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### **With rising construction costs forecast, and amid securities fraud allegations, NuScale UAMPS project cancelled**

On November 8, 2023, cancellation of the NuScale small modular reactor project slated for Idaho by the Utah Associated Municipal Power Systems (UAMPS) was announced. UAMPS was unable to find enough electricity subscribers for the project because of its already noncompetitive estimated costs. The project is also called the “Carbon Free Power Project.” Future spiraling cost increases would have been likely had construction begun, and ratepayers would have been on the hook for future cost increases had the project continued.

NuScale had begun the process of licensing the small modular reactor design in 2008 and had been granted a standard design approval (SDA) for the 50 MW-electric (MWe), per module, design in September 2020. <sup>1</sup> **Rarely stated is that the NRC’s design approval of the 50 MWe modules had not resolved the issue of the NuScale’s problematic and unique steam generator design regarding ability of “the steam generator tubes to maintain structural and leakage integrity during density wave oscillations....”** I could find no documentation of progress on the NuScale steam generator density wave oscillation problem since 2020. **It is rarely admitted that NRC license approval had NOT been granted to the modified and more challenging to cool 77 MW-e NuScale design.**

The sooner this small modular reactor project to be located at the Idaho National Laboratory was cancelled, the better. The NuScale design was touted as having safety improvements, yet so many documents were withheld or redacted, it is difficult to compare its safety to other designs. While the NuScale design used many aspects of conventional light-water pressurized water reactor designs, it also had numerous untested, novel features. The NRC withheld information that should have been publicly available, regarding NuScale’s safety discussions at Atomic Commission on Reactor Safeguards (ACRS) meetings.

Faulty steam generators have resulted in premature permanent shutdown of conventional pressurized water reactors, including reactors at San Onofre in California and the Trojan nuclear plant in Oregon. NuScale’s novel and never before built helical steam generators posed serious project risk (as well as accident risk) that isn’t being reported. There may be no practical way to repair the steam generator tubes inside a NuScale module, or it may simply be cost prohibitive.

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<sup>1</sup> Arjun Makhijani and M.V. Ramana, Prepared for Environmental Working Group, *Questions for NuScale VOYGR Reactor Certification: When Will It Be Done? And then, Will It Be Safe?,”* April 9, 2023.

The never-before-built helical steam generators, the lack of design standards for such a steam generator, and the vulnerabilities apparent from the helical steam generators posed safety issues that appear to not have been resolved.<sup>2 3</sup> Despite that, the NRC granted the design approval that it should never have granted and would not have granted if it were not such as captive agency, inclined to put nuclear projects ahead of public safety. The NRC ignores the economics of nuclear energy and ignores the spent nuclear fuel issues that were disproportionately worsened by the NuScale reactor on a megawatt generated basis.<sup>4</sup>

NuScale was requesting higher power level for each module and also higher burnup, from 35 gigawatt-days thermal per metric ton of uranium (GWdth/tU), to 45 GWdth/tU which means higher radionuclide inventory in the spent fuel and higher radiological consequences during an accident. Steam generator tube rupture can result in the release of radionuclides to the environment.

The NuScale UAMPS project would have put ratepayers on the hook for a very risky project. *Wyofile* reported that David Schlissel, director of resource planning analysis for the Institute for Energy Economics and Financial Analysis had predicted the NuScale project's demise in his February 2022 analysis.<sup>5</sup>

The Department of Energy had given \$600 million to NuScale and others. Back in 2013, the DOE had announced it would contribute partial funding for the NuScale project. The DOE had also approved \$1.35 billion over 10 years for the NuScale project.<sup>6</sup>

A Bulletin of the Atomic Scientists opinion article by Henry Sokolski, "A small modular reactor's demise calls for big change in Energy Department policy," notes **that small modular reactors are neither quick nor cheap to implement in the fight against global warming.** SMRs also increase proliferation of nuclear bomb making plutonium and raise nuclear security issues, especially when marketing to countries outside the U.S., near war zones.<sup>7</sup>

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<sup>2</sup> NRC, "Preapplication Readiness Assessment Report" (Washington, D. C.: Nuclear Regulatory Commission, November 15, 2022), <https://s3.documentcloud.org/documents/23321003/nuscale-sdaa-preapplication-readiness-assessment-summary-observation-report-final-4.pdf>.

<sup>3</sup> Susan O'Donnell and M.V. Ramana, NB Media Co-op, "Big costs sink flagship nuclear project and will sink future small modular reactor projects too [commentary]," November 23, 2023. <https://nbmediacoop.org/2023/11/23/big-costs-sink-flagship-nuclear-project-and-will-sink-future-small-modular-reactor-projects-too-commentary/>

<sup>4</sup> Lindsay M. Krall, Allison M. Macfarlane, and Rodney C. Ewing, *PNAS*, "Nuclear waste from small modular reactors," Received June 26, 2021, Published May 31, 2022, <https://doi.org/10.1073/pnas.2111833119>.

