

STATE OF VERMONT
PUBLIC UTILITIES COMMISSION

Joint Petition of NorthStar Decommissioning Holdings, LLC, NorthStar Nuclear Decommissioning Company, LLC, NorthStar Group Services, Inc., LVI Parent Corp., NorthStar Group Holdings, LLC, Entergy Nuclear Vermont Investment Company, LLC, and Entergy Nuclear Operations, Inc., any other necessary affiliated entities to transfer ownership of Entergy Nuclear Vermont Yankee, LLC, and certain ancillary approvals pursuant to 30 V.S.A. Sections 107, 231, and 232.

August 30, 2017

Docket No. 8880

PREFILED REBUTTAL TESTIMONY
OF ARNOLD GUNDERSEN
ON BEHALF OF NEW ENGLAND COALITION

Mr. Gundersen outlines his professional opinions regarding the proposed ownership transfer and decommissioning plans for the Vermont Yankee Atomic Power Reactor. He further provides informed perspectives on the presence of radioactive contamination on the Vermont Yankee (VY) site, the use of rubblization rather than removal of radioactivity from the VY site, comparisons of contamination between Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) decommissioning. In addition, Mr. Gundersen opines on the financial risks to the State of Vermont by the proposed NorthStar LLC purchase of Vermont Yankee from Entergy LLC, funding of the actual Vermont Yankee decommissioning project and a separately funded Department of Energy Interim Spent Fuel Storage Installation, and the overall lack of corporate experience and capabilities of NorthStar as the proposed prime decommissioning contractor.

Mr. Gundersen's analysis indicates that granting the Petition *as it stands* would not on balance serve the public good.

**STATE OF VERMONT
PUBLIC UTILITIES COMMISSION**

In the matter of

Joint Petition of NorthStar Decommissioning Holdings, LLC, NorthStar Nuclear Decommissioning Company, LLC, NorthStar Group Services, Inc., LVI Parent Corp., NorthStar Group Holdings, LLC, Entergy Nuclear Vermont Investment Company, LLC, and Entergy Nuclear Operations, Inc., any other necessary affiliated entities to transfer ownership of Entergy Nuclear Vermont Yankee, LLC, and certain ancillary approvals pursuant to 30 V.S.A. Sections 107, 231, and 232.

August 30, 2017

Docket No. 8880

TESTIMONY OF ARNOLD GUNDERSEN SUPPORTING
THE NEW ENGLAND COALITION:
AN EVALUATION OF THE FINANCIAL RISKS TO VERMONT
IN THE PROPOSED SALE OF
THE ENTERGY NUCLEAR VERMONT YANKEE POWER PLANT SITE
TO NORTHSTAR DECOMMISSIONING HOLDINGS, LLC

WITNESS BACKGROUND

Q1. Please state your name and residence.

A. My name is Arnold Gundersen, and I live in Burlington, Vermont

Q2. What is the purpose of your testimony?

A. The New England Coalition has retained Fairewinds Associates, Inc to evaluate the financial risks associated with the proposed sale of the Entergy Nuclear Vermont Yankee (ENVY) Power Plant to NorthStar, LLC for the proposed purpose of decommissioning Vermont Yankee. As an employee of Fairewinds Associates, and its chief engineer, I performed this risk assessment for New England Coalition.

Q3. Please summarize your educational and professional experience.

A. I earned my Bachelor Degree in Nuclear Engineering from Rensselaer Polytechnic Institute (RPI) cum laude. I earned my Master Degree in Nuclear

Engineering from RPI via an Atomic Energy Commission Fellowship. Cooling tower operation and cooling tower plume theory were my area of study for my Master Degree.

I began my career as a reactor operator and instructor in 1971 and progressed to the position of Senior Vice President for a nuclear licensee prior to becoming a nuclear engineering consultant and expert witness. An updated Curriculum Vitae is attached as Exhibit 1.

I have testified as a nuclear engineering expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), in Federal Court, the State of Vermont Public Service Board, the State of Vermont Environmental Court, and the Florida Public Service Commission.

I am an author of the first edition of the Department of Energy (DOE) Decommissioning Handbook. I was a member of an NRC Licensee's Radiation Safety Committee responsible for decommissioning nuclear facilities throughout the United States. I am the author of a peer reviewed scientific paper entitled *Radioactively-hot particles detected in dusts and soils from Northern Japan by combination of gamma spectrometry, autoradiography, and SEM/EDS analysis and implications in radiation risk assessment* published in the Journal (STOTEN) Science of the Total Environment.

As an appointee of Vermont State Legislature for two years, I was charged with serving in an oversight role of Entergy Nuclear Vermont Yankee and an advisory role on nuclear reliability issues to the Vermont State Legislature.

I have more than 45-years of professional atomic power engineering experience as delineated in my attached CV.

Q4. Have you ever testified before the Vermont Public Utility Commission

(VTPUC) or Vermont Public Service Board (VTPSB)?

A. Yes, I have testified in several Vermont Yankee Dockets heard before the VTPSB.

Q5. Have you read the Application and Prefiled Testimony of Entergy and NorthStar?

A. Yes.

Q6. What are your preliminary observations and conclusions?

A. NorthStar's lack of experience in decommissioning boiling water reactors (BWRs) has led me to conclude that there is a significant financial risk to the State of Vermont and its citizens if Vermont Yankee were to be decommissioned and dismantled with the petitioners' approach.

Q7. Did you review NorthStar's claimed proprietary material?

A. Yes, but I found none of the material was useful in reaching any conclusions, so it is not incorporated into this report.

Q8. According to prefiled testimony by petitioners NorthStar and Entergy, both petitioners claim that the proposed change in ownership of the shutdown Entergy Vermont Yankee (ENVY) atomic power reactor will allow its decommissioning to move forward more quickly following the transfer of ownership. Furthermore, the parties claim that the transfer of ownership of ENVY from Entergy to NorthStar will reduce decommissioning costs by hundreds of millions of dollars and also reduce the length of time required to dismantle Vermont Yankee by approximately 30 years. Does the proposed sale of ENVY from Entergy to NorthStar provide these claimed benefits?

A. No, selling Vermont Yankee to NorthStar, a corporation that is inexperienced in atomic power reactor and nuclear power plant decommissioning does not produce

any of the claimed financial or schedule benefits. Entergy's TLG subsidiary or any one of many newly formed decommissioning competitors all are capable of hiring a team of subcontractors to completely dismantle VY by the early 2030's within the funds available in the Decommissioning trust. In fact, Entergy has acknowledged that its TLG subsidiary is a highly experienced nuclear industry leader in decommissioning.

JACKSON, Miss., Sept. 7 /PRNewswire/ -- Entergy Corporation (NYSE: ETR) has agreed to buy TLG Services Inc. of Bridgewater, Conn., in a deal that will make Entergy **one of the most experienced companies in decommissioning in the U.S. nuclear industry**, the two companies jointly announced today.

"TLG Services is a globally recognized expert in decommissioning engineering, related cost estimation, and field services. Their expertise strengthens Entergy's capabilities as one of the nation's premier nuclear operators," said Jerry Yelverton, chief executive officer of Entergy Nuclear.

"We already are doing decommissioning work in the utility industry, and acquiring TLG solidifies our position as an industry leader.

"Yelverton pointed out **the expertise of TLG Services will reduce the decommissioning risk**, a potentially significant liability, at Entergy Nuclear's existing nuclear plants and the additional plants it buys as Entergy pursues its principal growth strategy of acquiring more nuclear generation.

"TLG's knowledge is necessary for a national nuclear company and fits well with our growth strategy," he said. **(emphasis added)**

Q9. Entergy and NorthStar have claimed a series financial and schedule savings due to NorthStar's proposed plan. Are the claimed Entergy and NorthStar savings correct? Are the presumptions and cost analysis delineated by Entergy and NorthStar and that underlie the claimed savings correct?

A. No, both the claimed financial savings and schedule reduction and the underlying presumptions and cost analysis being used to justify the proposed sale of VY are incorrect.

In 2012, Entergy provided the State of Vermont with a Yankee decommissioning

planning document entitled *Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station*¹, written by TLG Services. A literal reading of this Entergy document led Vermont State policymakers to reach erroneous conclusions regarding the timing of Entergy's program for decommissioning Vermont Yankee. *Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station* speculates that the costs associated with decommissioning Vermont Yankee are so excessive and exorbitant that it will take at least 60-years for the underfunded trust fund to finally accumulate adequate funds to address the excessive cost estimates of decommissioning the 40-year-old plant.

Formerly an independent decommissioning services company, TLG Services is now a wholly- owned subsidiary of Entergy Corporation. Beginning in 2012, TLG Services created a series of spurious financial premises released in its 2012 VY report that allowed Entergy to reach its erroneous financial and schedule conclusions. These premises may be found hidden in the footnotes and small print of the 2012 document. Specifically, according to Footnote 3 on page viii:

Projected expenditures for spent fuel management identified in the cost analyses do not consider the outcome of the litigation (including compensation for damages) with the DOE with regard to the delays incurred by Entergy VY in the timely removal of spent fuel from the site. As such, this analysis takes no credit for collection of damages, even though utilities are now routinely being awarded such damages in the courts. Collection of spent fuel damages from the DOE is expected to provide the majority of funds needed for spent fuel management following shutdown.

Throughout the United States (U.S.) nuclear industry, the ISFSI costs are routinely submitted to the Department of Energy (DOE) that then routinely compensates the utility and/or energy corporation for these expenses that by statute are being absorbed by the U.S. government. While Entergy subsidiary TLG clearly indicates that the cost of the Interim Spent Fuel Storage Installation

¹ *Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station* (E11-1643-001, Rev. 1) prepared by TLG Services, Inc., February 2012.

(ISFSI) would be withdrawn from the decommissioning fund, the corresponding reimbursements by the DOE were not deposited back into the Vermont Yankee Decommissioning fund.

