From: Dirk Dunning, retired professional engineer
Date: February 12, 2023
Subject: Testimony in opposition to HB 2215, SB 676 and SB 832.

I write today in opposition to HB 2215, SB 676 and SB 832. This is a truly terrible proposal. I strongly encourage you to resoundingly reject it.

Listen instead to the sage advice of the citizens of Oregon from decades ago. Retain the requirement that before any nuclear reactor can ever be sited in Oregon that a fully licensed nuclear waste repository must be in place, operating, and designated to receive all waste that would result from reactors operated in Oregon.

Before any consideration is made to refer such a measure to the public, a detailed analysis should be prepared by the State, revisiting all aspects addressed in the States 1975 analysis. Following that the public needs to be engaged in a broad discussion of all benefits, risks, costs, and other issues involved, prior to any such vote being held.

Brief synopsis:
HB 2215, SB 676 and SB 832 propose to erase the prohibition on siting of nuclear facilities until a waste repository is licensed. These proposals should be soundly rejected.

From my quarter century working on behalf of the State of Oregon and the Citizens of the State of Oregon doing technical analysis and policy development on the "clean up" of the disastrous Hanford nuclear mess, I note a few lessons.

First and foremost - ***No bad idea ever dies. Make no mistake, the idea of siting nuclear reactors in Oregon is just such a bad idea.***

In 1974, the Oregon Office of Energy in the Governor's office (the predecessor to the Oregon Department of Energy) correctly concluded that nuclear power was an unwarranted Faustian Bargain. Governor McCall signed the preface to that analysis on behalf of the State of Oregon in 1975, setting as policy the States' opposition to nuclear power. It was the correct analysis then. It remains the correct analysis today. This same bad idea returns year after year and session after session.

Two - Nuclear has a waste problem. We are no closer to siting a repository today than we were at the start of the nuclear age over 80 years ago.

The wastes from these reactors will be extremely hazardous for time periods hundreds of times longer than the entire recorded history of human civilization. There is no possibility that we can control the wastes for such immense time frames. Quite the opposite.

Three - Nuclear can play no meaningful role in fighting climate change.

Nuclear plants are far from being low carbon as is so often asserted. That assertion excludes the huge carbon emissions that occur from mining, milling, concrete production, steel manufacture, construction, demolition, waste processing, waste disposal and other carbon costs.

We require massive carbon emission reductions today. Nuclear cannot contribute to that. What can contribute are energy efficiency, solar (both heat and power), wind, and hydroelectric power. There is no realistic scenario in which nuclear power can be fielded rapidly enough to make even a small contribution to the efforts to reduce carbon emissions to fight climate change.

Four - Nuclear cannot economically work as variable power, or as base load power.

Nuclear cannot be used as variable power without being enormously expensive. It also cannot compete as base load power. Nuclear plants require periodic outages that rapidly remove large power supplies from the net, transferring the burden for their replacement to other sources. This then requires the construction of alternate power sources to back up the nuclear facilities making them even more uneconomical. By taking the bottom off the daily power cycle, reactors like these would also unfairly make wind energy less economical.

Five - Nuclear produces immense long term financial liabilities, is incredibly expensive, and poses a huge cost to future generations who will not benefit from them.

The true costs of nuclear power can never be completely assessed until we have licensed and begun operation of a deep geologic repository for the wastes generated. The costs measured both in harms to human life and the environment, as well as in dollars will far exceed any calculation performed.

It is fiscally irresponsible to produce waste without a fully licensed repository in operation and designated to receive the waste from existing and new facilities. Doing so foists the immense costs and liabilities of these facilities operations on future generations who garner no benefit from them. That inter-generational transfer of responsibility is irresponsible and wrong.

The costs both in terms of financial costs and carbon emissions for wind and solar power have now dropped to below levels that any scale of nuclear plant can ever reach under any circumstances. As a result, nuclear can never compete with wind or solar in terms of costs.

Six - Nuclear plants must now be designed to withstand climate change, further increasing their costs and risks.

Climate change is here. All nuclear facilities are subject to enormous threats excluded from previous safety analysis. Every future nuclear facility must withstand the ravages of a rapidly changing and unpredictable climate. They must be designed to withstand both direct and indirect impacts of climate change, massive storms, heat waves, flooding, subduction zone earthquakes and other events. As the war in Ukraine makes clear, nuclear plants must also be designed to withstand intentional attacks both on the physical plants and infrastructure, and their software.

Longer perspective:

I have a unique perspective on the proposed actions. I am a retired Registered Professional Engineer, and formerly licensed Nuclear Power Engineer. For the last 25 years of my career, I worked for the Oregon Department of Energy as senior staff doing technical analysis and policy review of nuclear

matters and in the cleanup of the nuclear mess at the Hanford Nuclear Reservation in eastern Washington State, as well as for Nuclear Safety and Energy Emergency Response for the State of Oregon. I was on call 24/7 throughout my entire career in that role, principally concerned with the Columbia Generating Station and every conceivable nuclear accident at Hanford or the Columbia Generating Station. I was part of the institutional memory of the site.