<sup>5</sup> Dustin Bleizeffer, WyoFile.com Via Wyoming News Exchange, "Wyoming nuclear plant [Natrium] on track despite industry setback, developer says," November 22, 2023. [https://www.wyomingnews.com/laramieboomerang/news/wyoming-nuclear-plant-on-track-despite-industry-setback-developer-says/article\\_46523f56-88a4-11ee-9426-ef095dbde4ec.html](https://www.wyomingnews.com/laramieboomerang/news/wyoming-nuclear-plant-on-track-despite-industry-setback-developer-says/article_46523f56-88a4-11ee-9426-ef095dbde4ec.html)

<sup>6</sup> Timothy Gardner and Manas Mishra, *Reuters*, "NuScale ends Utah project, in blow to US nuclear power ambitions," November 8, 2023 (with later updates). <https://www.reuters.com/business/energy/nuscale-power-uamps-agree-terminate-nuclear-project-2023-11-08/>

<sup>7</sup> Henry Sokolski, *Bulletin of the Atomic Scientists*, "A small modular reactor's demise calls for big change in Energy Department policy," November 14, 2023. <https://thebulletin.org/2023/11/a-small-modular-reactors-demise-calls-for-big-change-in-energy-department-policy/>

**The Department of Energy policy is to bet taxpayers' dollars on multiple risky losing schemes that won't solve climate change because they are too slow to implement.**

NuScale had been continuing to market its prematurely, partially approved design to Romania, Kazakhstan, Poland and Ukraine, betting that these countries desire the risky and most expensive way to produce electricity and risking disaster because Ukraine is in a war zone. The US Export Import Bank and the US Development Finance Corporation have foolishly promised NuScale \$4 billion in financing toward a plant in Romania.

**A Class Action Lawsuit has been brought against NuScale for NuScale securities investors because the lawsuit alleges that NuScale made materially false and/or misleading statements and failed to disclose material adverse facts about NuScale's prospects.**<sup>8</sup> NuScale's pursuit of another domestic project with Standard Power was heralded despite Standard Power not having the resources to build a small modular reactor project.

In another securities fraud lawsuit, the complaint alleges that NuScale misrepresented and concealed that: (1) due to the inflationary impact on cost of construction and power, NuScale and UAMPS would be unable to sign up enough subscribers to fulfill the CFPP; and (2) Standard Power did not have the financial ability to support its agreement with NuScale.<sup>9 10</sup>

On Oct. 19, 2023, *Iceberg Research* published the results of its analysis in a report entitled "NuScale Power (\$SMR): A Fake Customer and a Major Contract in Peril Cast Doubt on NuScale's viability."<sup>11 12</sup> The report concluded that the huge contract for NuScale with Standard Power, a blockchain datacenter service provider, was not credible as Standard Power did not have the means to support a large contract with NuScale. Also, the NuScale UAMPS project required more electricity subscribers and had only until January 2024 to raise project

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<sup>8</sup> Business Wire, "NUSCALE ALERT: Bragar Eigel & Squire, P.C. Announces that a Class Action Lawsuit Has Been Filed Against NuScale Power Corporation and Encourages Investors to Contact the Firm," November 16, 2023. <https://www.businesswire.com/news/home/20231116746556/en/NUSCALE-ALERT-Bragar-Eigel-Squire-P.C.-Announces-that-a-Class-Action-Lawsuit-Has-Been-Filed-Against-NuScale-Power-Corporation-and-Encourages-Investors-to-Contact-the-Firm>

<sup>9</sup> Hagens Berman Sobol Shapiro LLP, *Hagens Berman Shareholder Advocates*, "Investors Sue NuScale (SMR) for Concealing True Cost of Flagship Nuclear Reactor Project - Hagens Berman," November 27, 2023. <https://www.globenewswire.com/news-release/2023/11/27/2786273/32716/en/Investors-Sue-NuScale-SMR-for-Concealing-True-Cost-of-Flagship-Nuclear-Reactor-Project-Hagens-Berman.html>

<sup>10</sup> *MarketScreener*, "The Law Offices of Vincent Wong Remind NuScale Investors of a Lead Plaintiff Deadline of January 16, 2024," November 27, 2023. <https://www.marketscreener.com/quote/stock/NUSCALE-POWER-CORPORATION-137238735/news/The-Law-Offices-of-Vincent-Wong-Remind-NuScale-Investors-of-a-Lead-Plaintiff-Deadline-of-January-16-45441320/>

<sup>11</sup> *Businesswire*, "ROSEN, SKILLED INVESTOR COUNSEL, Encourages NuScale Power Corporation Investors to Inquire About Securities Class Action Investigation – SMR," October 23, 2023. <https://www.businesswire.com/news/home/20231023610651/en/ROSEN-SKILLED-INVESTOR-COUNSEL-Encourages-NuScale-Power-Corporation-Investors-to-Inquire-About-Securities-Class-Action-Investigation-%E2%80%93-SMR>

<sup>12</sup> *Iceberg Research*, "NuScale Power (\$SMR): A fake customer and a major contract in peril cast doubt on NuScale's viability," October 19, 2023. <https://iceberg-research.com/2023/10/19/nuscale-power-smr-a-fake-customer-and-a-major-contract-in-peril-cast-doubt-on-nuscales-viability/>

commitments to 370 MW-electric. NuScale's UAMPS project only had project commitments for 120 MW-electric and with the rising project costs, there were no takers.