Furthermore, according to paragraph 3.4.1 on pages 7&8 of Section 3:

An ISFSI [formally Interim Spent Fuel Storage Installation now changed by the NRC to Independent Spent Fuel Storage Installation] has been constructed within the protected area (PA) to support continued plant operations. The ISFSI has a capacity of 36 dry storage modules. As such, under the current assumptions for DOE performance, a second ISFSI will be required to completely off-load the spent fuel pool at the cessation of plant operations.

My analysis of the 2012 TLG report shows that construction, operation and maintenance costs for the ISFSI (Interim Spent Fuel Storage Installation) are included within the estimates and address the costs for staffing the facility, as well as security, insurance, taxes and licensing fees. The TLG estimates include the costs to purchase, load, and transfer the multipurpose spent fuel storage canisters (MPCs) from the pool to the DOE or to/from the ISFSI. Costs are also provided for the final disposition of the facilities once the transfer is complete.

The impact of these two presumptions made by Entergy and TLG on the projected cost of decommissioning and dismantling the Vermont Yankee site is enormous and actually increases the apparent cost to dismantle VY by almost \$400 million beyond what an accurate cost analysis would determine.

For example, according to *Table 6.1* of Entergy's 2012 Report, *Summary of Decommissioning Cost Contributions*², the cost to build the second ISFSI then load and transfer the spent fuel to the new ISFSI facility is 15 to 17 percent of the entire cash outlay required for decommissioning the Vermont Yankee site and exceeds \$150,000,000. More importantly, Entergy planned to withdraw these

² *Summary of Decommissioning Cost Contributions, Table 6.1, DECOMMISSIONING COST ANALYSIS for the VERMONT YANKEE NUCLEAR POWER STATION (Document E11-1643-001, Rev. 1) TLG Services, Inc., February 2012*

funds early in the decommissioning process thus draining the decommissioning fund, which further reduces the interest that can be accrued for plant dismantlement.

Finally, Table C-1³ entitled *Vermont Yankee Nuclear Power Station: Scenario 1, 2012 Shutdown, SAFSTOR Alternative*, shows that Entergy/TLG also plans to extract an additional major charge to the decommissioning fund of \$61,000,000 ostensibly to guard the spent fuel and monitor its radiation while it is stored on site.

While 10 CFR §50.75 does not adequately provide a means to determine the true cost of decommissioning, the regulation is quite clear that funding for the Independent Spent Fuel Storage Installation (ISFSI) is simply not included in the regulations as promulgated.

Entergy is fully aware that under existing NRC regulations it is *illegal* to fund an Independent Spent Fuel Storage Installation (ISFSI) at Vermont Yankee using the decommissioning trust fund. As recently as February 9, 2015, Entergy acknowledged that *it is not authorized to raid* the decommissioning trust fund to supply cash to build an ISFSI as it has proposed to do in its PSDAR.

In the letter by T. Michael Twomey, Vice President, External Affairs, written to Kyle H. Landis-Marinello, Vermont Assistant Attorney General, and to Christopher Recchia, Commissioner Vermont Department of Public Service, Mr. Twomey said,

ENVY acknowledges that current NRC regulations do not permit ENVY to use decommissioning funds for actual (i.e. non-planning) spent fuel management activities.⁴

³ Table C-1 2a.4, *Vermont Yankee Nuclear Power Station: Scenario 1, 2012 Shutdown, SAFSTOR Alternative*, DECOMMISSIONING COST ANALYSIS for the VERMONT YANKEE NUCLEAR POWER STATION (Document E11-1643-001, Rev. 1) TLG Services, Inc., February 2012

⁴ *Pre-Notice of Disbursement from Entergy Nuclear Vermont Yankee, Decommissioning Trust*, Entergy Letter of an Entergy letter to Vermont Assistant Attorney General Landis–Marinello and to DPS

Even the NRC has publicly stated that the Decommissioning Trust Fund shall not be used to fund an ISFSI. In a newspaper article entitled **VY spent fuel plan gets nod** (2/4/09: Brattleboro Reformer), NRC spokesman Neil Sheehan said,

The NRC rejected the request because trust fund money may only be used for decommissioning work unless the funds are in addition to decommissioning funds and if they have been earmarked for spent fuel management, said Neil Sheehan, spokesman for the NRC.

Furthermore, in a private email dated January 19, 2011 from the Vermont Department of Public Service to Mr. Gundersen, both the NRC and the State of Vermont acknowledge that reactors should not be paying for an ISFSI from the decommissioning fund without seeking and receiving a special waiver [**emphasis added**]:

From: "Hofmann, Sarah"
Subject: FW: questions to NRC
Date: January 19, 2011 11:39:29 AM EST
To: 'Arnie Gundersen'
Cc: "Miller, Elizabeth"

Good morning Arnie. In response to your email this morning, I thought I would see what NRC could give us for info on this issue. I asked three questions of Doug Tift to ask of the decomm unit at NRC. Doug is our state liaison to NRC. I asked the questions and he answered in a phone call so I have typed his response below each question.

Could you pass on three questions for me to your decommissioning gurus:

(1) Are plants paying for an ISFSI upon decommissioning out of their decommissioning trust funds?

A. **They shouldn't be paying for an ISFSI from the decommissioning fund without getting an exemption.**

(2) If so, is it necessary to get an exemption from NRC?

A. **Yes, an exemption would be necessary**

(3) Have any plants gotten exemptions to use money out of their

decommissioning trust funds for ISFSIs or any other spent fuel management purpose?

A. **Two plants asked for exemptions and then withdrew the requests. No other plant has requested an exemption.** They believe others will but no others to date other than the two.

Many thanks.

Sarah Hofmann
Director for Public Advocacy
Vermont Department of Public Service

Q10. Once the cost of the ISFSI is removed from the 2012 *Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station*, are existing decommissioning funds available to dismantle Vermont Yankee sooner than 2050?

A. Absolutely. Once the funds improperly allocated by Entergy for ISFSI are removed from the 2012, then any one of many experienced and financially stable decommissioning contractors would be able to dismantle the Vermont Yankee site and its buildings by approximately 2030. The process could be done using the available decommissioning funds and meeting the Greenfield standard agreed to by Entergy.

In 2016, Fairewinds Associates developed an Excel application spreadsheet, which it provided March 17, 2016 to the Nuclear Regulatory Commission [at no cost] in a report entitled **The Nationwide Failures of Decommissioning Regulation: Decommissioning Trust Funds or Slush Funds?**⁵ The methodology delineated in this spreadsheet enables any user to adjust the rate of growth for the decommissioning trust fund to grow at a rate of interest that is predetermined by the user. Users may then apply the spreadsheet to calculate withdrawals from the decommissioning trust fund balance based upon decommissioning activity cost schedules that were previously provided by

⁵ <http://www.fairewinds.org/nuclear-energy-education//03tj9289ut746v9sb3cbkrhfzqgtdz?rq=decommissioning>

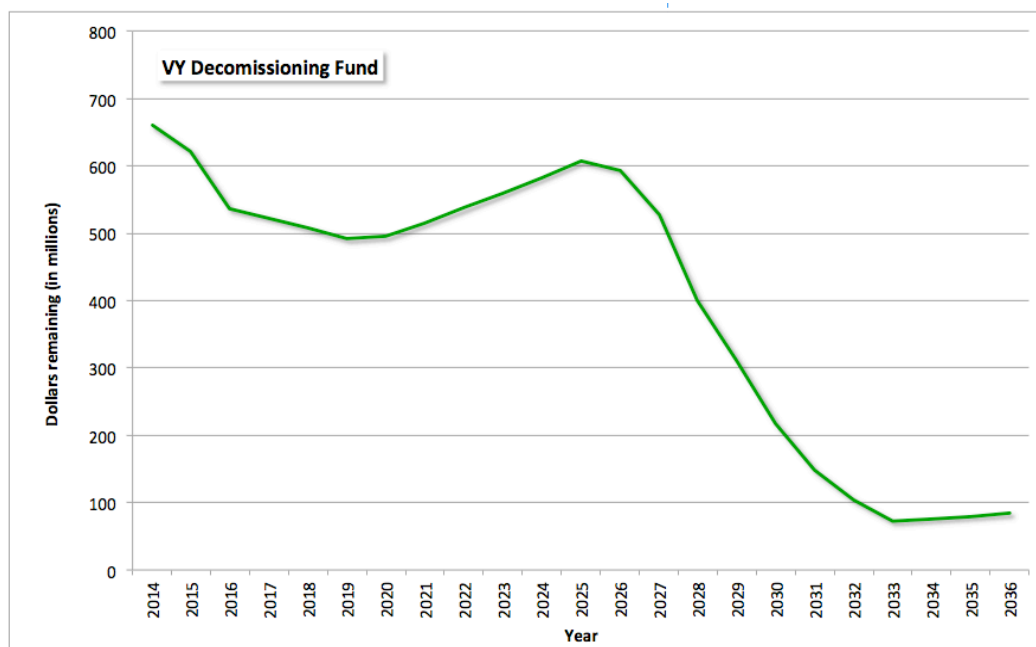
Entergy. It is then possible to create new anticipated yearly balances based upon the projected growth of the fund and projected withdrawals from that fund.

Exhibit 2 to this report is a spreadsheet based upon a 5% rate of growth in the fund and a 3% rate of inflation for the costs associated with decommissioning. Being able to vary these two rates (interest and inflation) allows policymakers and other stakeholders to make informed decisions about when decommissioning can commence.

The data in Exhibit 2 is based upon information previously provided by Entergy in its 2012 report. By conducting this mathematically-based cash flow analysis, Fairewinds Associates has determined that sufficient funds would be available for Entergy to completely decommission the Vermont Yankee nuclear power plant by approximately by 2032.

Here is a graphical representation of the data provided in Exhibit 1 entitled:

Cash Flow Analysis Vermont Yankee Decommissioning



You will see that both the 2012 Entergy/TLG decommissioning plan and the 2016 NorthStar decommissioning plan can completely dismantle Vermont Yankee by approximately 2030 if the costs for funding the ISFSI are properly accounted for in each analysis.

The Public Utilities Commission should recognize, that these calculations show that upon completion of the project, more than \$50 Million [50 million dollars] remain to be returned to Vermont Ratepayers as prescribed by law because the Decommissioning Trust was originally funded by Vermont ratepayers.