Nuclear was a field with promise 70 years ago. That time and that promise is now gone.

Now with 75 years of experience we know with certainty that nuclear power has severe and fatal flaws in all its forms. Once long-ago nuclear power was touted as being "too cheap to meter". We know today that nuclear cannot economically compete with power from solar, wind, hydroelectric production, or renewable or non-renewable sources of natural gas.

Whereas in the beginning it was believed that the problems with nuclear waste were minor and would one day be solved, we know today that we are no closer to having a permanent geologic repository for the waste than we were then. Nuclear power plants produce ever increasing amounts of long-lived radioactive wastes, highly mobile wastes, and extremely dangerous actinides wastes. The problems in dealing with these wastes has proven to be unsolvable. We should not create more such wastes until we have first dealt with the wastes already created. The prospects for doing that remain miniscule.

The public spoke firmly and clearly on this issue. All the involved issues were heavily debated, discussed, and analyzed in the 1970s in Oregon. The Citizens of the State passed an Initiative limiting nuclear power until such time as certain conditions were met - including the creation and operation of a licensed high-level nuclear waste repository.

Prior to considering referral to the citizens of the State for a public Statewide vote, a thorough analysis of all the issues should be performed by the State, followed by a broad and deep discussion of the issues with the citizens of the State. Simply referring this to the people without that deep analysis and background to guide them is irresponsible. This proposal makes no commitment or effort to perform such an open and through analysis, or to involve the public.

Such an analysis was performed in the 1970s. Then Governor Tom McCall created an office in the Governor's Office to examine the whole range of energy issues following the oil embargo of 1973. Nuclear power was a part of that. That review resulted in a major report: "***TRANSITION, A BOOK ON FUTURE ENERGY: NUCLEAR OR SOLAR?"***.

The report was issued by the Governor's Office on January 1, 1975. Two Governors, Tom McCall and Robert Straub signed off on the recommendations made in the report, Including the never-since changed policy of the State of Oregon to oppose the use of nuclear power.

The report the Office issued though dated is remarkably prescient. They were correct in their analysis. History has born them out. Their conclusions and discussion are even more applicable now than then.

They concluded on page 142:

"***If alternatives to nuclear fission were not available, we would likely pursue the development of this immensely hazardous source of energy. But since we have viable alternative energy sources and conservation programs, it cannot possibly be in the best interests of present and unborn populations to strike the "Faustian Bargain".***"

The per unit cost and reliability of wind, solar and hydroelectric power are now so good and so low that nuclear at any scale is unable to financially compete, or to play any meaningful role - particularly not as base load power. Reactors that can surge to meet demand impose additional requirements and costs that make them ill-suited and uneconomical for that role. The proposed small reactors have no future place in the energy supply of the whole of the United States.

Also supporting this, it was the stated view of Admiral Hyman Rickover, the father of the US Nuclear Navy in his retirement speech to the Congress that naval reactors should be retired from use as soon as a viable alternative to them exists.

The US Nuclear Navy has an astoundingly good nuclear safety record, due largely to the uncompromising Safety Culture created by Admiral Rickover, and in part due to their not having to hew to the least expensive way to do everything. Instead, they do it the right way - and only the right way. In his retirement address to the Congress, Admiral Rickover said in part:

"COMMENTS ON NUCLEAR POWER

I think that ultimately we will need nuclear power because we are exhausting our nonrenewable resources; that is, coal and oil. I think they will go far more rapidly than we think they will and the cost is already going up. I believe that nuclear power for commercial purposes shows itself to be more economic, but that's a fake line of reasoning because we do not take into account the potential damage the release of radiation may do to future generations.

I'll be philosophical. Until about two billion years ago, it was impossible to have any life on earth; that is, there was so much radiation on earth you couldn't have any life - fish or anything. Gradually, about two billion years ago, the amount of radiation on this planet and probably in the entire system reduced and made it possible for some form of life to begin, and it started in the seas, I understand from what I've read, and that amount of radiation has been gradually decreasing because all radiation has a half-life, which means ultimately there will be no radiation.

Now, when we go back to using nuclear power, we are creating something which nature tried to destroy to make life possible. Now that is the philosophical aspect, whether it's nuclear power or using radiation for medical purposes or whatever. Of course, those are not bad because they don't last long, but every time you produce radiation, you produce something that has life, in some cases for billions of years, and I think there the human race is going to wreck itself, and it's far more important that we get control of this horrible force and try to eliminate it.

