factored into any additional accident doses. Therefore, DOE's attempt to use NRC guidance in "off-site" exposures is false.

DOE's report continues; "Confinement Release Rate; The total source term at 100%/day leak is assumed displaced [released to the environment] in 24 hours." [15]

Since the ATR is housed in ordinary steel sheathed industrial building built in the 1960s, there is no credible containment. Therefore, DOE's claim to 24 hour source term is not credible because it would be near immediate – especially during an accident.

DOE's own 2007 Occurrence Report states; "The ATR Design Basis Reconstruction Project identified five issues with the ATR safety basis evaluation of potential confinement over-pressurization as follows;

1.) The Safety Analysis Report **over states** the capability of the confinement to withstand an over-pressure event.

2.) The Remote Monitoring System functions for confinement over-pressure protection were **eliminated** without adequate evaluation.

3.) Confinement leak performance data has been extrapolated **far beyond the range of measured data**.

4.) The SAR does **not** adequately account for potential confinement heat sources. Confinement under-pressure events have **not** been evaluated." [Emphasis added] [16]

ATR Spent Fuel Storage Canal Accident Vulnerabilities

The highly radioactive ATR spent/used reactor fuel requires the same continuous water cooling as the reactor. This storage is in a water cooled "Canal" co-located with the ATR. Loss of coolant to this storage pool can cause huge radioactive releases due to radiation decay heat that will literally boil off the coolant.

DOE's report states; "ATR Canal; The inventory of concern is related to the fission products contained in the fuel elements from the most recent refueling operation. The fission product and activation product

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[13] SAR, Page, 15.12-10 and 11.

[14] See Institute for Energy and Environmental Research, Science for Democratic Action, August 2009, for detailed critical analysis of the inadequacy of EPA, DOE and NRC exposure regulations to the public. www.ieer.org

[15] SAR, 15.12-13.

[16] NE-ID-BEA-ATR-2007-0022

inventory at the reactor scram following 60 days of continuous operations at 250 MW is 1.11 E+9 Ci **[1,110,000,000 Ci]."**

Table A.1-3 presents the inventory of radionuclides that have the most significant contributions to radiation dose. This inventory (8.91 E+7 Ci) [89,100,000 Ci] is used as the starting basis for all accident scenarios that are evaluated in this document." [17]

DOE's report continues; "Source Term: 5.0 E+6 **R/h** at 1 ft." [**5,000,000 Rem/hour**] "RTC [where ATR is located] main parking lot at 500 m could be approximately 2 R/h. Table A.1-20 [later on page 135] provides exposure rate information at several distances, which are based on an initial exposure rate of 5.0 E+6 R/h at 1 foot (0.3048 m) and applying the inverse square equation. Other Barriers and Effects: Although the ATR building structural materials may provide some shielding, no credit is taken for shielding." [18] [Because no ATR shielding can be legitimately be claimed]

These additional unacknowledged risks – listed above separately – are in fact cumulative in the event of commercial/ emergency electrical power or seismic events and are thus unacceptable to the downwind public.

In the coming months more information will be posted here. In the mean time for a more comprehensive analysis of the released DOE documents see; http://environmental-defense-institute.org/publications

Governor Brewer Hears from County Downwinders

Suzanne Adams reports in the Utah *Miner* Staff Reporter, 3/14/10; "After 20 years of waiting, some Mohave County residents are starting to see progress in their fight for compensation from the federal government. On Tuesday, Gov. Jan Brewer met with the Mohave County Downwinders, a group of residents who were affected by the nuclear testing in Nevada in the 1950s and '60s.

The group has been fighting since the 1990 passage of the Radiation Exposure Compensation Act to get the southern half of Mohave County included in a list of 20 counties in Nevada, Utah and Arizona receiving compensation from the federal government for health problems, such as cancer, linked to the testing.

According to Arizona Mining Inspector Joe Hart, the southern half of the county was left off of the list due to a typo. Mohave was spelled with a "j" instead of an "h," and a federal staffer thought the document referred to the Mojave Desert, not the county, he said. Many of the 100 residents attending Tuesday's meeting told Brewer of their and their friends'
and family members' battles with cancer.