Q11. Did the decommissioning approach presented by Entergy's TLG Services in 2012 use rubblization to dispose of contaminated concrete by mixing it into clean concrete?

A. No, the TLG decommissioning estimate agreed with Entergy's legal commitments to the State of Vermont from prior proceedings that rubblization of contaminated concrete would never be applied at Vermont Yankee.

Moreover, the 2012 TLG analysis underlines the fact that the Vermont Yankee site can be completely dismantled by approximately 2030 without rubblization and with the promised funds returned to Vermont ratepayers as committed in the original agreement Entergy made when it purchased Vermont Yankee from Vermont utilities. The 2012 TLG approach without rubblization and the NorthStar approach that claims to require rubblization arrive at the same cost and schedule outcomes. The evidence provided by both Entergy and NorthStar shows that rubblization is not required to successfully dismantle VY.

Q12. You discuss rubblization in your testimony. What exactly is rubblization?

- A. Rubblization is a process by which *highly-contaminated radioactive material is ground-up and blended with non-radioactive material so that the average concentration of the blend is below regulatory limits.* The most important fact to remember is that the actual content of radioactive material in the final rubblized product contains the same number of radioactive particles as the highly-contaminated material before rubblization occurred.

Therefore, *the surface area of the highly-radioactive material is increased, not decreased, when it is ground into smaller, more numerous pieces.* The financial problem for Vermont is that with a greater surface area in the rubblized blend, the radioactive material is more likely to leach into the surrounding soil, increasing the spread of highly-toxic radioactive material via migration to the surrounding soil and groundwater.

Various processes might account for the release of radionuclide contaminants from concrete. Whether, and which of, these processes (or what combination of them) will operate in real disposal conditions depends on a number of factors: (i) The nature of the original contamination, in terms of chemical character and mode of deposition; (ii) Subsequent history of the contaminated concrete, e.g. whether it has remained dry, water saturated, or in intermediate states of partial saturation and the extent of secondary alteration by carbonation, sulfate ingress, alkali-silica reaction, wet-dry cycling, freeze-thaw, mechanical damage and other mechanisms for cracking, etc; (iii) **Extent to which internal matrix of concrete has been exposed due to breaking or crushing of concrete;**⁶ [emphasis added]

Simply put, rubblization increases the unforeseen financial risk for Vermonters of additional costs associated with the likelihood of groundwater contamination. To avoid further financial risk and radioactive contamination of the Vermont Yankee site, Entergy previously committed in a legal agreement with the State of Vermont to decommission Vermont Yankee *without the use of rubblization.*

⁶ *RADIOACTIVE CONTAMINATION OF CONCRETE: UPTAKE AND RELEASE OF RADIONUCLIDES*, Proceedings of ICEM'03: The 9th International Conference on Environmental Remediation and Radioactive Waste Management, September 21 – 25, 2003, Examination Schools, Oxford, England

Q13. Is NorthStar qualified to dismantle Vermont Yankee?

- A. From my extensive decommissioning background, I believe that NorthStar lacks general nuclear decommissioning experience, and more specifically, the specialized experienced of dismantling a Boiling Water Reactor (BWR) nuclear power site. By design, BWRs release more radioactivity during operations, and certainly have sites that are more radiologically contaminated than Pressurized Water Reactor (PWR) sites.

The decommissioning of Vermont Yankee will be the first attempt by any contractor in the U.S. to dismantle a Boiling Water Reactor. Most importantly, the Vermont Yankee site is known to be radiologically contaminated by Cesium 137, Cobalt 60, Strontium 90, and tritium that were created by Entergy when VY was producing electricity. Furthermore, NorthStar has never dismantled a large atomic power reactor, let alone a large BWR on a site that is contaminated by radioactivity and adjacent to a major river and aquifer.

Q14. What are the risks associated with the dismantlement plan NorthStar has proposed?

- A. In my opinion the major financial risk to Vermont is caused by the unique contractual approach NorthStar is proposing. Specifically, NorthStar states that it will issue hundreds of fixed-price contracts to numerous different independent contractors. I believe this approach is very naive. Rather than own and manage the actual decommissioning, NorthStar appears to consider itself as the contract administrator on an extraordinarily complex process that has never been undertaken before on a BWR.

Fixed priced contracting requires an extremely detailed and well-defined understanding of the scope of each of hundreds of individual contracts and the

radiological and mechanical responsibilities of each contract as well as for the site as a whole. NorthStar claims it will require its subcontractors to bond their work price estimates, which is an impossible task if the work scope is not well defined. Documents submitted by NorthStar in discovery thus far indicate it lacks an adequate understanding of the extent of radiological contamination on the Vermont Yankee site to be able to issue well defined requests for proposal (RFP). NorthStar's admitted lack of nuclear power reactor experience, and the fact that Vermont Yankee is a BWR, coupled with NorthStar's weak understanding of both the amount and spread of the toxic radiation already released on site will create untenable fixed price contract dilemmas.

On its face, it appears that the process as currently proposed will inevitably create hundreds of contractual disputes among NorthStar and its contractors, especially when the aforementioned contamination is inevitably discovered. These disputes will increase costs and delay schedule timeline. Furthermore, the Vermont Yankee site is radiologically contaminated deep underground, yet in its preliminary proposal NorthStar appears to have limited both its cost estimates of soil clean-up and remediation, and its dismantlement activities to appropriately clean the site to only 4-feet below the surface of the soil.

According to NorthStar prefiled testimony:

NorthStar proposes to remove all above-ground structures on site, ...Pipes and other spaces with void space that are below 4 feet ...allowed to be left in place would be filled with concrete or other material as necessary to ensure stability of the ground above.⁷

The incongruences are considerable between what is proposed by NorthStar as its clean-up plan compared to the financial risk that will be incurred by the community and the fragile environment. NorthStar is at financial risk from cost overruns and schedule delay due to the known level of contamination on site,

⁷ Prefiled testimony, Steven State, page 31, lines 6, 16 and 17

which is extensive, and that is known to exist at much lower depths than NorthStar anticipates via its clean-up design.

Moreover, the vague responses from NorthStar to Discovery Questions submitted by all the parties to this proceeding certainly indicate that it has no definitive plans for the dismantlement of VY using its proposed rubbleization approach. The lack of specificity by NorthStar adds even more uncertainty to the cost and schedule estimates provided by NorthStar.

Q15. Does NorthStar have an understanding of the extent of radioactive contamination on the Vermont Yankee site?

A. No, NorthStar does not understand the extent of radioactive contamination.

According to the documents submitted by NorthStar, the corporation is basing its purchase agreement based on data from 2001 and 2014. According to the prefiled testimony submitted by NorthStar CEO Steven State,

NorthStar believes that it has sufficient information on the radiological and non-radiological conditions at the site to proceed with decommissioning and site restoration work based on its review of the 2001 Phase I and Phase II Environmental Assessment conducted at the time ENVY purchased the site and the 2014 Site Assessment Study, as well as its own due diligence.⁸

Neither the 2001 Environmental Assessment nor the 2014 Site Assessment prepared by Entergy adequately address the radioactive contamination generated on the ENVY site due to power plant mechanical problems created by Entergy after it acquired the facility.

There are numerous reports of serious radiological contamination on the Vermont Yankee site since Entergy assumed ownership. *It is well known that plant generated Strontium 90 has been detected more than 17 feet below the site surface.* These problems regarding the migration of been of radioactive known since 2010, and they were identified by Entergy in the following email:

⁸ Prefiled testimony, Steven State, pages 28 and 29, lines 19 on page 28 -2 on page 29

From: "Smith, Laurence M" <lsmit14@entergy.com>
Date: May 21, 2010 5:25:11 PM EDT (CA)
Subject: VY Tritium Update

VY Tritium Update
May 21, 2010

Work on soil remediation from the Vermont Yankee tritium leak is on schedule to be completed in the coming weeks. The rerouting of steam trap drain line piping from the Advanced Off Gas system is complete. These lines have been rerouted so they are accessible and can be easily monitored. The reachable areas of the AOG pipe tunnel have been cleaned as well.

VY received an anticipated analytical report on May 17th documenting the presence of strontium 90 in soils removed from the AOG excavation area. Entergy promptly transmitted the results to the Vermont Department of Health.

The identification of strontium 90 is not unexpected given other plant-generated isotopes were previously identified in soil samples taken from the same location. Strontium 90 is a by-product of nuclear fission and atmospheric testing. Entergy Vermont Yankee is confident that the strontium 90 is limited to the soils in contact with or adjacent to the terminated leak. There is no risk to public health or safety. Entergy Vermont Yankee will continue to analyze samples from the AOG excavation area and tritium-impacted groundwater wells for strontium 90 and other plant generated radionuclides as part of our due diligence.

These samples were taken from the Advanced Off Gas excavation area at depths of 15 feet and 17 feet, adjacent to the location of the tritium leak to the ground which was identified on February 15th. The peak strontium 90 concentration of 8,300pci/kg (soil) was observed from a sample 15 feet below grade that is adjacent to the leak to the environment. At a depth of 17 feet, the concentration was roughly halved at 4,800pci/kg.

Groundwater samples taken from the well with the highest tritium concentration (GZ-10) at its peak tritium activity level were analyzed for strontium 90. Neither strontium 90 nor any additional plant-generated radionuclides were identified in this or any other water sample taken to date.

Strontium 90 is classified as a hard to detect isotope, and has been found at the site of tritium leaks at other US nuclear plants. Laboratory analysis of this type take several weeks to complete. The soil samples were taken March 17th, shipped on April 1, received at the vendor's laboratory on April 5th, and are from the same areas that were recently remediated. Approximately 180 cubic feet of soil was removed from

the excavation pit last week and will be shipped to a licensed disposal facility. This remediated soil is currently stored in shipping containers, awaiting shipment to a licensed facility. Entergy has taken additional soil samples from the recently remediated areas and has shipped these samples to the same vendor laboratory for hard to detect analysis. Samples taken following remediation and tested on site indicated a significant reduction in the concentration for other isotopes such as cobalt 60 and zinc 65. A similar magnitude reduction is expected for strontium 90 as this isotope will be retained by the soil in a similar manner to cobalt 60 and zinc 65.