**Insiders have been selling off NuScale stock for over a year.** NuScale has made inflated claims that the work they “have completed to date has advanced our nuclear power modules to the point that utilities, governments and industrials can rely on a proven SMR technology that has regulatory approval, is in active production and is ready for commercial deployment.”<sup>13</sup>

Despite multiple news articles emphasizing NuScale's design approval, previously the U.S. Nuclear Regulatory Commission had not guaranteed that the design was worthy of a design certification or a construction permit. The U.S. NRC's communications to the Idaho Leadership in Nuclear Energy Commission at its October 2020 meeting<sup>14</sup> and to NuScale in writing regarding the original Standard Design Application for the 12-module 60 MWe reactors stated that “... **this [Nuclear Regulatory Commission] SDA [standard design approval] does not constitute a commitment to issue a permit, design certification (DC), or license....**”<sup>15 16</sup> The six-module 77 MW-e NuScale design did not have NRC approval at all.

The small city municipalities that signed up for the UAMPS project were provided specific dates that they could exit the project, paying some costs, and many subscribers did exit the project in 2020 and 2021. Staying with the project past certain date would have locked in the municipalities and their ratepayers for all subsequent cost overruns.

NuScale's parent company Fluor, holder of 55 percent of NuScale, did not result in project success. Read more about design problems with NuScale in Environmental Defense Institute's November newsletter and others.

Many news articles also state that NuScale was to be built near Idaho Falls. In reality, with assistance provided by the Department of Energy, the first two locations at the INL for NuScale were abandoned. NuScale's third location, finally selected, is an over 50-mile drive from Idaho Falls and this is not insignificant for regular workers nor for construction contractors, especially in the winter months of snowy and icy roads. INL site buses for government operations would not have been available for NuScale.

Despite years of trying, NuScale failed to deliver. Since 2011, \$6.6 billion has been appropriate for small modular reactors, including \$583 million for NuScale (with \$3 billion

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<sup>13</sup> *Businesswire*, “NuScale Power Comments on Inaccurate Short Seller Report,” October 24, 2023.

<https://www.businesswire.com/news/home/20231024578361/en/nuscale-power-comments-on-inaccurate-short-seller-report> and see also NuScale's website for its response.

<sup>14</sup> Doug Hunter, CEO and General Manager of Utah Association of Municipal Power Systems (UAMPS), presentation to the Idaho Line Commission CFPP [Carbon Free Power Project] October 14, 2020.

<https://line.idaho.gov/wp-content/uploads/sites/84/2020/10/2020-1014-cfpp.pdf>

<sup>15</sup> U.S. Nuclear Regulatory Commission, Letter from Anna H. Bradford, NRC to Zackary W. Rad, NuScale Power LLC, Subject: Final Safety Evaluation Report for the NuScale Standard Plant Design, August 28, 2020 at

<https://www.nrc.gov/docs/ML2023/ML20231A804.pdf>

<sup>16</sup> U.S. Nuclear Regulatory Commission, Letter from Anna H. Bradford, NRC to Zackary W. Rad, NuScale Power LLC, Subject: Final Safety Evaluation Report for the NuScale Standard Plant Design, September 11, 2020 at

<https://www.nrc.gov/docs/ML2024/ML20247J564.pdf>

obligated), \$318 million to TerraPower and \$242 million to X-energy.<sup>17</sup> So far, none of this investment has resulted in addressing climate change, nor are any of these projects coming online for years to come, if ever. Furthermore, the cost of spent nuclear fuel storage and disposal will be huge and isn't being factored in.

A 2018 MIT study that included experts from the Idaho National Laboratory asserted that the NuScale reactor was ready for commercial deployment.<sup>18</sup> In reality, NuScale is still not ready for commercial deployment and deployment of NuScale hopefully will never be attempted.

More about two other small modular reactor projects, the TerraPower Natrium sodium-cooled fast reactor slated for Kemmerer, Wyoming and X-energy's gas-cooled reactors, in articles below.

## **Bill Gate-backed TerraPower Natrium Sodium-Cooled Reactor is a highly risky venture**

Bill Gates, who wasted years in pursuit of a "traveling-wave" reactor, is now pursuing the TerraPower Natrium reactor, a type of sodium-cooled fast reactor that has been proven, worldwide, to be precariously difficult to operate. Many other countries have failed financially trying to use fast reactor technology. Construction cost escalation for a Natrium fast reactor is likely to be far worse than for the failed NuScale UAMPS project.

Fortunately, ratepayers, myself included, won't be on the hook. Rather, it will be taxpayers with TerraPower and the Department of Energy spitting the construction costs for Natrium.<sup>19</sup> The currently estimated price tag for Natrium's 345 megawatt-electric reactor is \$4 billion.

