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U.S. Nuclear Regulatory Commission cautions that its recent NuScale approval does not mean NRC will approve a NuScale construction permit or an operating license

The U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy are playing propaganda games with regard to propping up the proposed NuScale small modular reactor.

When the Department of Energy issued its press release last August that said the U.S. Nuclear Regulatory Commission had approved the NuScale design, DOE's website stated "The final safety evaluation report [FSER] issued by the NRC is the first of its kind for a SMR and represents the technical review and NRC staff's approval of the NuScale SMR design." [1]

Former NRC commissioner and former Assistant Secretary for the Department of Energy Office of Nuclear Energy Pete Lyons weighed in writing that "The NRC's issuance of the final safety evaluation report for NuScale's small modular reactor means that issues and questions related to the safety of NuScale's design have been resolved and affirms that the technology meets the United States' highest nuclear regulatory requirements. As former members of the regulatory bodies responsible for these types of review, we can assure the Post Register's readers that the NRC would not have issued NuScale's approval if it did not have every assurance the technology was safe." [2]

But the U.S. NRC's communications to the Idaho Leadership in Nuclear Energy Commission at its October meeting[3] and to NuScale in writing state that "… this SDA [standard design approval] does not constitute a commitment to issue a permit, design certification (DC), or license…." [4] [5]

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[1] U.S. Department of Energy, Office of Nuclear Energy, NRC Approves First U.S. Small Modular Reactor Design at https://www.energy.gov/ne/articles/nrc-approves-first-us-small-modular-reactor-design

[2] Peter Lyons and Luis Reyes, Opinion editorial, *The Idaho Falls Post Register*, "Trusted and ready – the CFPP [Carbon Free Power Project that NuScale would power] is a success in the making," October 18, 2020.

[3] 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

[4] 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

The U.S. NRC issued the FSER with numerous exclusions because NRC did not have sufficient information to approve various aspects of standard design. What this means is that the NRC did not finish its work and prematurely issued the FSER. The reason the NRC issued the incomplete FSER is apparently only because the NRC had a scheduled milestone to complete that phase of the NuScale review. [6] Two main parts of NRC's approval are to issue the FSER and then to review any the site-specific application for a combined operating license which is what UAMPS intends to do, that is, if it ever decides on a specific site at the Idaho National Laboratory. The NRC, by having left many unresolved safety issues, will leave these issues to be addressed by a future combined license (COL) applicant, namely, UAMPS.

The aspects of the NuScale design that the NRC excluded from approval in the FSER that it issued last August are whoppers in terms safety and the potential for spirally costs. The full NRC Final Safety Evaluation Report (FSER) can be found at the NRC website. [7] NuScale has also requested numerous exemptions from NRC regulations. [8]

The NRC was provided insufficient information from NuScale's design certification application [9] regarding: (1) the shielding wall design in certain areas of the plant; (2) the potential for containment leakage from the combustible gas monitoring system; and (3) the ability of the steam generator tubes to maintain structural and leakage integrity during density wave oscillations in the secondary fluid system…" [10]

Again, what this means is that the NRC issued its approval of NuScale with exclusions that involve important safety issues and the Department of Energy is providing propaganda to the public by failing to acknowledge these exclusions.

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[5] 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

[6] Anna Bradford, U.S. Nuclear Regulatory Commission, PowerPoint Presentation on Design Certification of the NuScale Small Modular Reactor, May 28-29, 2018. https://www.ifnec.org/ifnec/upload/docs/application/pdf/2018-06/20.a_bradford_design_certification_of_the_nuscale_small_modular_reactor.pdf The presentation gives the schedule for the NRC to complete the review of its Final Safety Evaluation Report for NuScale as September 8, 2020. Is schedule the main reason NRC issued the FSER in August while leaving many safety issues unresolved?

[7] U.S. Nuclear Regulatory Commission website, Phase 6 – NuScale DC Final Safety Evaluation Report (Complete with Appendices) at https://www.nrc.gov/docs/ML2002/ML20023A318.html

[8] Anna Bradford, U.S. Nuclear Regulatory Commission, PowerPoint Presentation on Design Certification of the NuScale Small Modular Reactor, May 28-29, 2018. https://www.ifnec.org/ifnec/upload/docs/application/pdf/2018-06/20.a_bradford_design_certification_of_the_nuscale_small_modular_reactor.pdf The presentation lists fifteen specific NuScale requested exemptions from NRC regulations on page 10.