The State of Vermont and The Nuclear Regulatory Commission have been informed of this information.

Laurence M. Smith

Manager of Communications

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Additionally, news reports and testimony to the state legislature and other regulators made it well-known that Strontium 90 generated by Entergy's operation of ENVY had entered the site's groundwater as detailed in the *Keene Sentinel*.

Officials debate isotope cleanup at Vermont Yankee

BRATTLEBORO — Recent test results showing strontium-90 in four monitoring wells at the Vermont Yankee nuclear power plant have renewed a five-year-old debate about whether to clean up the radioactive isotope now or wait 50 years.

Arnie Gundersen of Fairewinds Associates said Tuesday a relatively quick cleanup would save the Vermont Yankee decommissioning trust fund tens if not hundreds of millions of dollars. He is a well-known nuclear engineer based in Burlington who has worked for the Vermont Legislature on nuclear issues, including the 2010 tritium leak at Vermont Yankee.

According to a 2010 report he prepared for the Legislature, Gundersen had urged that Entergy Nuclear continue groundwater removal to control the spread of the radioactive contamination, including strontium-90, which was discovered in the ground near an underground vault close to the plant's advanced off-gas building. The vault was determined to be the source of the large tritium leak.

Gundersen said while Entergy discontinued the groundwater pumping it had initiated after the tritium leak in late 2010, he urged that the

source of the strontium-90 contamination be cleaned up now, rather than waiting until the Vermont Yankee reactor complex is cleaned up and dismantled. That is estimated to take 20 to 50 years, depending on the health of the plant's decommissioning trust fund.

The difference, he said, could run in the tens of millions of dollars.

Martin Cohn, spokesman for Entergy in Vermont, said Gundersen was not taking into consideration the fact that the strontium-90 levels were very low.

He emphasized that testing Entergy does on Yankee's monitoring wells did not detect strontium-90 because the levels were so low.

NRC spokesman Neil Sheehan said only two of the four monitoring wells that tested positive for strontium-90 were in the original 2010 tritium plume. Two are outside of the plume, but all four are a short distance from the Connecticut River.

Sheehan stressed that the source of the strontium-90 found in the wells had still not been determined.⁹

NorthStar seems blissfully unaware of the extensive financial risk it is assuming from this widespread site radiological contamination, relying upon a 2014 report:

7.2.2 Summary of Groundwater Impacts

The known impacts to groundwater at VYNPS can be summarized as follows:

Tritium is the only plant-generated radionuclide detected in groundwater at the site.¹⁰

Based upon these and numerous other recorded and reported examples of VY site contamination, it appears that NorthStar has not diligently met its fiduciary responsibility to properly assess site radiological contamination generated by radioactive material located deep underground and already migrating via groundwater. Therefore, the cost estimates provided by NorthStar are simply inadequate and cannot be relied upon in this proceeding.

⁹ Keene Sentinel, March 3, 2015

¹⁰ A.ANR.NS.1-3.26 pdf, Page 27 of 31 (Bates NS-VYNDC 0059016), Radiological Historical Site Assessment, September 2014, Radiation Safety & Control Services

The ground contamination at Vermont Yankee is reminiscent of the substantial contamination encountered during the mid-1990s decommissioning of the Northeast Utilities (NU) Connecticut Yankee (CY) atomic power Pressurized Water Reactor (PWR) during. When NU began decommissioning CY, it was believed that the site had minimal contamination. At the same time as the actual decommissioning effort began, unexpected extensive radioactivity that significantly contaminated groundwater was exposed. This unanticipated contamination increased the expenditures for decommissioning Connecticut Yankee by hundreds of millions of dollars. Because CY was a traditional utility structure with assets and utility ratepayers, not an LLC structure that claims no assets like Entergy or a newly founded corporation such as NorthStar LLC with no assets, the exorbitant costs were simply assessed to Connecticut's utility ratepayers.

These unforeseen decommissioning expenses were a tremendous financial encumbrance on Connecticut's ratepayers for 10-years. However, in a highly-populated state like Connecticut with more than 3,588,000 residents (2016 data), the costs could be assessed to its ratepayers for 10-years, and the financial burden was significantly less that it would be in Vermont due to almost 3-million more households in Connecticut than in Vermont. Such an unanticipated radiological contamination discovery in Vermont would be an extreme and untenable financial burden for Vermonters, since NorthStar's current financial structure would make it unable and/or unwilling to cover hundreds of millions of dollars of radiological cleanup.

Moreover, there are two exacerbating circumstances: decommissioning a Boiling Water Reactor (BWR) like VY is more difficult than it is to decommission a PWR like CY, and the testing data and evidence provided to the Vermont Yankee Oversight Panel following the leak of tritium, cobalt, cesium, and strontium that the Vermont Yankee site is highly contaminated.

Vermont is the second least populated state in the U.S. with a population of only 626,620 (2016 data). Vermont's citizens simply cannot absorb such huge financial losses in the event its LLC owner (Entergy or NorthStar) chooses bankruptcy and litigation against the previous utility owners like Green Mountain Power and others rather than completing the costly decommissioning and dismantlement of the highly contaminated VY atomic power site. *While NorthStar LLC has proposed establishing a \$125 million guarantee to address unforeseen problems it may encounter it is not a formal bond*, and more importantly, the experience at Northeast Utilities CY atomic power site shows that \$125 million will likely prove inadequate at VY with the extensive contamination already uncovered.

Moreover, NorthStar's lack of understanding of the extent of reactor-generated radiological contamination, due to BWR operations, presents a serious financial and contractual risk to NorthStar and its potential contractors and therefore ultimately to the ratepayers of Vermont.

Q16. Who is financially liable for the complete radiological decommissioning of Vermont Yankee?

- A. Statements to the press and at public meetings and legislative hearings in Vermont show that the NRC and Entergy have a significant difference of opinion regarding the legal interpretation of nuclear power plant decommissioning regulations and Entergy's responsibilities as both a corporate parent corporation and a separate LLC that is the owner of Vermont Yankee.

“We would not let Entergy walk away,” said Bruce Watson, chief of the NRC's reactor decommissioning office in Washington, D.C. on February 22, 2015, according to *Times Argus* reporter Susan Smallheer.¹¹

In an article written almost three weeks earlier, Smallheer also quotes two NRC officials, Bruce Watson and Marc Ferdas, who “said Entergy Nuclear is

¹¹ *Lack of Details in Cleanup Plan Draws Fire, Times Argus, February 22, 2015*

responsible financially for the plant's decommissioning under the terms of its federal license to operate Vermont Yankee. But they didn't give specifics on how a company would be held liable 60 years in the future if there were additional costs."¹²

"Ultimately, it is a parent guarantee and legal responsibility," Watson told Nancy Braus of Putney" according to a January 30, 2015, article by Smallheer.

He [Watson] said he guessed Entergy will ultimately have to contribute to the decommissioning fund, which currently amounts to about half of the \$1.24 billion needed."

"They are legally responsible for the safety of the plant," he emphasized.¹³

However, statements by Entergy during the same time period appear to be in stark opposition to the NRC's position regarding the decommissioning responsibilities of Entergy and other energy corporations. Entergy does not believe it has any responsibilities after the 60-year SAFSTOR period is over according to Dave Gram of the Associated Press, who quoted Entergy Vice President Mike Twomey during a legislative committee hearing on February 12, 2015.

An Entergy Corp. official said Wednesday the company is offering no guarantees it will pay to decommission its retired Vermont Yankee nuclear power plant if the job's still not done by the end of a 60-year period.

Entergy Vice President Michael Twomey told members of two Vermont legislative committees that if decommissioning isn't done by the end of the period, known in the nuclear industry as "SAFSTOR," he expects there would be litigation, with the state and Entergy taking different positions.

"There would probably be quite a bit of litigation about that," Twomey told a joint hearing of the House and Senate Natural Resources committees. "We'd all have different points of view."¹⁴

¹² *NRC Deflects Queries on Yankee Costs, Times Argus*, February 6, 2015

¹³ *NRC Reassures Residents on Yankee Cleanup, Times Argus*, January 30, 2015

¹⁴ *Nuclear Plant Closing Costs Not Covered Past 60 years, Associated Press*, February 12, 2015

Clearly there is a significant disparity between the position taken by Entergy compared to the statutory authority of the NRC regarding corporate responsibilities for complete decommissioning of the contaminated Vermont Yankee site.

By selling Vermont Yankee to NorthStar, an undercapitalized Limited Liability Corporation, Entergy appears to be making a second, different and defiant attempt to shed its decommissioning liability for a highly-radioactive nuclear power carcass.

Q17. Will officials of the State of Vermont be allowed to have a full-time inspector on the Vermont Yankee site as the dismantlement of the atomic power plant is progressing?

A. No, officials from the State of Vermont will not participate in assurance that NorthStar is actually meeting its contractual obligations. There will be no full-time oversight of NorthStar. Lack of oversight increases the financial risk to Vermont when contamination is found after NorthStar terminates its NRC license.

NorthStar proposes to perform and to pay for any analysis required by the NRC and to provide the results to the Vermont Department of Health, Vermont Agency of Natural Resources, and Vermont Department of Public Service.

Q18. What does NorthStar propose for sharing the results of its final site status survey?

A. NorthStar proposes to perform and to pay for all analysis required by the NRC and to provide copies of any submissions to the NRC to the Vermont Department of Health, Vermont Agency of Natural Resources, and Vermont Department of Public Service regarding the results of the final status survey analysis.¹⁵

¹⁵ Prefiled Testimony, Steven State, page 33, lines 6-13

By maintaining its NRC license until all site work has been completed, NorthStar effectively bars the State from assessing whether Vermont's Greenfield Standards – to which Entergy committed – have been effectively implemented. NorthStar and its subcontractors have significant profit motives to quickly and inexpensively dismantle the Vermont Yankee site. Without oversight by the State of Vermont and/or independent monitoring contracted to the State of Vermont, there will never be any assurance that commitments to the State of Vermont made as part of these VTPUC proceedings will be maintained or enforced.