PacifiCorp, which operates as Rocky Mountain Power has tentatively agreed to take on ownership of the power plant sometime after it goes into operation in 2030. PacifiCorp has coal plants, that the news article stated it wanted to retire. That seems to imply reducing carbon fuel use, but in reality, PacifiCorp is converting its coal plants to gas plants, signaling it does not expect Natrium to be running any time soon.

The Natrium reactor slated for Kemmerer, Wyoming, will be too small to make a difference and too late to make a difference in addressing climate change. In fact, coal and gas-fired plants will be relied upon in Kemmerer Wyoming as the Natrium project sucks in federal dollars and will not be deployed in time to make a dent in climate change. The argument for nuclear energy being base-load plants that are needed when the solar and wind don't provide power is a false. In

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<sup>17</sup> Stephanie Cooke, *Energy Intelligence*, "Opinion – The End of DOE's Flagship SMR – A Cautionary Tale," November 17, 2023. <https://www.energyintel.com/0000018b-cf50-dbb5-a5ef-df7378750000>

<sup>18</sup> MIT Energy Initiative, *The Future of Nuclear Energy in a Carbon-Constrained World – An Interdisciplinary MIT Study*, Massachusetts Institute of Technology, Revision 1, September 2018. <https://energy.mit.edu/publication/the-future-of-nuclear-energy-in-a-carbon-constrained-world/>

<sup>19</sup> Dustin Bleizeffer, *WyoFile*, *The Idaho Falls Post Register*, "Wyo. Nuclear plant on track despite industry setback, developer says – Despite assurances from Bill Gates-backed TerraPower, some skeptics contend its Wyoming project could be a 'financial disaster,'" November 24, 2023.

fact, fossil fueled plants are the base-load for nuclear plants and nuclear plants are so expensive to construct and operate, that nuclear plants want to operate as much as they are able, pressing out cheaper power generation.

The United Arab Emirates' (UAE) in Dubai has agreed to study the potential development of advanced reactors.<sup>20</sup> But the Bill Gates-TerraPower Natrium reactor, if ever built, is likely more than a decade away, and will be yet another costly boondoggle that does not address climate change. Promoting nuclear reactors, in fact, insures the continued and high reliance on fossil fuels.

Nuclear promoters continue to spread myths and false information while ignoring the evidence of excessive cost, high risk of nuclear accidents and the International Atomic Energy Agency is one of nuclear energy's most shameless promotor.<sup>21</sup> Factual analysis shows that nuclear is not the answer for climate change. Renewable energy is cheaper and can be installed quickly. The costs of spent nuclear management and disposal are being ignored as is the peril to life should solutions not be found and implemented.

A Bulletin of the Atomic Scientists opinion article "A small modular reactor's demise [NuScale] calls for big change in Energy Department policy," notes that small modular reactors are neither quick nor cheap, **and that the Bill Gates-TerraPower Natrium reactor in particular, increases concern of proliferation of nuclear bomb making plutonium.** Nuclear security issues, especially when marketing to countries outside the U.S., are not being addressed by the Department of Energy as it promotes these projects.<sup>22</sup>

It will be too little and too late to address climate change. And it will accident prone and add to weapons material proliferation problems and to nuclear waste problems. Pyroprocessing of spent fuel releases radionuclides to the air and also requires waste disposal. The amount of any burning of existing spent fuel stocks is miniscule to non-existent. The Natrium reactor relies on high assay low enriched uranium (HALEU) fuel and had sought HALEU fuel from the Ukraine. TerraPower is seeking HALEU now from a company called Centrus' Piketon, Ohio, facility.<sup>23</sup>

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<sup>20</sup> Reuters, "COP28 [climate conference in Dubai]: UAE signs deal with Bill Gates' nuclear company on advanced reactors," December 3, 2023. <https://www.reuters.com/business/environment/cop28-uae-signs-deal-with-bill-gates-nuclear-company-advanced-reactors-2023-12-04/>

<sup>21</sup> Anmar Frangoul, COP28, "Nuclear's uncertain role in the shift away from fossil fuels is seen as critical and very contentious," November 27, 2023. <https://www.cnbc.com/2023/11/27/the-debate-over-nuclears-role-in-the-energy-transition-continues.html>

<sup>22</sup> Henry Sokolski, *Bulletin of the Atomic Scientists*, "A small modular reactor's demise calls for big change in Energy Department policy," November 14, 2023. <https://thebulletin.org/2023/11/a-small-modular-reactors-demise-calls-for-big-change-in-energy-department-policy/>

<sup>23</sup> TerraPower webpage, "TerraPower and Centrus Energy execute MOU to accelerate joint efforts to create domestic, commercial-scale HALEU production," dated July 17, 2023 and accessed December 4, 2023. <https://www.terrapower.com/terrapower-and-centrus-expand-efforts-to-commercialize-domestic-haleu-production/>

**Despite the often-cited 2030 operational milestone, the Bill Gates-Terra Power 345 MWe Natrium reactor can be expected to not go online for at least a decade after it receives NRC design certification. The Natrium has not received an NRC design certification and is only in the pre-application stage.** <sup>24</sup>

## **X-Energy aborts effort to offer public stock but is pushing a project in Washington state**

After the failed NuScale UAMPS project and falling stock prices and subsequent stockholder fraud allegations, X-energy has decided not to provide a public offering of its stock. <sup>25</sup>

But X-energy is pressing for partnerships, such as with Energy Northwest, for its high-temperature gas-cooled (HTGR) pebble-bed reactor. <sup>26</sup> Energy Northwest has signed a joint development agreement with X-energy for up to 12 Xe-100 small modular reactors, for a total generating capacity of 960 MW-e in central Washington, adjacent to the Columbia Generating Station nuclear plant. <sup>27</sup> The X-energy project adjacent to the Columbia Generation Station hopes to bring the first Xe-100 module (of 80 MWe) online by 2030.