[9] NuScale's Standard Plant Design Certification Application to apply for standard design approval can be found at https://www.nrc.gov/reactors/new-reactors/smr/nuscale/documents.html

[10] 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 (Don't bother looking at the letter NRC made easily accessible from its webpages for NuScale at https://www.nrc.gov/docs/ML2023/ML20231A804.pdf)

With a nuclear reactor, keys to safety are to shut down the reactor and cool the fuel. If you fail to cool the fuel, then the key is to contain the fission products released from the melted fuel.

Steam generator tube failure can lead to fuel melt and a large release of fission products outside of containment, to the environment.

Regarding the NRC's exclusion of the steam generator problem from the FSER, the NRC has stated: [11]

"Regarding steam generator stability during density wave oscillations and the associated method of analysis, the NRC staff identified that there was not sufficient information available to demonstrate that the flow oscillations that are predicted to occur on the secondary side of the steam generators will not cause failure of the inlet flow restrictors. Structural and leakage integrity of the inlet flow restrictors in the steam generators is necessary to avoid damage to multiple steam generator tubes, caused directly by broken parts or indirectly by unexpected density wave oscillation loads. Damage to multiple steam generator tubes could disrupt natural circulation in the reactor coolant pathway and interfere with the decay heat removal system and the emergency core cooling system, which is relied upon to cool the reactor core in a NuScale nuclear power module. This steam generator design issue is narrowly focused on the effects of density wave oscillations in the secondary fluid system on steam generator tubes to maintain structural and leakage integrity, including the method of analysis to predict the thermal-hydraulic conditions of the steam generator secondary fluid system and resulting loads, stresses, and deformations from density wave oscillations including reverse flow."

When certain combinations of NuScale's ECCS valves fail or for other accidents resulting in fuel melt, hydrogen gas builds up from the zirconium cladding. Oxygen can build up due to radiolysis. And while the NuScale containment vessel surrounding the reactor pressure vessel is able to withstand certain hydrogen events, questions remain about the ability to monitor the hydrogen and oxygen and prevent the release of fission products to the environment.

Regarding the NRC's exclusion of the hydrogen and oxygen "combustible gas monitoring system problem from the FSER, the NRC has stated: [12]

"Regarding containment leakage from the combustible gas monitoring system, the NRC staff identified that there was not sufficient information available regarding the NuScale combustible gas monitoring system and the potential for leakage from this system outside containment. Without additional information regarding the potential for leakage from this system, the NRC staff was unable to determine whether this leakage could impact analyses performed to assess

[11] 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

[12] 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

main control room dose consequences and offsite dose consequences to members of the public and whether this system can be safely re-isolated after monitoring is initiated."

Regarding the NRC's exclusion of the shielding wall design problem from the FSER, the NRC has stated: [13]

"…the NRC staff is unable to confirm that the radiological doses to workers will be maintained within the radiation zone limits specified in the application."

In addition, to the three exclusions, the NRC's Advisory Committee on Reactor Safeguards (ACRS) wrote on July 29 that the ACRS had identified several potentially risk-significant items that are also not completed. The ACRS has requested the opportunity to review the qualification of emergency core cooling system (ECCS) valve performance, the identification of a successful recovery strategy to prevent potential reactivity insertion accidents associated with boron dilution sequences, and the updated probabilistic risk assessment (PRA). [14]

The ECCS valve performance is very important to preventing NuScale nuclear reactors from melting fuel. And while NuScale has often emphasized that operator actions were not needed for safety responses, there are apparently needed operator responses and the power supplies and radiation levels to permit such actions.

The NRC procedurally was allowed to make exclusions when issuing its so-called Final Safety Evaluation Report (FSER) for the NuScale design. But the fact that these exclusions involve significant NuScale safety issues that remain unresolved means that the NRC did not finish its assignment. The NRC is putting off resolving the issues until later, which means higher economic risk for NuScale investors and UAMPS participants. And worse, the Department of Energy is actively engaged in propaganda to claim that the NRC's incomplete FSER issued last August indicates that a thorough safety review was completed when in fact, it was not.

Known problematic aspects of the NuScale design that the NRC excluded from its FSER or that the ACRS has said need further review are shown in Table 1.

[13] 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

[14] U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, Letter from Matthew W. Sunseri, to Kristine L. Svinicki, Subject: Report on the Safety Aspects of the NuScale Small Modular Reactor, July 29, 2020 at https://www.nrc.gov/docs/ML2021/ML20212L586.pdf as Appendix F or https://www.nrc.gov/docs/ML2021/ML20211M386.pdf

Table 1. Currently unresolved NuScale safety problems.