Q19. Please outline the issues with which you think the Public Utilities Commission should be concerned.

A. There are five issues that I believe the Vermont Public Utilities Commission should be aware:

1. The proposed sale of Entergy's Vermont Yankee Nuclear Site to NorthStar does not expedite either the dismantlement schedule or reduce its decommissioning costs. Given my oversight role and lengthy experience with decommissioning, I believe that the complete decommissioning of the Vermont Yankee site could be accomplished during the early 2030s time-frame or sooner by other financially stable and technically qualified contractors using the available decommissioning funds.
2. Entergy has previously made binding legal commitments that it would not use rubbleization to dismantle the Vermont Yankee site. If ENVY is finally sold to NorthStar, or another decommissioning vendor, the same codicils and restrictions that were signed with Entergy should be carried forward in any new contract. NorthStar, or any other decommissioning corporation or purchasing vendor, should not be allowed to apply rubbleization to the ENVY site. As a mechanical dismantlement process, rubbleization greatly increases the financial risks of lingering contamination to Vermont. Furthermore, rubbleization is not faster and costs the same or more than completely

removing radiologically contaminated materials.

3. Given NorthStar's admitted lack of knowledge regarding the extent of ENVY generated radioactive contamination at the site, and the corporation's lack of overall nuclear decommissioning experience, there are no assurances that any of NorthStar's chaotic contract management style financial estimates and anticipated schedule to decommission and dismantle the entire VY site may be relied upon.
4. The proposed sale of the Entergy Nuclear Vermont Yankee Site to NorthStar LLC replaces a wealthy stockholder-backed and asset-backed publicly traded company like Entergy, with a financially weaker entity. NorthStar is a newly created, privately held limited liability corporation with limited assets of its own, so its purchase of ENVY greatly increases the financial risk for Vermonters in the event that significant contamination is encountered during the dismantlement of the Entergy Nuclear Vermont Yankee site.
5. During the decommissioning of Vermont Yankee, the active, permanent on-site presence of qualified State of Vermont personnel or an independent monitoring firm reporting to the State of Vermont is critical. It is imperative that the ENVY site be returned to the contractually agreed upon Greenfield Status and that the future financial welfare of all Vermonters is assured by thorough oversight and monitoring of all decommissioning endeavors by ENVY's owner, whomever that may be, and any contractors retained to conduct the environmentally sensitive work.

Q20. Does this conclude your testimony?

A. Yes, at this time it does.

End

Exhibit 1- Gundersen CV

Exhibit 2- Decommissioning Spread Sheet

**Arnold Gundersen, Curriculum Vitae
Chief Engineer, Fairewinds Associates, Inc
August 2017**

Education and Training

ME NE	Master of Engineering Nuclear Engineering Rensselaer Polytechnic Institute, 1972 U.S. Atomic Energy Commission Fellowship Thesis: Cooling Tower Plume Rise
BS NE	Bachelor of Science Nuclear Engineering Rensselaer Polytechnic Institute, Cum Laude, 1971 James J. Kerrigan Scholar
RO	Licensed Reactor Operator, U.S. Atomic Energy Commission, License # OP-3014

Qualifications – including and not limited to:

- Chief Engineer, Fairewinds Associates, Inc
- Nuclear Engineering, Safety, and Reliability Expert
- Federal and Congressional hearing testimony and Expert Witness testimony
- Vermont Community Research Fellow, University of Vermont
- Former Senior Vice President Nuclear Licensee
- Former Licensed Reactor Operator
- Atomic Energy Commission Fellow
- 45-years of nuclear industry experience and oversight
 - Nuclear engineering management assessment, prudence assessment, contract administration, assessment and review
 - Nuclear power plant licensing and permitting – assessment and review
 - Decommissioning experience: including radioactive waste processes, storage issue assessment, and waste disposal
 - Nuclear safety and risk assessment, source term reconstruction, dose assessments, criticality analysis, and thermohydraulic assessment (i.e. power plant steam generation)
 - Systems engineering and structural engineering assessments
 - Cooling tower operation, cooling tower plumes, thermal discharge assessment, and consumptive water use
 - Technical patents, nuclear fuel rack design and manufacturing, and nuclear equipment design and manufacturing
 - Reliability engineering, & aging plant management assessments, in-service inspection
 - Employee awareness programs, whistleblower protection, and public communications
 - Quality Assurance (QA) & records

Publications

Co-author — *Science of the Total Environment* (STOTEN) published a peer-reviewed article entitled: *Radioactively-hot particles detected in dusts and soils from Northern Japan by combination of gamma spectrometry, autoradiography, and SEM/EDS analysis and implications in radiation risk assessment*. Co-authored with Dr. Marco Kaltofen, Worcester Polytechnic Institute (WPI), it details the analysis of radioactively hot particles

- collected in Japan following the Fukushima Dai-ichi meltdowns.
[<http://www.sciencedirect.com/science/article/pii/S0048969717317953>]
- Published Lecture — *The Lessons of the Fukushima Daiichi Nuclear Accident* published in the *International Symposium on the Truth of Fukushima Nuclear Accident and the Myth of Nuclear Safety*, August 30, 2012 University of Tokyo, Iwanami Shoten Publishers, Tokyo, Japan
- Published Lecture -- *Crisis Without End: The Medical and Ecological Consequences of the Fukushima Nuclear Catastrophe, from the Symposium at the New York Academy of Medicine, The New Press, 2014, Chapter 12, What Did They Know and When*
- Author — *The Echo Chamber: Regulatory Capture and the Fukushima Daiichi Disaster, Lessons from Fukushima*, February 27, 2012, Greenpeace International
- Author — *Fukushima Daiichi: Truth and The Way Forward*, Shueisha Publishing, February 17, 2012, Tokyo, Japan.
- Co-author — *Fairewinds Associates 2009-2010 Summary to JFC, July 26, 2010* State of Vermont, Joint Fiscal Office, (<http://www.leg.state.vt.us/jfo/envy.aspx>).
- Co-author — *Supplemental Report of the Public Oversight Panel Regarding the Comprehensive Reliability Assessment of the Vermont Yankee Nuclear Power Plant July 20, 2010*, to the Vermont State Legislature by the Vermont Yankee Public Oversight Panel.
- Co-author — The Second Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding buried pipe and tank issues at Entergy Nuclear Vermont Yankee and Entergy proposed Enexus spinoff. See two reports: *Fairewinds Associates 2nd Quarterly Report to JFC* and *Enexus Review by Fairewinds Associates*.
- Co-Author — Fairewinds Associates, Inc *First Quarterly Report to the Joint Legislative Committee*, October 19, 2009.
- Co-author — *Report of the Public Oversight Panel Regarding the Comprehensive Reliability Assessment of the Vermont Yankee Nuclear Power Plant*, March 17, 2009, to the Vermont State Legislature by the Vermont Yankee Public Oversight Panel.
- Co-author — *Vermont Yankee Comprehensive Vertical Audit – VYCVA – Recommended Methodology to Thoroughly Assess Reliability and Safety Issues at Entergy Nuclear Vermont Yankee, January 30, 2008 Testimony to Finance Committee Vermont Senate*.
- Co-author — *Decommissioning Vermont Yankee – Stage 2 Analysis of the Vermont Yankee Decommissioning Fund – The Decommissioning Fund Gap*, December 2007, Fairewinds Associates, Inc. Presented to Vermont State Senators and Legislators.
- Co-author — *Decommissioning the Vermont Yankee Nuclear Power Plant: An Analysis of Vermont Yankee’s Decommissioning Fund and Its Projected Decommissioning Costs*, November 2007, Fairewinds Associates, Inc.
- Co-author — *DOE Decommissioning Handbook, First Edition*, 1981-1982, invited author.

Patents

Energy Absorbing Turbine Missile Shield – U.S. Patent # 4,397,608 – 8/9/1983

Honors

U.S. Atomic Energy Commission Fellowship, 1972

B.S. Degree, Cum Laude, RPI, 1971, 1st in nuclear engineering class

Tau Beta Pi (Engineering Honor Society), RPI, 1969 – 1 of 5 in sophomore class of 700

James J. Kerrigan Scholar 1967–1971

Publicly commended to U.S. Senate by NRC Chairman, Ivan Selin, in May 1993 – “It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service.”

Committee Memberships

Member Board of Directors of Fairewinds Energy Education Corp, 501(c)3

Vermont Yankee Public Oversight Panel, appointed 2008 by President Pro-Tem Vermont Senate

National Nuclear Safety Network – Founding Board Member

Three Rivers Community College – Nuclear Academic Advisory Board

Connecticut Low Level Radioactive Waste Advisory Committee – 10 years, founding member

Radiation Safety Committee, NRC Licensee – founding member

ANSI N-198, Solid Radioactive Waste Processing Systems

Expert Witness Testimony and Nuclear Engineering Analysis and Consulting

Before the Public Utilities Commission of The State of California – January 27, 2017 – Prepared Direct Testimony of Arnold Gundersen of Fairewinds Associates, Inc., For San Luis Obispo Mothers for Peace regarding the: Application of Pacific Gas and Electric Company for Approval of the Retirement of Diablo Canyon Power Plant, Implementation of the Joint Proposal, and Recovery of Associated Costs Through Proposed Ratemaking Mechanisms Application 16-08-006 (Filed August 11, 2016)

Nuclear Regulatory Commission Before the Secretary – May 2, 2016, – Declaration of Arnold Gundersen To Support the Petition For Leave To Intervene And Request For Hearing By The Blue Ridge Environmental Defense League Regarding Southern Nuclear Operating Company’s Vogtle Electric Generating Plant Units 3 And 4 Request For License Amendment And Exemption: Containment Hydrogen Igniter Changes (LAR-15-003)

Fairewinds Energy Education Report Submitted to NRC in Response to an Advance Notice of Proposed Rulemaking for Regulatory Improvements for Decommissioning Power Reactors: – March 17, 2016, *The Nationwide Failures of Decommissioning Regulation: Decommissioning Trust Funds or Slush Funds?*