The X-energy reactor would use TRISO fuel pellets and is similar to the failed gas cooled reactor concept used at Fort St. Vrain in Colorado, that requires millions of dollars annually just to store the spent fuel that was generated before premature shutdown of the plant.

The Union of Concerned Scientists found that X-energy reactors are not designed for efficient utilization of uranium compared to a conventional light-water reactor, require expansion of enrichment capacity because it uses HALEU fuel, and are not practical for large-scale distributed power generation. <sup>28</sup>

X-energy reactors release noble gases xenon, krypton, and also iodines and cesium during normal operation. <sup>29</sup> They also release tritium during normal operation. <sup>30</sup> Like other reactors, the

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<sup>24</sup> U.S. Nuclear Regulatory Commission, Natrium webpage accessed December 5, 2023 is only in the pre-application stage. <https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/licensing-activities/pre-application-activities/natrium.html>

<sup>25</sup> Stephanie Cooke, *Energy Intelligence*, “Opinion – The End of DOE’s Flagship SMR – A Cautionary Tale,” November 17, 2023. <https://www.energyintel.com/0000018b-cf50-dbb5-a5ef-df7378750000>

<sup>26</sup> X Energy, LLC, *Submittal of X Energy, LLC (X-energy) Xe-100 Principal Design Criteria Licensing Topical Report*, June 30, 2023. ML23181A172 at NRC.gov ADAMS. See also <https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/licensing-activities/pre-application-activities/xe-100.html> and

<sup>27</sup> Larry Pearl, *UtilityDive*, “Energy Northwest, X-energy sign joint development agreement for up to 12 small modular reactors,” July 20, 2023. <https://www.utilitydive.com/news/energy-northwest-x-energy-xe-100-nuclear-small-modular-reactor/688460/>

<sup>28</sup> Edwin Lyman, Union of Concerned Scientists, “*Advanced*” *Isn’t Always Better – Assessing the Safety, Security, and Environmental Impacts of Non-Light-Water Nuclear Reactors*, March 2021. <https://www.ucsusa.org/resources/advanced-isnt-always-better#read-online-content>

<sup>29</sup> Idaho National Laboratory, Letter: Contract No. DE-AC07-05ID14517 – Next Generation Nuclear Plant Project Licensing White Paper Submittal – Mechanistic Source Terms – NRC Project #0748, July 21, 2010. ML102040260.

X-energy Xe-100 reactors do not make good neighbors because inhaled and/or ingested radionuclides increase the rates of cancer, other illnesses and birth defects.

While there isn't enough information to fully evaluate the safety of the X-energy high-temperature gas cooled reactors,<sup>31</sup> anticipated reductions in containment strength, emergency planning zone size and the ever-present vulnerability to sabotage undermine any safety benefits of TRISO fuel ability to withstand higher temperatures.

No technology has been developed for reprocessing TRISO fuel and disposal of the fuel exacerbates already overwhelming spent nuclear fuel disposal problems.

## **U.S. military revokes plan for Oklo Micro-reactor at Alaska Air Force base**

This November, the U.S. military has rescinded the preliminary award for the Oklo micro-reactor that would have built a nuclear plant at Eielson Air Force Base near Fairbanks, Alaska.<sup>32</sup> All bidders including Westinghouse, Rolls-Royce and Siemens are still under consideration. Ultra Safe Nuclear Corp. is also interested.

The desire is to not use fossil fuels like diesel fuel or coal and the base needs about 15 megawatts-electric (WMe) is needed at the base. But no prototype micro-reactor has been built.

Claims had been made that the micro-reactor would go online by the end of 2027 but this does not appear realistic.

The problems with micro-reactors include making the micro-reactor a terrorist target at the military base and the problem of storing and shipping the spent nuclear fuel.

The U.S. Nuclear Regulatory Commission has denied the Oklo micro-reactor combined license application in January 2022 because of repeated failure to provide necessary information for the NRC to review the safety of its design that was to be built at the Idaho National Laboratory.<sup>33</sup> The Oklo reactor was to use high-assay low-enriched uranium (HALEU) fuel from the INL<sup>34</sup> and to be a "compact fast reactor" that would use heat pipes as thermal

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<sup>30</sup> Paul A. Demkowicz, *TRISO Fuel: Mechanistic Source Term*, INL/MIS-19-52962-Revision-0, April 2019. Sort\_24841.pdf

<sup>31</sup> U.S. Nuclear Regulatory Commission, Summary of the October 24, 2023, Observation Meeting with X Energy, LLC, to discuss NRC Staff Questions Pertaining to X-Energy's Atmospheric Dispersion and Dose Calculation Topical Report, December 4, 2023. ML23333A134. (This document reveals nothing about the X-Energy's safety or radionuclide dispersion performance.)