Problem	Information about the seriousness of the problem
Shield wall design	Formally excluded from FSER and not approved by the NRC. May affect worker radiation dose levels, particularly during plant upsets.
Containment leakage from combustible gas monitoring	Formally excluded from FSER and not approved by the NRC. When nuclear fuel melts, hydrogen gas builds up. The NuScale design states that hydrogen build up won't compromise the containment integrity within the first 72 hours. But the buildup of oxygen coupled with hydrogen may be a problem after 72 hours. The NuScale design says that hydrogen levels will be monitored and actions taken to mitigate the problem will be taken after 72 hours. But the detailed design for monitoring or redirecting the hydrogen does not exist. The ACRS is concerned that monitoring itself may increase the probability of contamination and hydrogen detonation outside containment. The ACRS has noted that operator action to monitor the containment atmosphere for hydrogen and oxygen concentrations sometime after 72 hours following a postulated severe core damage event would allow operators to minimize the chance of a detonation that could challenge the containment integrity. (ML20113F049). The buildup of hydrogen gas in a module, associated with melting of nuclear fuel, means that venting the hydrogen allows venting fission products from the melted fuel. This situation is of extremely high accident risk and consequence of a large fission product release outside of containment.
Steam generator tube structural and leakage integrity	Formally excluded from FSER and not approved by the NRC. The integrity and performance of the steam generators have not yet been sufficiently validated because of uncertainties associated with unstable density wave oscillations (DWO) on the steam generator secondary side. Accelerated wear of the alloy 690TT (thermally treated) steam generator tubing material is also a potential concern. There are members of the ACRS that believe this issue should have been resolved before the NRC issued the FSER approval. This is a show stopper in terms of safety and cost for the NuScale design.
Qualification of emergency core cooling system (ECCS) valve performance	ACRS concerns not resolved. Successful reactor cooling and thus reactor safety is highly dependent on proper operation of five ECCS valves opening when needed. Particular concern is that possible degradation mechanisms such as deposits, precipitates, and fouling over time in the presence of boric acid in a high temperature and radiation environment may increase the valve failure probability.
Identification of a successful recovery strategy to prevent potential reactivity insertion accidents associated with boron dilution	ACRS concerns not resolved. The issue of boron dilution as coolant boils in the reactor vessel and coolant with less boron returns to the reactor core was not identified by NuScale designers or modeled in its PRA. NuScale made design changes adding new riser holes. But ECCS actuation of reactor recirculation valves result in water levels below the newly added riser holes and render them ineffective. Operator actions may also inadvertently introduce deborated water into the core. There is no method

sequences	of monitoring the distribution of boron in the reactor vessel module. Various ways boron dilution events could occur are not included in the PRA. Operator actions may alleviate or exacerbate boron dilution problems. Dilution of boron in the coolant can cause reduced reactor shutdown margins or cause reactivity insertion events. The 1961 SL-1 accident and the 1986 Chernobyl accident were reactivity insertion accidents. NuScale requested and was granted an exemption to GDC 27 because the NuScale design could not achieve the stated reactor shutdown margin, even at the 50 MW-electric design. NuScale cost estimates are already assuming the uprate to 60 MW-electric. Operator action is required to avoid recriticality if a control rod failed to insert.
The updated probabilistic risk assessment (PRA).	ACRS concerns not resolved. Single module risks addressed, but incomplete multi-module risk. Boron-dilution accident causes omitted. The ACRS does not agree that the recovery actions or important errors of commission mitigate all boron dilution concerns adequately and recommends additional analyses of boron dilution events. Loss of ac and dc power would affect multiple modules and the ability to perform operator actions. Also, the ACRS has concerns that the PRA does not adequately address steam generator concerns, ECCS valve performance concerns, reactor building crane concerns, PRA importance determination (of equipment, initiators or operator actions), and multi-unit operation. Despite NuScale's statements of not relying on operator actions, operator accidents may initiate accidents, such as load drop in the reactor pool from crane operation or maintenance mistakes. Boron dilution and return to reactor criticality may be affected by operator opening CVCS injection valves or operator opening containment flooding and drain system injection valves. And operator actions to open these valves are risk-important for non-boron-related accidents as well. The lack of a completed design, lack of plant experience and lack of plant procedures and experience mean that the risk model is currently not well supported.
NuScale reactor module load drop	ACRS concerns not resolved. NuScale and the NRC staff have decided that the issue of reactor building crane and human factors pertaining to reactor module lifting and movement will be addressed by the reactor building crane vendor. And the PRA will later be updated to address adequately the load drop probability. NuScale is currently relying on baloney to argue that no errors in crane operation will occur. The lifting can be conducted with adjacent reactor modules at power operation. A NuScale module only passively cools if it remains vertical and fuel melts if the module is knocked over.
Electric power	The NuScale plant states that it does not require onsite or offsite alternating current (AC) or direct current (DC) power to cope with design-basis events. But numerous human actions to address boron dilution, control rod failure to insert