I do not believe that nuclear power is worth it if it creates radiation. Then you might ask me why do I have nuclear-powered ships? That's a necessary evil. I would sink them all.

I'm not proud of the part I've played in it. I did it because it was necessary for the safety of this country. That's why I'm such a great exponent of stopping this whole nonsense of war and attempt to limit war have always failed. The lesson of history is: When a war starts, every nation will ultimately use whatever weapon has been available. That is the lesson learned time and again. Therefore, we must expect, if another war - a serious war - breaks out, we will use nuclear energy in some form. That's due to the imperfection of human beings."
http://www.worldfuturefund.org/Articles/rickover.html

Yes - The father of the Nuclear Navy opposed the continued use of nuclear power in any form. Though the Admiral was correct in his time in suggesting that commercial nuclear power might play a role, the costs, dangers, and problems with nuclear have abundantly demonstrated that nuclear power no longer has any role to play at all.

Nuclear reactors are not low carbon "clean" power as is often asserted. They never have been. They do not produce "clean energy" by any measure. The entire supply chain from mining ore, through milling, separation, enrichment, and fuel fabrication uses vast amounts of carbon-based fuels. The concrete and steels used in the construction of the facility likewise entail huge carbon costs. And once the plants cease operation, the dismantlement, burial, and deep burial of the nuclear wastes produced carry enormous carbon costs. All of these are a part of the nuclear fuel cycle.

The wastes produced in operating nuclear power plants must be secured and guarded essentially forever, both for their radiation risks, and for the risk that the fissile materials the spent nuclear fuel and wastes contain may be processed to produce weapons usable fissile materials or dirty bombs.

Neither is nuclear power cheap. Nuclear is among the most expensive ways to generate energy. It carries huge upfront energy costs. And it entails enormous long-term risks and costs. Once a plant is begun, the financial viability of the companies and government units involved are very much at stake, as many jurisdictions have learned to their great despair. Chernobyl and Fukushima prove that.

Oregon is blessed with immense resources of hydroelectric, solar and wind energy. We have no need of nuclear. Each of these renewable resources is vastly less expensive than nuclear. And their costs are declining, while the costs for nuclear power continue to rise. The costs arguments argue against nuclear power at any scale.

Industry argues that reactors are needed for base load power. This is the power that cannot be turned off, and that returns the least price of any power. Nuclear cannot compete here. Wind and solar production combined approximately match the power profile of human power consumption, with increased use in the daytime and decreased use at night. Hydroelectric power plays the role of the battery for storage and surge capacity in the Pacific Northwest. Nuclear does not. Nuclear wants to take the bottom off the power supply business and require that every other source provide variable power, increasing their market costs. This is wrong.

Additionally, with the impending cataclysmic Cascadia subduction zone earthquake, and other lesser disasters, Oregon needs to aggressively move to distributed power production and utilization. We must not refocus our power supplies into central power stations. We do not need to add another centralized risky power source to the mix.

What we need is solar power on as many roofs in Oregon as we can manage so that when disasters strike, as they inevitably do, that most communities are able to continue with little power disruption. Centralized power, even in the guise of 'smaller' nuclear plants cannot support that. During disasters, nuclear power plants are often forced offline for safety reasons, exacerbating the power outages rather than supporting recovery. And should an accident occur, the plant detracts from efforts to restore our communities.

Nuclear power creates enormous uninsurable dangers. As a result, the Federal Government has limited liability in the event of nuclear disasters. That unfairly and inequitably shifts the burden to the very people harmed in a nuclear disaster at the worst times in their lives.

Nuclear has a proven track record of being an unsafe form of power production when cost has any measure of importance in the design and operation of the facility, or when safety culture is the least bit under-appreciated or misunderstood. It is only in the highly socialized command structure of a military operation that it has been done safely. Even then, the relative safety is extremely dependent on the safety culture created around it.

What I learned in my quarter century working on nuclear problems is just how myopic the nuclear profession can be. They see the high-power density and short-term benefits easily enough. However, they often fail to see, assess, or adequately deal with the long-term risks. Instead, as Chernobyl, Fukushima and dozens of other plants demonstrate, they often fail to see fundamental design issues that make the plants imminently dangerous.

Societally, we have made excruciatingly little progress on dealing with nuclear waste and show little prospect of doing so. Instead, we have repeatedly tried to define away the problem and to abandon highly radioactive waste in badly engineered waste forms in the near surface that provide inadequate protection, or to simply not clean up the wastes at all.

We have ample, safe, economic, renewable alternatives that can be fielded quickly. Nuclear is none of these.

The legislature should reject these proposals as being unwarranted risks to the citizens of Oregon, and a violation of the trust of the citizens of Oregon, and faith in the policy choice the citizens made via Initiative. Nuclear has no place in the energy makeup of our future.