<sup>32</sup> Nathaniel Herz, *Northern Journal*, "U.S. military quietly revokes planned contract for small nuclear plant at Alaska Air Force base," November 18, 2023. <https://alaskabeacon.com/2023/11/18/u-s-military-quietly-revokes-planned-contract-for-small-nuclear-plant-at-alaska-air-force-base/>

<sup>33</sup> U.S. Nuclear Regulatory Commission webpage <https://www.nrc.gov/reactors/new-reactors/large-lwr/col/aurora-oklo.html> and application denial letter to Oklo dated January 6, 2022 (ML21357A034).

<sup>34</sup> Idaho National Laboratory webpage, "INL selects Oklo Inc. for opportunity to demonstrate reuse of fuel material," February 19, 2020. Accessed November 30, 2023. <https://inl.gov/nuclear-energy/inl-selects-oklo-inc->



superconductors. It is often implied that reactors that use HALEU fuel are burning nuclear waste. In reality the HALEU fuel from the high enriched fuel used in the Experimental Breeder Reactor II is nothing like the bulk of the nation's low enriched spent nuclear fuel and therefore does nothing to solve the nation's spent nuclear fuel problem.

How the military picked the Oklo micro-reactor is quite amazing, given that there is no design documentation available for its licensing, or perhaps no design at all. The fanciful artistic depiction of the hoped-for but undesigned reactor were apparently enough to convince the U.S. Air Force.<sup>35</sup> A 2018 MIT study that included experts from the Idaho National Laboratory mentions the Oklo micro-reactor as though the reactor was unquestionably viable.<sup>36</sup>

### **Tracking the tardy, cancelled or otherwise irrelevant to combatting climate change nuclear reactor projects promoted by the Department of Energy**

With the Department of Energy throwing taxpayer money at a plethora of proposed reactors, a summary, though incomplete, is provided in Table 1. Note that the NuScale small modular reactor project had received partial approval for an earlier design but the project slated for Utah Associated Municipal Power Systems (UAMPS) was cancelled in November. Also, this November, the U.S. Air Force pulled back on a contract to build the Oklo micro-reactor. Oklo was denied an NRC license due to insufficient design information in January 2022.

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[for-opportunity-to-demonstrate-reuse-of-fuel-material/](#) The fuel material is from Experimental Breeder Reactor II highly enriched fuel and unlike the bulk of the nation's problematic spent nuclear fuel.

<sup>35</sup> Secretary of the Air Force Public Affairs, U.S. Air Force, "Micro-reactor pilot program reaches major milestone," August 31, 2023. <https://www.af.mil/News/Article-Display/Article/3512696/micro-reactor-pilot-program-reaches-major-milestone/>

<sup>36</sup> MIT Energy Initiative, *The Future of Nuclear Energy in a Carbon-Constrained World – An Interdisciplinary MIT Study*, Massachusetts Institute of Technology, Revision 1, September 2018. <https://energy.mit.edu/publication/the-future-of-nuclear-energy-in-a-carbon-constrained-world/>

**Table 1.** Partial list of nuclear reactors currently receiving U.S. research dollars, including the Versatile Test Reactor, Natrium, X-energy's Xe-100, NuScale and other reactors.

<b>Reactor Category</b> <i>Reactor name</i>	<b>Reactor type/ Fuel type</b>	<b>MW-thermal</b>	<b>MW-electric</b>	<b>Fissile Material</b>	<b>Special notes</b>
<b>Materials Testing</b>					
<i>Versatile Test Reactor (DOE/EIS-0542)</i>	Fast neutron, sodium-cooled, U-Pu-Zr	300 MWth	None	Uranium-plutonium-zirconium metal	Uses but does not generate electricity.  Very high accident consequences.
<b>Commercial electrical power</b>					
TerraPower & GE Hitachi <i>Natrium</i>	Fast neutron, sodium-cooled, U-Zr	840 MWth	345 MWe	Uranium-zirconium-hydride using HALEU	High project risk. High accident risk. High risk of frequent repairs. High risk of premature shutdown like other similar reactors.
GE Hitachi BWRX-300	Fast neutron, sodium-cooled, U-Zr ?	?	300 MWe	?	Clinch River site proposed
X-energy's <i>Xe-100</i>	High-temperature gas cooled, TRISO "pebble bed"	200 MWth times 4	Xe-100, 80 MWe; 4-pack is 320 MWe	TRISO (tristructural isotropic) uranium fuel from HALEU  DOE Advanced Reactor Demonstration Program, 2020, promised up to \$ 1.2 Billion.	High risk of frequent repairs. TRISO fuel used in Fort St. Vrain reactor. No containment. No existing technology for reprocessing.
	Hermes, Kairos Power  Fluoride salt cooled high-temperature reactor	320 MWth or reduced scale	140 MWe, Or reduced scale	TRISO fuel	Received DOE Advanced Reactor Demonstration Program money.