	and other upsets are credited and seem to imply power availability for monitoring and responding to plant challenges.
Source Term (an estimate of the amount of each radionuclide released from an accident scenario)	NuScale uses a core damage source term for siting dose evaluation based on several severe accident scenarios "that are selected to encompass most of the risk dominant sequences for their design." The ACRS and NRC approve this approach. But given the moving target nature of what accidents actually dominate the NuScale risk, how do we know that the selected accidents adequately represent the accidents that release more fission products to the environment because of multiple modules melting or the release of fission products outside of the containment vessels? Reactivity insertion accidents and steam generator tube rupture accidents might release far more fission products to the environment but have not been addressed yet, despite the NRC's issuance of the FSER with many exclusions. The ACRS notes that other commercial nuclear plants are required to perform long-term monitoring of hydrogen and oxygen levels, but the risk of monitoring the NuScale containment should be weighed against alternatives that may not require such monitoring because of the risks of performing this monitoring of the NuScale containment. NuScale has requested an exemption to the requirement to perform the hydrogen and oxygen monitoring, yet currently relies on such monitoring in order to mitigate hydrogen risks after 72 hours. (See ML19354A031 and Topical Report TR-0915-17565, Revision 3, "Accident Source Term Methodology" December 20, 2019 (ML19354A031)). The NRC has written in ML20113F049, April 28, 2020, that "NuScale and the staff see a need for operators to monitor containment atmosphere for H2 and O2 concentrations sometime after 72 hours following a postulated severe core damage event. Continuous monitoring of combustible gases would allow operators to minimize the chance of a detonation that could challenge containment integrity."
Seismic risk	The NRC has accepted NuScale's use of seismic margin analysis rather than the high core damage frequency predicted by a more detailed seismic probabilistic risk assessment. This is typical – use PRA results only if they lower the risk, ignore the PRA if it raises the risk. The choice to ignore the higher core damage frequency from a seismic PRA affects the effort to reduce the size of the emergency planning zone. See ML19087A240 (May 6, 2019) for discussion and note that the NRC's FSER relies only on seismic margins analysis from the NuScale Standard Plant Design Certification Application at https://www.nrc.gov/docs/ML2022/ML20224A508.pdf

Table notes: My narrative in the table based largely on information in the letter from ACRS Chairman Sunseri to NRC Chairman Svinicki, "Subject: Report on the Safety Aspects of the NuScale Small Modular Reactor," July 29, 2020 (ML20212L586) at nrc.gov. Additional information regarding hydrogen monitoring is from the letter from ACRS Chairman Sunseri to NRC's Doane, "Subject: NuScale Combustible Gas Monitoring," April 28, 2020 (ML20113F049) at https://www.nrc.gov/docs/ML2011/ML20113F049.pdf Additional information regarding the risk of unisolating the NuScale containment to enable long-term hydrogen and oxygen monitoring is discussed in the letter from ACRA Chairman Riccardella to NRC's Doane, "Subject: Safety Evaluation of the NuScale Power, LLC Topical Report TR-0915-17565, Revision 3, "Accident Source Term Methodology," and Source Term Area of Focus Review for the NuScale Small Modular Reactor," December 20, 2019 at https://www.nrc.gov/docs/ML1935/ML19354A031.pdf

DOE puts up $1.4 Billion for NuScale but quietly abandons the bulk of JUMP research

The Department of Energy gave $1.355 billion to partially fund the Carbon Free Power Project (CFPP) that features building NuScale small modular reactors. While the current license application is only for 50 megawatts-electric (MWe), the project is already planning on uprating to 60 MWe reactor modules. The building can accommodate up to twelve reactor module that could generate up to 720-MWe if all twelve modules were built and operating at full power. The Utah Associated Municipal Power Systems (UAMPS) is trying to determine a site at an Idaho National Laboratory site near Idaho Falls, Idaho for a NuScale power plant. [15] UAMPS has already selected and rejected two proposed building sites, but is hopeful that a third choice on the far western edge of the site will be suitable.