Fairewinds Energy Education Report Submitted to NRC for Public Comment to Staff Regarding the Decommissioning of the Vermont Yankee Atomic Reactor – March 23, 2015, *Vermont Yankee’s Decommissioning as an Example of Nationwide Failures of Decommissioning Regulation*

NRC Before the Atomic Safety and Licensing Board (ASLB) – December 1, 2014, *Gundersen Declaration Palisades Embrittlement, Docket No. 50-255, Entergy, Palisades, Petition to Intervene and for A Public Adjudication Hearing of Entergy License Amendment Request for Authorization to Implement 10 CFR §50.61a, Alternate Fracture Toughness Requirements For Protection Against Pressurized Thermal Shock Events.*

NRC Before the Commission – November 6, 2014, *Second Supplemental Declaration of Arnold Gundersen, In the Matter of Florida Power & Light Co., Docket No. 50-389, St. Lucie Plant, Unit 2.*

NRC Atomic Safety and Licensing Board (ASLB) – October 10, 2014 – *Diablo Canyon Nuclear Power Plant, Units 1 and 2 – Gundersen Affidavit Supporting Friends of the Earth's Petition to Intervene: In the matter of Pacific Gas & Electric Company Docket No. 50-275-LR & Docket No. 50-323-LR, License Renewal Application.*

NRC Hearing Request – March 10, 2014 – *Declaration of Arnold Gundersen Supporting Hearing Request* – retained by Southern Alliance for Clean Energy (SACE) in the matter of Florida Power & Light Co., Docket No. 50-389, St. Lucie Plant, Unit 2

NRC ASLB Proceeding Fermi Unit 3 52-033-COL – October 30, 2013 – Retained by Don't Waste Michigan, Beyond Nuclear et al, Oral Expert Witness Testimony regarding Contention 15: Quality Assurance.

State of Utah Seventh District Court of Emory County – September 25, 2013 – Retained by HEAL Utah et al as an expert witness testifying on cooling tower consumptive use of water for a proposed nuclear power plant owned by Blue Castle Holdings and located on the Green River. Defendants were Kane County Water Conservancy District.

Canadian Nuclear Safety Commission – May 29-30, 2013 – Retained by Durham Nuclear Awareness to present expert witness testimony in hearings regarding the proposed life extension for the Pickering Nuclear Station owned Ontario Power Generation.

Nuclear Regulatory Commission – May 30, 2013 – Expert witness report Before the Secretary NRC in the Matter of Detroit Edison Nuclear Power Station: *Rebuttal Testimony of Arnold Gundersen Supporting of Intervenors' Contention 15: DTE COLA Lacks Statutorily Required Cohesive QA Program.* Retained by Don't Waste Michigan, Beyond Nuclear et al.

Nuclear Regulatory Commission – May 20, 2013 – Expert witness report Before the Secretary NRC in the Matter of Davis Besse Nuclear Power Station: *Expert Witness Report of Arnold Gundersen to Support the Petition for Leave to Intervene and Request for Hearing by Beyond Nuclear, Citizens Environment Alliance Southwest Ontario Canada, Don't Waste Michigan, and The Sierra Club.* Retained by Beyond Nuclear, Citizens Environment Alliance Southwest Ontario Canada, Don't Waste Michigan, and The Sierra Club.

Nuclear Regulatory Commission – May 6, 2013 – Expert witness report Before the Secretary NRC: *Expert Witness Report of Arnold Gundersen to Support the Petition for Leave to Intervene and Request for Hearing by The Blue Ridge Environmental Defense League, Bellefonte Efficiency and Sustainability Team, And Mothers Against Tennessee River Radiation.* Retained by BREDL et al.

Nuclear Regulatory Commission – April 30, 2013 – Expert witness report to Atomic Safety and Licensing Board: *Testimony of Arnold Gundersen Supporting of Intervenors Contention 15: DTE Cola Lacks Statutorily Required Cohesive QA Program.* Retained by Don't Waste Michigan, Beyond Nuclear et al.

Canadian Nuclear Safety Commission (CNSC) – April 29, 2013 – Expert witness report to Canadian Nuclear Safety Commission (CNSC): *Analysis of The Relicensing Application for Pickering Nuclear Generating Station*. Retained by Durham Nuclear Awareness.

Nuclear Regulatory Commission – January 16, 2013 – Expert witness presentation to NRC Petition Review Board: *2.206 Presentation San Onofre Units 2 and 3 Replacement Steam Generators Meeting with Petitioner Friends of the Earth, Requesting Enforcement Action Against Southern California Edison Under 10 CFR 2.206*

Expert Witness Report for Friends of The Earth – July 11, 2012 – *San Onofre's Steam Generators: Significantly Worse Than All Others Nationwide*, Fairewinds Associates, Inc

Expert Witness Report for Friends of the Earth – May 15, 2012 – *San Onofre Steam Generator Failures Could Have Been Prevented*, Fairewinds Associates, Inc

Expert Witness Report for Friends of the Earth – April 10, 2012 – *San Onofre Cascading Steam Generator Failures Created by Edison: Imprudent Design and Fabrication Decisions Caused Leaks*, Fairewinds Associates, Inc

Expert Witness Report for Friends of the Earth – March 27, 2012 – *Steam Generator Failures at San Onofre: The Need for A Thorough Root Cause Analysis Requires No Early Restart*, Fairewinds Associates, Inc

Expert Witness Report for Greenpeace – February 27, 2012 – *Lessons from Fukushima: The Echo Chamber Effect*, Fairewinds Associates, Inc

Nuclear Regulatory Commission – December 21, 2011 – Expert witness report to Atomic Safety and Licensing Board: *Prefiled Direct Testimony of Arnold Gundersen Regarding Consolidated Contention RK-EC-3/CW-EC-1 (Spent Fuel Pool Leaks)*

New York State Department of Environmental Conservation – November 15-16, 2011 – Expert witness report for Riverkeeper: hearing testimony regarding license extension application for Indian Point Units 2 and 3 – contention: tritium in the groundwater.

Nuclear Regulatory Commission – November 10, 2011 – Expert witness report entitled: *Fukushima and the Westinghouse-Toshiba AP1000, A Report for the AP1000 Oversight Group by Fairewinds Associates, Inc*, and Video. Submitted to NRC by the AP1000 Oversight Group.

Nuclear Regulatory Commission – October 7, 2011 – *Testimony to the NRC Petition Review Board Re: Mark 1 Boiling Water Reactors*, Petition for NRC to shut down all BWR Mark 1 nuclear power plants due to problems in containment integrity in the Mark 1 design.

New York State Department of Environmental Conservation – October 4, 2011 – *Prefiled Rebuttal Testimony of Arnold Gundersen On Behalf of Petitioners Riverkeeper, Inc., Scenic Hudson, Inc., And Natural Resources Defense Council, Inc. To The Direct Testimony of Matthew J. Barvenik (Senior Principal GZA Geoenvironmental, Inc.) Regarding Radiological Materials*

Southern Alliance for Clean Energy (SACE) submission to TVA Board of Directors – August 3, 2011– Expert witness report entitled: *The Risks of Reviving TVA's Bellefonte Project*, and Video prepared for the Southern Alliance for Clean Energy (SACE).

New York State Department of Environmental Conservation, July 22, 2011 – Prefiled Direct Testimony of Arnold Gundersen On Behalf of Petitioners Riverkeeper, Inc., Scenic Hudson, Inc., And Natural Resources Defense Council, Inc. Regarding Radiological Materials

Nuclear Regulatory Commission – May 10, 2011 – *Comment to the proposed rule on the AP1000 Design Certification Amendment Docket ID NRC-2010-0131 As noticed in the Federal Register on February 24, 2011* Retained by Friends of the Earth as Expert Witness.

Nuclear Regulatory Commission – May 10, 2011 – *Comment to the proposed rule on the AP1000 Design Certification Amendment Docket ID NRC-2010-0131 As noticed in the Federal Register on February 24, 2011* Retained by Friends of the Earth as Expert Witness.

NRC Advisory Committee on Reactor Safeguards (ACRS) – May 26, 2011 – Lessons learned from Fukushima and Containment Integrity on the AP1000.

Vermont Energy Cooperative (VEC) – April 26, 2011 – Presentation to the Vermont Energy Cooperative Board of Directors, *Vermont Yankee – Is It Reliable for 20 more years?*

Vermont State Nuclear Advisory Panel (VSNAP) – February 22, 2011 – Testimony and presentation entitled the *Vermont Yankee Public Oversight Panel Supplemental Report* regarding management issues at the Vermont Yankee Nuclear Power Plant to the reconvened Vermont State Nuclear Advisory Panel.

Vermont State Legislature Senate Committee on Natural Resources and Energy – February 8, 2011. Testimony: *Vermont Yankee Leaks and Implications*. (<http://www.leg.state.vt.us/jfo/envy.aspx>)

Vermont State Legislature – January 26, 2011 – House Committee on Natural Resources and Energy, and Senate Committee on Natural Resources and Energy – Testimony regarding Fairwinds Associates, Inc's report: *Decommissioning the Vermont Yankee Nuclear Power Plant and Storing Its Radioactive Waste* (<http://www.leg.state.vt.us/jfo/envy.aspx>). Additional testimony was also given regarding the newest radioactive isotopic leak at the Vermont Yankee nuclear power plant.