<b>Reactor Category</b> <i>Reactor name</i>	<b>Reactor type/ Fuel type</b>	<b>MW-thermal</b>	<b>MW-electric</b>	<b>Fissile Material</b>	<b>Special notes</b>
(Small Modular Reactor) <i>NuScale</i>	Light-water pressurized reactor, standard PWR fuel with MOX and other fuels envisioned  The reactor modules are submerged in a common pool and lifted modules pose a risk to entire facility.	?	NuScale 50 MWe Various uprating to 60 MWe and even higher. For 60 MW per module, a 12-pack plant is 720 MWe	<4.95 percent enriched standard PWR fuel, hope to use plutonium mixed oxide fuel (MOX) and/or higher enrichment fuels.  Zirconium-clad fuel poses hydrogen generation when overheated, like all PWRs.	High risk of frequent and costly repairs. Hot risk of premature shutdown due to materials reliability and novel design. Accident risks not better than conventional PWRs. <b>(UAMPs project cancelled November 2023.)</b>
<b>Mobile reactors</b>	Variety  Generally sized for cargo container shipment.	?	< 20 MWe	variety	Wide range of sizes and accident consequences.
	Project Pele, BWXT Advanced Technologies, LLC, X-energy, LLC, high temperature gas cooled		1 to 5 MWe	TRISO fuel	Department of Defense High target risk at deployed at military bases. Likely to become permanent stranded fuel site where ever deployed.

<b>Reactor Category</b> <i>Reactor name</i>	<b>Reactor type/ Fuel type</b>	<b>MW-thermal</b>	<b>MW-electric</b>	<b>Fissile Material</b>	<b>Special notes</b>
	Oklo, a \$25-million startup company (Aurora Powerhouse)	4 MWth	1.5 MWe	HALEU	Creates spent nuclear fuel problems without any significant benefit. <b>(Design application denied by NRC due to insufficient information)</b>
	Ultra Safe Nuclear Corporation (USNC), gas-cooled reactor demonstration project		5 MWe	TRISO fuel	Canada at Ontario's Chalk River site
	Westinghouse Canada eVinci Micro Reactor		1 MWe to 5 MWe		
<b>Micro</b> <i>MARVEL</i>	Sodium-potassium-cooled, HALEU	100 kWth	"less than 100 kWe"  Expect 20 kWe (0.02 MWe)	150 kg of 20 percent enriched U-235 (U-Zr-Hydride fuel in stainless-steel cladding)	Testing planned at INL's TREAT facility
<b>Molten Salt or Chloride Reactor</b>	Molten Chloride Reactor Experiment (MCRE) DOE/EA-2209.	200 kWth	None for the research experiment	Not enough information. Note that the fuel is in the reactor coolant.  Any significantly scaled-up reactor would be many decades away.	Preliminary research with no reprocessing capability and hold up of gaseous radiological releases.

Table notes: MWth is megawatts-thermal energy, MWe or simply MW is megawatts-electric energy. HALEU is high assay low-enriched uranium, produced by the Idaho National Laboratory in a highly environmentally airborne polluting pyroprocessing operation. Note regarding past, current or under construction reactors: the nominally 1000 MWe Westinghouse AP1000 under construction is a light-water pressurized reactor, 1000 MWe, fuel of uranium oxide of 4.55 percent uranium-235 enrichment; existing Advanced Test Reactor, 250 MW-thermal, 93 percent enriched uranium-235; formerly operated Fort St. Vrain high-temperature gas-cooled reactor, 330 MWe, used TRISO fuel; formerly operated Peach Bottom reactor, 40 MWe; formerly operated Hanford's Fast Flux Test Facility reactor was a 400 MW-thermal fast neutron sodium-cooled reactor; formerly operated INL's Experimental Breeder Reactor II (EBR-II) was a fast neutron sodium-cooled pool-type reactor of 62.5 MW-thermal (19 MWe), see Perry et al., Seventeen Years of LMFBR Experience: Experimental Breeder Reactor II (EBR-II), CONF-820465—2, April 1982 at <https://www.osti.gov/servlets/purl/6534205>. Some MWth information added from Edwin Lyman, Union of Concerned Scientists, "Advanced" isn't always better – Assessing the Safety, Security, and Environmental Impacts of Non-Light-Water Nuclear Reactors, March 2021.

## **Response from the Department of Energy to my questions to the Idaho Cleanup Project Citizens Advisory Board, many months late**

On November 16, the Department of Energy gives responses to my ICP CAB questions from last April. And actually, I had asked several of the questions, in writing, several months before that. The responses from the Department of Energy, often conceal more than they reveal.

What is the proposed soil cap depth for ICDF? Not including what will now be using contaminated soil.

**Response:**

The cap depth for the ICDF must comply with DOE Order 435.1 requirements for a 10 ft cover thickness on top of waste.