The INL had planned to conduct research in one of the NuScale small modular reactor modules. But interestingly, the ambitious JUMP research program that the Department of Energy had proposed in December 2018 [16] has all but vanished.

The original Joint Use Module Project (also known as JUMP) included two NuScale reactor modules. One module to be designated strictly for research activities and the second module was to be used in a Power Purchase Agreement (PPA) to provide power to INL. The research was expected to focus principally on integrated energy systems that support the production of both electricity and non-electric energy products like hydrogen.

The JUMP research program was to examine a range of non-electricity applications, including thermal energy for industrial processes, desalination and hydrogen production, Shannon Bragg-Sitton, INL Systems Integration Manager and JUMP program director, told Nuclear Energy Insider. Expanding on previous research by NuScale, INL claimed it would also create a platform which allows operators to respond to renewable energy intermittency and deploy non-electricity applications during times of excess power supply. [17]

Without a way to respond to renewable energy intermittency, the power levels of an operating reactor module must be lowered. Lowered electrical generation means the plant is less profitable and takes longer to recover construction costs.

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[15] Sonal Patal, *Power Magazine*, "Commercial NuScale SMR in Sight as UAMPS Secures $1.4B for Plant," October 22, 2020. https://www.powermag.com/commercial-nuscale-smr-in-sight-as-uamps-secures-1-4b-for-plant/

[16] U.S. Department of Energy, Office of Nuclear Energy, "DOE Office of Nuclear Energy Announces Agreement Supporting Power Generated from Small Modular Reactors," December 21, 2018. https://www.energy.gov/ne/articles/doe-office-nuclear-energy-announces-agreement-supporting-power-generated-small-modular

[17] Reuters Events, "DOE expands NuScale SMR plan to quantify heat, hydrogen benefits," February 13, 2019. https://www.reutersevents.com/nuclear/doe-expands-nuscale-smr-plan-quantify-heat-hydrogen-benefits

According to the UAMPS communication to the city of Los Alamos, New Mexico on July 15, 2020 that original research focus has been eliminated: [18]

"The Joint Use Module Project (also known as JUMP) was originally set up to provide support for the CFPP through participation by DOE/INL in one of the NPMs. The concept was that funds would be specifically directed to the first NPM at the CFPP as well as one-twelfth of the Balance of Plant. DOE would then lease NPM1 for research purposes from UAMPS for a minimum of 15 years with a maximum of 30 years. Thirty-four of the thirty-five Participants elected to pursue this low-cost future capacity option. **After vetting the cost of the research projects envisioned to be performed with JUMP, DOE and Congressional appropriations staff elected not to fund the research projects, thus negating the need for a lease.** [emphasis added] Instead, the amount requested by UAMPS for JUMP has been reallocated as part of the New DOE Multi-Year Award. UAMPS is providing a reduced cost for NPM1 to the existing JUMP Participants and if not acceptable to them then to the other Participants in the CFPP. Should the existing JUMP Participants accept this proposal, then their cost associated with output from NPM1 is estimated at approximately $39/MWh."

As to recent apparent construction cost increases, according to the *Power Magazine* interview of the NuScale vice president: "The $3.6 billion in 2017 figure … reflects the project specific overnight capital cost estimate plus our proposal for fee and warranty," she said. "This figure has not changed. When UAMPS includes the other cost components of owner's costs, contingency, escalation, and interest, the total is the CFPP installed project cost of $6.1 billion." [19]

George Chandler of New Mexico has written that the hoped-for efficiencies of assembly prior to shipping NuScale modules has been abandoned and the design of the fuel for NuScale is still in flux. Chandler states: "The first time these and many other design innovations will be tested together will be in the first module at the twelve-module reactor site in Idaho. That will be the prototype. The sad fact is, this is an experiment, it is not a tried and true design that is ready for production. He encouraged Los Alamos, NW to exit the UAMPS NuScale project. [20]

The search for other customers has extended to South Africa. *Power Magazine* also reported [21] that the International Development Finance Corporation (DFC) announced it had signed a letter of intent to support the development of 2.5 GW of NuScale modules in South Africa.