"It's heartbreaking to watch family and friends die of cancer. It's heartbreaking to read a Web site and see a list of counties eligible for federal compensation and knowing that I've been raised in a county that's not on the list," said Downwinder Eve Hanna. "I feel like we were discriminated against. I have relatives in Yavapai County who are receiving
compensation," said Helen Masten from Hackberry. Both of her parents, a brother and a sister
have suffered from cancer.

Another resident said she lost 31 members of her family, her husband's family and friends to illness linked to the radioactive fallout. She saw people lose their homes and property just to cover their medical bills. Eddie Patello found it hard to believe that the winds blowing south from the test site turned east once they reached the

[17] HAD-3, Page 114.
[18] HAD-3- Page 129.

Grand Canyon and never crossed the southern part of Mohave County.

"(My grandfather) was always bewildered by the high rate of cancer in the area," said Matt Capalby. His grandfather was a doctor during the 1950s and '60s. Capalby still has his grandfather's records, and along with other records he has been able to determine the wind patterns in the area during the testing. He said he sent the information to the Arizona
Legislature and Congress to no avail. "We've seen an entire generation decimated," Capalby said.

Mohave County residents weren't the only ones affected by the testing, said Louise Benson from the Hualapai Tribe. The tribe has many elders who have suffered and died from cancer. "How many have already passed away? Whole families have been affected," she said. "This has really been hard for Mohave County." "I am not unfamiliar with your situation," Brewer said. She grew up in Nevada during the testing. "This has been a long-time issue. It's 2010 and we're still talking about it," she said.

Brewer said she was aware of a bill introduced by U.S. Rep. Trent Franks on Feb. 26 that would include the county in the act. She encouraged the Downwinders to organize behind one spokesperson and share their stories and data with her office so she could lend her support."

Matheson Saddened by Death of Utah "downwinders" Champion – Stewart Udall

Washington, D.C.—Congressman Jim Matheson said today the West has lost a powerful voice for holding the federal government accountable, with the passing of former Arizona Congressman and Interior Secretary Stewart Udall.

Matheson said Utahns will forever remember Udall's fight on behalf of the victims of exposure to radioactive fallout from the nuclear weapons testing era and against the government cover up regarding the dangers.

"Stewart was the Western lion who roared when he read "top secret" government memos that referred to the people living downwind of the Nevada Test Site as "a low-use segment of the population", said Matheson. "This was the land and the people that he loved. He knew them as patriotic Americans, who trusted their government. His legal crusade-- on behalf of the families of the Navajos who suffered lung cancer in uranium mining-- helped lead to the truth about the government conspiracy that harmed so many in the small towns of the Southwest."

Matheson said that when he was first elected to Congress, one of his first battles was to work with Stewart Udall's son Tom—then a Congressman from New Mexico—to restore funding for applicants through the federal Radiation Exposure Compensation Act (RECA). Some cancer victims were dying while awaiting payment for their awarded claims. Matheson, Tom Udall and his cousin Mark Udall, successfully restored the funding.

Matheson said that in his 1994 book, Udall reassessed the actions of his own generation and criticized the rush to develop the atomic bomb and decades of government secrecy in what he described as "our tragic affair with the atom."

"Although the suffering from that era continues to this day, many of us at least have the satisfaction of knowing—thanks to men like Stewart Udall—that democracy can prevail against injustice and duplicity," said Matheson.

Matheson said his thoughts are with the extended family of Secretary Udall at this difficult time."

Editors note; Stewart Udall was also instrumental in the class-action lawsuit brought against DOE by sheep ranchers whose herds were decimated by nuclear fallout from the Nevada Test Site. This litigation though ruled in favor of the ranchers by the Federal Court judge, was subsequently overturned in the U.S. Court of Appeals based not on the merits of the case that the Court acknowledged, but on the U.S. Government/ DOE's "sovereign immunity." For an informative analysis of this tragic history, see Harvey Wasserman, Norman Solomon and Robert Alvarez's "Killing Our Own, The Disaster of America's Experience With Atomic Radiation."