*Thatcher comment on the response: The Department of Energy response avoids answering the question.*

- Why aren't DNFSB reports, or issues ever discussed that regard cleanup?

**Response:**

The DNFSB is chartered by Congress to provide DOE oversight. DNFSB oversight results are reported to Congress. Periodic DNFSB oversight reports are published on the DNFSB website. DOE-ICP has no current safety issues with the DNFSB.

*Thatcher comment on the response: The Department of Energy response is inadequate because the DNFSB has had multiple concerns from the Mackay Dam to transuranic waste storage safety.*

- Why is the lack of foresight for future D&D at INL not being planned?

**Response:**

D&D is based on mission completion and available funding. Most infrastructure on the INL is identified under the General Action Memorandum for D&D, however D&D cannot occur until missions are

completed and funding identified. Until D&D begins, infrastructure is maintained in a manner protective of human health and the environment.

*Thatcher comment on the response: The Department of Energy response avoids answering the question.*

- Please explain the recent ORPS report regarding radiological issues. What facility, why did this meet ORPS criteria? What happened in order for an ORPS reportable event, at unidentified Idaho Cleanup Project, to be ORPS reportable and apparently related to a radiological event? What radionuclides were involved?

**Response:**

It is believed that the occurrence report referenced above is EM-ID--IEC-RWMC-2023-0001, Contamination Found on Boot While Exiting ARP 2 Enclosure.

On February 6, 2023, personnel entered the Accelerated Retrieval Project waste exhumation facility (ARP-II), with appropriate PPE. After exiting and doffing their PPE, an operator stepped into a personnel contamination monitor which alerted the presence of contamination on their personal boot. The boot was taken and bagged. Surveys indicated 30,000 DPM/100 cm<sup>2</sup> total contamination. The isotopes were Pu-239 and Am-241.

DOE Occurrence Reports and reporting criteria can be found in DOE O 232.2A CHG 1, Occurrence Reporting and Processing of Operations Information. The contamination discovered on the operator's boot met the minimum reporting criteria of Group 6D(3), which stated:

Identification of onsite personnel or clothing contamination (excluding anti contamination clothing provided by the site for radiological protection) that exceeds 10 times the total contamination values identified in 10 CFR Part 835, Appendix D. The contamination level must be based on direct measurement and not averaged over any area. This criterion does not apply to tritium contamination.

To view DOE Orders, go to <https://www.directives.doe.gov/>.

To view DOE Occurrence Reports, go to <https://www.energy.gov/ehss/policy-guidance-reports/dashboards>.

*Thatcher comment on the response: This is a helpful response. And people should understand that 30,000 disintegrations per minute (DPM), is enormous. The event should have been discussed during the ICP CAB meeting.*

- Why aren't CAB meeting minutes being posted online?

**Response:**

Due to a transition in support staff for the ICP CAB, there was a period of time where the website was not being updated as the necessary security clearances and website access permissions were obtained. Minutes are now being posted within 30 days of meeting dates. [Later, it was emailed to me that they are allowed 45 days.]

- Why isn't the Mackay Dam failure and flood of INL (INTEC, etc.) included in RCRA permits, especially for INTEC – it is now more likely than 1-in-100 yr.

**Response:**

- Hazardous Waste Management Act/Resource Conservation and Recovery Act (HWMA/RCRA) requires floodplain requirements be applied to the permit if a facility is located within the 100-year floodplain. At INTEC, a portion of the facility area was shown to be within the 100-year floodplain, and a rationale was

provided regarding the presence of drainage and flood control barriers. The portion of INTEC shown to be in the 100-year floodplain, includes information about physical barriers providing flood protection for that HWMA/RCRA unit. Specifically, information about the INL Site Diversion Dam, which was constructed in 1958 to divert high run-off flows away from downstream facilities. The diversion dam consists of a small earthen dam and head gate that diverts water from the main channel, through a connecting channel, and into a series of four natural depressions called spreading areas. The INL Site Diversion Dam has sufficient capacity to mitigate water from the 100-year flood from the Big Lost River and the potential failure of Mackay Dam away from INL and ICP facilities.

The HWMA/RCRA does not have requirements for assessing the probability of an upstream dam failure. INL and ICP each have a Documented Safety Analysis (DSA) to provide safety analysis methodologies and information required for and common to all facilities operated by ICP or INL that are subject to the requirements of Title 10 Code of Federal Regulations (CFR) Part 830, Subpart B, "Safety Basis Requirements." The DSA includes flooding from natural phenomena and flooding from Mackay Dam failure. DOE does not estimate the probability of the Mackay Dam failure from a structural integrity perspective as the hydrologic consequences would be unchanged. DOE does estimate flooding inundation potential (i.e., hydrologic consequences) based on various modeled scenarios of the Mackay Dam failing.

*Thatcher comment on the response: The DOE is relying on the inadequacy of the HWMA/RCRA regulations. The DOE's DSA is not made publicly available and its adequacy cannot be reviewed. This actually means it is a DNFSB concern as well as a public safety problem.*

*Articles by Tami Thatcher for December 2023.*