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[18] UAMPS Carbon Free Power Project, Communication to city of Los Alamos, New Mexico, "Carbon Free Power Project Development Status and Overview," July 15, 2020 at https://www.losalamosnm.us/UserFiles/Servers/Server_6435726/File/Government/Departments/Public%20Utilities/CFPP/CFPP%20Development%20Status%20and%20Overview_July%2015%202020.%20FINAL%20(2).pdf

[19] Sonal Patal, *Power Magazine*, "Commercial NuScale SMR in Sight as UAMPS Secures $1.4B for Plant," October 22, 2020. https://www.powermag.com/commercial-nuscale-smr-in-sight-as-uamps-secures-1-4b-for-plant/

[20] George Chandler, Opinion editorial, Los Alamos Daily Post, "Get Out of Fluor/NuScale Small Modular Reactor (SMR) Project," August 23, 2020. https://ladailypost.com/george-chandler-get-out-of-fluor-nuscale-small-modular-nuclear-reactor-smr-project/

[21] Sonal Patal, *Power Magazine*, "Commercial NuScale SMR in Sight as UAMPS Secures $1.4B for Plant," October 22, 2020. https://www.powermag.com/commercial-nuscale-smr-in-sight-as-uamps-secures-1-4b-for-plant/

Nuclear energy offers the most expensive way to generate electricity and NuScale in reality offers the most expensive form of nuclear power, despite artificially low estimated electricity generating costs.

A NuScale plant would require a seismically qualified building and spent fuel pool to house twelve reactor modules. Despite the propaganda that small modular reactors would help alleviate "energy poverty" as mentioned by U.S. Nuclear Regulatory Commission chairman Kristine Svinicky at the Leadership in Nuclear Energy (LINE) meeting in Idaho Falls on October 14, [22] a country with little power transmission and no way to secure or dispose of the spent nuclear fuel that NuScale will generate is hardly an endeavor undertaken with the best interests of the people of South Africa in mind. It is clearly an endeavor to funnel money to NuScale's unsafe, unreliable and uneconomic small modular reactor program.

UAMPS small modular reactors don't truly offer clean energy

By Ralph Hutchison, Opinion Editorial in The Idaho Falls Post Register*, October 6, 2020. Ralph Hutchison is the coordinator of the Oak Ridge Environmental Peace Alliance in Oak Ridge, Tennessee.*

Idaho Falls is poised to play a pivotal role in the next generation of nuclear power plants, called "small modular reactors."

With those words, the Post Register backs the continued investment of taxpayer dollars to underwrite the nuclear industry's effort to move its new small modular reactor technology off the drawing board and into the real world. How much? The Post Register is a little shy about putting a number to it but does say the costs "are not small." As in tens of millions of dollars.

The Utah Associated Municipal Power Systems plans to fund the SMR development through a consortium of its member utilities that subscribe to the project. But the plan has run into problems. Some towns that were part of the cooperative venture have done the math and withdrawn their participation, writing off hundreds of thousands of dollars as sunk costs, largely because the electricity generated would not be cost-competitive — natural gas, solar, hydro and wind energy would all be cheaper.

Logan, Utah's council voted 4-1 to withdraw; the Lehi and Kaysville city councils' votes to walk away were unanimous. What do they know that the Post Register doesn't want its readers to think about?

[22] The Leadership in Nuclear Energy (LINE) website available meeting materials at https://line.idaho.gov/agendas-and-meetings/ for the October 14, 2020 meeting. The U.S. NRC chairman did not provide a written presentation of her multifaceted comments to promote all things nuclear and imply no concern for nuclear safety or waste disposal problems to the LINE Commission but I was able to listen to the live audio of the meeting at the time of the meeting.

The Post Register touts the energy as "clean" and "carbon-free." But the process of producing the enriched uranium fuel for the reactor, including mining, milling, processing, enrichment and machining, is a highly energy-intensive process. Also not counted — nuclear waste that will remain deadly for hundreds of millions of years. The NuScale-designed reactors will produce more waste per megawatt than conventional "old technology" reactors. Those reactors have generated 80,000 tons of waste that will be disposed of at — oh, right, we don't have a repository or a dump for spent nuclear fuel, despite 70 years of trying to site one.

The Small Modular Reactor project is fraught with uncertainty. This past July, developers raised the cost estimate to $6.1 billion; it started out at $3.1 billion. They're also counting on an iffy $1.4 billion handout from the federal government to meet the budget. And this summer they pushed the timeline for completing the first unit back four years, from 2026 to 2030.