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – Decommissioning the Vermont Yankee Nuclear Power Plant and Storing Its Radioactive Waste January 2011. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards (NRC-ACRS) AP1000 Sub-Committee – Nuclear Containment Failures: Ramifications for the AP1000 Containment Design, Supplemental Report submitted December 21, 2010.
(<http://fairewinds.com/reports>)

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – Reliability Oversight Entergy Nuclear Vermont Yankee, December 6, 2010. Discussion regarding the leaks at Vermont Yankee and the ongoing monitoring of those leaks and ENVY's progress addressing the 90-items identified in Act 189 that require remediation. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contention Regarding Consumptive Water Use at Dominion Power's Newly Proposed North Anna Unit 3 Pressurized Water Reactor in the matter of Dominion Virginia Power North Anna Power Station Unit 3 Docket No. 52-017 Combined License Application ASLBP#08-863-01-COL, October 2, 2010.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's New Contention Regarding AP1000 Containment Integrity on the Vogtle Nuclear Power Plant Units 3 And 4 in the matter of the Southern Nuclear Operating Company Vogtle Electric Generating Plant, Units 3&4 Combined License Application, Docket Nos. 52-025-COL and 52-026-COL and ASLB No. 09-873-01-COL-BD01, August 13, 2010.

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – July 26, 2010 – Summation for 2009 to 2010 Legislative Year for the Joint Fiscal Committee Reliability Oversight Entergy Nuclear Vermont Yankee (ENVY) Fairewinds Associates 2009-2010. This summary includes an assessment of ENVY's progress (as of July 1, 2010) toward meeting the milestones outlined by the Act 189 Vermont Yankee Public Oversight Panel in its March 2009 report to the Legislature, the new milestones that have been added since the incident with the tritium leak and buried underground pipes, and the new reliability challenges facing ENVY, Entergy, and the State of Vermont.
(<http://www.leg.state.vt.us/jfo/envy.aspx>)

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions in the matter of Dominion Virginia Power North Anna Station Unit 3 Combined License Application, Docket No. 52-017, ASLBP#08-863-01-COL, July 23, 2010.

Florida Public Service Commission (FPSC)

Licensing and construction delays due to problems with the newly designed Westinghouse AP1000 reactors in *Direct Testimony in Re: Nuclear Plant Cost Recovery Clause by The Southern Alliance for Clean Energy (SACE)*, FPSC Docket No. 100009-EI, July 8, 2010.

U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards (NRC-ACRS) AP1000 Sub-Committee – Presentation to ACRS regarding design flaw in AP1000 Containment – June 25, 2010 Power Point Presentation: <http://fairewinds.com/content/ap1000-nuclear-design-flaw-addressed-to-nrc-acrs>.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – *Second Declaration of Arnold Gunderson Supporting Supplemental Petition of Intervenors Contention 15: DTE COLA Lacks Statutorily Required Cohesive QA Program* – June 8, 2010.

NRC Chairman Gregory Jaczko, ACRS, Secretary of Energy Chu, and the White House Office of Management and Budget – *AP1000 Containment Leakage Report Fairewinds Associates - Gunderson, Hausler, 4-21-2010*. This report, commissioned by the AP1000 Oversight Group, analyzes a potential flaw in the containment of the AP1000 reactor design.

Vermont State Legislature House Committee on Natural Resources and Energy – April 5, 2010 – Testified to the House Committee on Natural Resources and Energy – regarding discrepancies in Entergy’s TLG Services decommissioning analysis. See *Fairewinds Cost Comparison TLG Decommissioning* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – February 22, 2010 – The Second Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding buried pipe and tank issues at Entergy Nuclear Vermont Yankee and Entergy proposed Enexus spinoff. See two reports: *Fairewinds Associates 2nd Quarterly Report to JFC* and *Enexus Review by Fairewinds Associates*. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Senate Natural Resources – February 16, 2010 – Testified to Senate Natural Resources Committee regarding causes and severity of tritium leak in unreported buried underground pipes, status of Enexus spinoff proposal, and health effects of tritium.

Vermont State Legislature Senate Natural Resources – February 10, 2010 – Testified to Senate Natural Resources Committee regarding causes and severity of tritium leak in unreported buried underground pipes. <http://www.youtube.com/watch?v=36HJiBrJSxE>

Vermont State Legislature Senate Finance – February 10, 2010 – Testified to Senate Finance Committee regarding *A Chronicle of Issues Regarding Buried Tanks and Underground Piping at VT Yankee*. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature House Committee on Natural Resources and Energy – January 27, 2010 – *A Chronicle of Issues Regarding Buried Tanks and Underground Piping at VT Yankee*. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Submittal to Susquehanna River Basin Commission, by Eric Epstein – January 5, 2010 – *Expert Witness Report of Arnold Gunderson Regarding Consumptive Water Use of the Susquehanna River by The Proposed PPL Bell Bend Nuclear Power Plant* in the Matter of RE: Bell Bend Nuclear Power Plant Application for Groundwater Withdrawal Application for

Consumptive Use BNP-2009-073.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Declaration of Arnold Gundersen Supporting Supplemental Petition of Intervenors Contention 15: Detroit Edison COLA Lacks Statutorily Required Cohesive QA Program, December 8, 2009.

U.S. NRC Region III Allegation Filed by Missouri Coalition for the Environment – Expert Witness Report entitled: Comments on the Callaway Special Inspection by NRC Regarding the May 25, 2009 Failure of its Auxiliary Feedwater System, November 9, 2009.

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – Oral testimony given to the Vermont State Legislature Joint Fiscal Committee October 28, 2009. See report: *Quarterly Status Report - ENVY Reliability Oversight for JFO* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – The First Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding reliability issues at Entergy Nuclear Vermont Yankee, issued October 19, 2009. See report: *Quarterly Status Report - ENVY Reliability Oversight for JFO* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Florida Public Service Commission (FPSC) – Gave direct oral testimony to the FPSC in hearings in Tallahassee, FL, September 8 and 10, 2009 in support of Southern Alliance for Clean Energy (SACE) contention of anticipated licensing and construction delays in newly designed Westinghouse AP 1000 reactors proposed by Progress Energy Florida and Florida Power and Light (FPL).

Florida Public Service Commission (FPSC) – NRC announced delays confirming my original testimony to FPSC detailed below. My supplemental testimony alerted FPSC to NRC confirmation of my original testimony regarding licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Supplemental Testimony in Re: Nuclear Plant Cost Recovery Clause by The Southern Alliance for Clean Energy*, FPSC Docket No. 090009-EI, August 12, 2009.

Florida Public Service Commission (FPSC) – Licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Direct Testimony in Re: Nuclear Plant Cost Recovery Clause by The Southern Alliance for Clean Energy (SACE)*, FPSC Docket No. 090009-EI, July 15, 2009.

Vermont State Legislature Joint Fiscal Committee Expert Witness Oversight Role for Entergy Nuclear Vermont Yankee (ENVY) – Appointment from July 2009 to May 2010. Contracted by the Joint Fiscal Committee of the Vermont State Legislature as an expert witness to oversee the compliance of ENVY to reliability issues uncovered during the 2009 legislative session by the Vermont Yankee Public Oversight Panel of which I was appointed a member along with former NRC Commissioner Peter Bradford for one year from July 2008 to 2009. At the time, Entergy Nuclear Vermont Yankee (ENVY) was under review by Vermont State Legislature to determine

if it should receive a Certificate for Public Good (CPG) to extend its operational license for another 20-years. Vermont was the only state in the country that had legislatively created the CPG authorization for a nuclear power plant. Act 160 was passed to ascertain ENVY's ability to run reliably for an additional 20 years.

U.S. Nuclear Regulatory Commission – Expert Witness Declaration regarding Combined Operating License Application (COLA) at North Anna Unit 3 *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions* (June 26, 2009).

U.S. Nuclear Regulatory Commission – Expert Witness Declaration regarding Through-wall Penetration of Containment Liner and Inspection Techniques of the Containment Liner at Beaver Valley Unit 1 Nuclear Power Plant *Declaration of Arnold Gundersen Supporting Citizen Power's Petition* (May 25, 2009).

U.S. Nuclear Regulatory Commission – Expert Witness Declaration regarding Quality Assurance and Configuration Management at Bellefonte Nuclear Plant *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions in their Petition for Intervention and Request for Hearing*, May 6, 2009.

Pennsylvania Statehouse – Expert Witness Analysis presented in formal presentation at the Pennsylvania Statehouse, March 26, 2009 regarding actual releases from Three Mile Island Nuclear Accident. Presentation may be found at: <http://www.tmia.com/march26>

Vermont Legislative Testimony and Formal Report for 2009 Legislative Session – As a member of the Vermont Yankee Public Oversight Panel, I spent almost eight months examining the Vermont Yankee Nuclear Power Plant and the legislatively ordered Comprehensive Vertical Audit. Panel submitted Act 189 Public Oversight Panel Report March 17, 2009 and oral testimony to a joint hearing of the Senate Finance and House Committee on Natural Resources and Energy March 19, 2009. <http://www.leg.state.vt.us/JFO/Vermont%20Yankee.htm>

Finestone v Florida Power & Light Company (FPL) (11/2003 to 12/2008) Federal Court – Plaintiffs' Expert Witness in United States District Court for the Southern District of Florida. Retained by Plaintiffs' Attorney Nancy LaVista, from Lytal, Reiter, Fountain, Clark, Williams, West Palm Beach, FL. Case# 06-11132-E. This case involved two plaintiffs in cancer cluster of 42 families alleging that illegal radiation releases from nearby nuclear power plant caused children's cancers. Production request, discovery review, preparation of deposition questions and attendance at Defendant's experts for deposition, preparation of expert witness testimony, preparation for Daubert Hearings, ongoing technical oversight, source term reconstruction and appeal to Circuit Court.

U.S. Nuclear Regulatory Commission Advisory Committee Reactor Safeguards (NRC-ACRS) – Expert Witness providing oral testimony regarding Millstone Point Unit 3 (MP3) Containment issues in hearings regarding the Application to Uprate Power at MP3 by Dominion Nuclear, Washington, and DC. (July 8-9, 2008).