In fact, all but the most ardent and determined nuclear power boosters understand the deal is a rotten one. Nuclear power can't compete financially and can't clean up its own mess. It claims to be "clean," but it can't compete with solar, hydro or wind — true renewables. On top of that, UAMPS' project meets a need that doesn't exist — less than a third of the power they plan to generate is actually subscribed to by their own member utilities.

A decision on what Idaho Falls should do in this "pivotal moment" should be made by fully informed decision-makers representing a fully informed public. After all, it's the public's money they are sinking in an unproven technology that is neither clean nor green — and is cost-prohibitive to boot.

UAMPS Presents at October LINE Meeting, Power Subscriptions Lowering and Nuclear Waste Problems Admitted to be Worse for New Reactors Like NuScale

Apparently, the presentation dated October 14 could not be updated in time to address the lowered power subscriptions to the Utah Associated Municipal Power Systems (UAMPS) project, the NuScale small modular reactor (SMR) project. [23] The slide presented at the Leadership in Nuclear Energy (LINE) meeting [24] states the current subscriptions at 213 MW but **during the meeting the subscription was acknowledged to be only 190 MW**. If you didn't listen in to the virtual meeting but later looked at the UAMPS presentation, you would have the wrong information. (On October 22, the City of Idaho Falls reduced its share from 10 MW to 5

[23] 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

[24] The Leadership in Nuclear Energy (LINE) website available meeting materials at https://line.idaho.gov/agendas-and-meetings/ for the October 14, 2020 meeting.

MW. [25] And another city in Utah, Murray, has been reported to have withdrawn from the UAMPS NuScale project. [26])

The UAMPS presentation does point out some problems in the Department of Energy's announcement that the U.S. Nuclear Regulatory Commission had approved the design. Last August, the Department of Energy website stated that "The final safety evaluation report [FSER] issued by the NRC [U.S. Nuclear Regulatory Commission] is the first of its kind for a SMR and represents the technical review and NRC staff's approval of the NuScale SMR design." [27]

But the UAMPS presentation pointed out that the Department of Energy was fibbing. With the August issuance of NRC's "Final Safety Evaluation Report" for NuScale, the NRC actually states that the design meets the requirements for the design certification stage, but then adds "The NRC staff's issuance of this FSER does not constitute a commitment to issue the design certification …" [28] This is only for 50 MW per module power levels, see the FSER at nrc.gov. [29]

The UAMPS presentation states that in 2022 they anticipate submitting the "Standard Design Application" for 60 MW per module and cites the August 28, 2020 letter from the NRC which says nothing about this 60 MW application, application date or estimated approval date.

The location currently being investigated for siting the NuScale facility at the Idaho National Laboratory is at the far western edge of the INL near highway 33 and west of the Naval Reactors Facility. This means, among other radionuclide contaminants, a lot of contamination from past releases including uranium-238, plutoniun-238, and other radionuclide contamination that usually isn't monitored in environmental monitoring programs.

There was no discussion of the many serious safety issues uncovered in the NuScale reviews. For an overview, see this NRC Advisory Committee on Reactor Safeguards letter dated July 29, 2020 at nrc.gov. [30]

When asked about the waste, the nuclear spent fuel, Hunter said that Yucca Mountain would not be expected to have room for NuScale fuel, so it would go to a second repository,

[25] Nathan Brown, *The Idaho Falls Post Register*, "City sticks with nuke project, halves kilowatts," October 25, 2020.

[26] Sonal Patal, *Power Magazine*, "Commercial NuScale SMR in Sight as UAMPS Secures $1.4B for Plant," October 22, 2020. https://www.powermag.com/commercial-nuscale-smr-in-sight-as-uamps-secures-1-4b-for-plant/

[27] Office of Nuclear Energy, NRC Approves First U.S. Small Modular Reactor Design at https://www.energy.gov/ne/articles/nrc-approves-first-us-small-modular-reactor-design

[28] 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

[29] U.S. Nuclear Regulatory Commission, Phase 6 – NuScale DC Final Safety Evaluation Report (Complete with Appendices) at nrc.gov ADAMS Accession No. ML20023A318, https://www.nrc.gov/docs/ML2002/ML20023A318.html (all sections) and here's one place documenting that the current FSER is only for 50 MW per module, https://www.nrc.gov/docs/ML2021/ML20211M386.pdf

[30] U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, Letter from Matthew W. Sunseri, to Kristine L. Svinicki, Subject: Report on the Safety Aspects of the NuScale Small Modular Reactor, July 29, 2020 at https://www.nrc.gov/docs/ML2021/ML20212L586.pdf as Appendix F or https://www.nrc.gov/docs/ML2021/ML20211M386.pdf

being at the end of the que for the nation's spent fuel. He said like all nuclear utilities in the U.S. the spent fuel is to come under the ownership of the Department of Energy. It was then pointed out that the DOE was to take ownership of commercial spent fuel in 1998 but still has not and many utilities have sued DOE over this. Thus, the NuScale project continues to deny that there is any spent fuel problem and the NRC will just extend the license for storage at the generator site.

The NRC Chairman, Kristine Svinicki, also stated that the spent fuel is just a football field in volume. She doesn't mention that that football field is already stacked more than 30 feet high. Nor does she mention that after 70 years of trying, the U.S. has failed to obtain a spent nuclear fuel repository. To avoid discussing the intractable problem of confining the radiotoxic materials in spent nuclear fuel appear manageable, nuclear industry proponents refer to a football field as large enough to confine the nation's spent nuclear fuel.

This misleading characterization, centering on the volume of spent nuclear fuel, is simply a ploy to avoid discussing the expensive and intractable problem of confining spent nuclear fuel which remains radiotoxic to all living beings as it leaches into groundwater, oceans or air for millennia.

Versatile Test Reactor presentation at the LINE Meeting

If approved, construction on the Department of Energy's sodium-cooled fast reactor, the "Versatile Test Reactor" could begin in 2023 and be operational by the end of 2026, subject to funding appropriations by Congress.

Materials testing currently conducted by existing Department of Energy thermal neutron (or slow neutron) reactors such as the Advanced Test Reactor at the Idaho National Laboratory and the High Flux Isotope Reactor at Oak Ridge National Laboratory can't adequately test materials for fast neutron exposures. The only other fast neutron test reactor is the BOR-60 reactor in Russia.

The VTR would be a 300 MT-thermal reactor based on the Experimental Breeder Reactor II. And despite no economic benefit to the U.S. from the EBR II technology and no one in the world wanting to build a reactor based on EBR II, and despite no economic benefits being apparent to Russia by their having a fast neutron test reactor, the U.S. Department of Energy is touting this reactor as needed to boost our economy. [31]

The environmental impact statement public review will be this fall and include one public meeting with at least 15 days advanced notice, according to the presentation at the October 14

[31] See LINE.Idaho.gov October 14, 2020 meeting presentation materials, "Fostering New Technologies for the World's Clean-Energy Future," https://line.idaho.gov/wp-content/uploads/sites/84/2020/10/2020-1014-vtr2.pdf

LINE meeting. [32] The proposed reactor fuel would be 70 percent uranium, 20 percent plutonium and 10 percent zirconium.

The VTR would be authorized and operated under the Department of Energy, but would "work closely with the Nuclear Regulatory Commission (NRC)." This actually means the type of unsafe and inadequately regulated reactor typical of the Department of Energy. The Department of Energy's Hanford and Idaho reactors operated (and still operate) with no containment. The Advanced Test Reactor's confinement is basically a leaky industrial metal building, inadequately and actually fraudulently tested for years. The lack of emergency system testing at the Advanced Test Reactor was identified after operating the facility for several decades. No one should feel safe to have the Department of Energy authorizing and regulating the VTR, despite the vague allusion to NRC involvement.

Sodium-cooled reactors are even more unsafe and uneconomical that light-water reactors. Sodium-bearing materials pose added spent nuclear fuel disposal problems. And $100 billion dollars spent world-wide on sodium-cooled nuclear reactors has not resulted in discernable improvement in cost or safety. [33]

Articles by Tami Thatcher for November 2020.

[32] LINE.Idaho.gov presentation by Kemal Pasamehmetoglu, "Versatile Test Reactor – Solving global energy challenges through science," October 14, 2020, https://line.idaho.gov/wp-content/uploads/sites/84/2020/10/2020-1014-vtr.pdf

[33] Arjun Makhijani, Institute for Energy and Environment Research (ieer.org), "Traveling Wave Reactors: Sodium-cooled Gold at the End of a Nuclear Rainbow?" September 4, 2013. https://ieer.org/resource/energy-issues/traveling-wave-reactors-sodium-cooled-gold-at-the-end-of-a-nuclear-rainbow/