Appointed by President Pro-Tem of Vermont Senate Shumlin (later elected as Vermont Governor) to Legislatively Authorized Nuclear Reliability Public Oversight Panel – To oversee Comprehensive Vertical Audit of Entergy Nuclear Vermont Yankee (Act 189) and testify to State Legislature during 2009 session regarding operational reliability of ENVY in relation to its 20-year license extension application. (July 2, 2008 to present).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Expert Witness providing testimony regarding *Pilgrim Watch's Petition for Contention 1 Underground Pipes* (April 10, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Expert Witness supporting *Connecticut Coalition Against Millstone in Its Petition for Leave to Intervene, Request for Hearing, And Contentions Against Dominion Nuclear Connecticut Inc.'s Millstone Power Station Unit 3 License Amendment Request for Stretch Power Uprate* (March 15, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Expert Witness supporting *Pilgrim Watch's Petition for Contention 1: specific to issues regarding the integrity of Pilgrim Nuclear Power Station's underground pipes and the ability of Pilgrim's Aging Management Program to determine their integrity.* (January 26, 2008).

Vermont State House – 2008 Legislative Session –

- House Committee on Natural Resources and Energy – Comprehensive Vertical Audit: *Why NRC Recommends a Vertical Audit for Aging Plants Like Entergy Nuclear Vermont Yankee (ENVY)*
- House Committee on Commerce – Decommissioning Testimony

Vermont State Senate – 2008 Legislative Session –

- Senate Finance – testimony regarding Entergy Nuclear Vermont Yankee Decommissioning Fund
- Senate Finance – testimony on the necessity for a Comprehensive Vertical Audit (CVA) of Entergy Nuclear Vermont Yankee
- House Committee on Natural Resources and Energy – testimony regarding the placement of high-level nuclear fuel on the banks of the Connecticut River in Vernon, VT

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – MOX Limited Appearance Statement to Judges Michael C. Farrar (Chairman), Lawrence G. McDade, and Nicholas G. Trikouros for the “Petitioners”: Nuclear Watch South, the Blue Ridge Environmental Defense League, and Nuclear Information & Resource Service in support of *Contention 2: Accidental Release of Radionuclides, requesting a hearing concerning faulty accident consequence assessments made for the MOX plutonium fuel factory proposed for the Savannah River Site.* (September 14, 2007).

Appeal to the Vermont Supreme Court (March 2006 to 2007) – Expert Witness Testimony in support of *New England Coalition's Appeal to the Vermont Supreme Court Concerning:*

Degraded Reliability at Entergy Nuclear Vermont Yankee as a Result of the Power Uprate. New England Coalition represented by Attorney Ron Shems of Burlington, VT.

State of Vermont Environmental Court (Docket 89-4-06-vtec 2007) – Expert witness retained by New England Coalition to review Entergy and Vermont Yankee’s analysis of alternative methods to reduce the heat discharged by Vermont Yankee into the Connecticut River. Provided Vermont's Environmental Court with analysis of alternative methods systematically applied throughout the nuclear industry to reduce the heat discharged by nuclear power plants into nearby bodies of water and avoid consumptive water use. This report included a review of the condenser and cooling tower modifications.

U.S. Senator Bernie Sanders and Congressman Peter Welch (2007) – Briefed Senator Sanders, Congressman Welch and their staff members regarding technical and engineering issues, reliability and aging management concerns, regulatory compliance, waste storage, and nuclear power reactor safety issues confronting the U.S. nuclear energy industry.

State of Vermont Legislative Testimony to Senate Finance Committee (2006) – Testimony to the Senate Finance Committee regarding Vermont Yankee decommissioning costs, reliability issues, design life of the plant, and emergency planning issues.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB) – Expert witness retained by New England Coalition to provide Atomic Safety and Licensing Board with an independent analysis of the integrity of the Vermont Yankee Nuclear Power Plant condenser (2006).

U.S. Senators Jeffords and Leahy (2003 to 2005) – Provided the Senators and their staffs with periodic overview regarding technical, reliability, compliance, and safety issues at Entergy Nuclear Vermont Yankee (ENVY).

10CFR 2.206 filed with the Nuclear Regulatory Commission (July 2004) – Filed 10CFR 2.206 petition with NRC requesting confirmation of Vermont Yankee's compliance with General Design Criteria.

State of Vermont Public Service Board (April 2003 to May 2004) – Expert witness retained by New England Coalition to testify to the Public Service Board on the reliability, safety, technical, and financial ramifications of a proposed increase in power (called an uprate) to 120% at Entergy’s 31-year-old Vermont Yankee Nuclear Power Plant.

International Nuclear Safety Testimony – Ten Days advising the President of the Czech Republic (Vaclav Havel) and the Czech Parliament on their energy policy for the 21st century.

Nuclear Regulatory Commission (NRC) Inspector General (IG) – Assisted the NRC Inspector General in investigating illegal gratuities paid to NRC Officials by Nuclear Energy Services (NES) Corporate Officers. In a second investigation, assisted the Inspector General in showing that material false statements (lies) by NES corporate president caused the NRC to overlook important violations by this licensee.

State of Connecticut Legislature – Assisted in the creation of State of Connecticut Whistleblower Protection legal statutes.

Federal Congressional Testimony –

- Publicly recognized by NRC Chairman, Ivan Selin, in May 1993 in his comments to U.S. Senate, “It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service.”
- Commended by U.S. Senator John Glenn, Chair NRC Oversight Committee for public – for testimony to NRC Oversight Committee

PennCentral Litigation – Evaluated NRC license violations and material false statements made by management of this nuclear engineering and materials licensee.

Three Mile Island Litigation – Evaluated unmonitored releases to the environment after accident, including containment breach, letdown system and blowout. Proved releases were 15 times higher than government estimate and subsequent government report.

Western Atlas Litigation – Evaluated neutron exposure to employees and license violations at this nuclear materials licensee.

Commonwealth Edison – In depth review and analysis for Commonwealth Edison to analyze the efficiency and effectiveness of all Commonwealth Edison engineering organizations, which support the operation of all of its nuclear power plants.

Peach Bottom Reactor Litigation – Evaluated extended 28-month outage caused by management breakdown and deteriorating condition of plant.

Presentations & Media

- *38 Years and Five Meltdowns Later: The Real Lessons from TMI (Three Mile Island)*, March 25, 2017, hosted by Three Mile Island Alert, Harrisburg, PA
- *Arnie Gundersen speaks with Margaret Prescod*, March 14, 2017, Sojourner Truth Radio, Pacifica Radio on the Sixth-Year Commemoration of the Fukushima Daiichi nuclear power disaster.
- *Arnie Gundersen interviewed on Radiation rattles robot in Fukushima, Newsday - BBC World Service*, High levels of nuclear radiation have forced a robot to cut short its investigations of the Fukushima reactor in Japan. The probe’s mission was to clean a passage to enable further robotic exploration, February 10, 2017.
- *Extreme Nuclear Dangers, Radio Ecoshock host Alex Smith interviews Arnie Gundersen*, the relationship between the nuclear power industry and nuclear weapons development, February 2, 2017.
- *Arnie Gundersen Appears on Project Censored with Dan Simon, Ted Rall, and Maggie Gundersen*, November 27, 2016
- *Arnie Gundersen Appears on Solartopia's Green Power and Wellness Hour*, November 16, 2016
- *Nuclear Power Is Not "Green Energy": It Is a Fount of Atomic Waste*, Published in Truthout, November 14, 2016

- *Powerstruggle Sneak Preview Panel Discussion*, Northampton, MA (October 23, 2016) Brattleboro, VT (Nov 3, 2016), organized by Turning Tide Productions
- *Is Solar Power in Nuclear Disaster Exclusion Zones Advisable?*, Published in The Bulletin of the Atomic Scientists, September 15, 2016
- *CO2 Smokescreen Presentation*, Montreal, Canada, invited speaker at the World Social Forum at the University of Quebec at Montreal (August 8, 2016) & McGill University, (August 10, 2016)
- *Gendai Business Online* exclusive interview with Fairewinds Chief Engineer Arnie Gundersen entitled: *American nuclear expert warns: "There is a possibility that now in Fukushima recontamination is occurring."*, June 14, 2016.
- *Seacoast Anti-Pollution League Annual Meeting*, Seabrook, NH, organized by the Seacoast Anti-Pollution League, open to the public, May 16, 2016
- *Arnie Gundersen Appears on Project Censored with Medea Benjamin*, March 30, 2016
- *Pilgrim Coalition Decommissioning Forum*, Plymouth, MA, organized by the Pilgrim Coalition, March 23, 2016
- *Osaka Global Environment Forum 2016*, in Osaka City, Japan, organized by Choetsu Kiko Association of Osaka and Friends of the Earth, February 27, 2016
- *Peace Forum Presentation*, in Kobe City, Japan, organized by YMCA, UNICEF, and Kobe Cooperative, February 22, 2016
- *Nuclear and Human Beings after Fukushima Event*, in Hiroshima City, Japan organized by Hiroshima YMCA, and Hiroshima Cooperative HANWA (Hiroshima Alliance for Nuclear Weapons Abolition), February 20, 2016
- *Peace Event at Jimmy Carter Civic Center*, in Konu-town Miyoshi, Hiroshima, Japan organized by Peace Platform, February 17, 2016
- *Middlebury College Student Global Affairs Conference: Power and Protest*, Middlebury, VT at Middlebury College, invited speaker for a student organized event, January 22, 2016
- *Ready for the Big One? Diablo Canyon Earthquake Vulnerability*, San Luis Obispo, invited guest of the San Luis Obispo Mothers for Peace, December 2, 2015
- *Expect the Unexpected: Nuclear Power's Unlearned Lessons*, California Polytechnic Institute, December 1, 2015
- *World in Danger: From Fukushima to California*, University of California at Berkeley, in conversation with Joanna Macy, November 22, 2015
- *World in Danger: The Fukushima - California Connection*, Point Reyes Station, in conversation with Mary Beth Brangan, November 21, 2015
- *World in Danger: Fukushima*, Sonoma State University, in conversation with Majia Nadesan, November 18, 2015
- *Fukushima's Impact at Five Years*, World Uranium Symposium 2015: Fukushima Workshop, April 2015
- *Did Tesla Just Kill Nuclear Power?* May 1, 2015, Article written by journalist Jeff McMahon for Forbes Magazine that captures the excitement and buzz surrounding Tesla's big announcement and Arnie's auspicious speech
- *Building New Nukes Would Make Global Warming Worse* April 30, 2015, Speech presented at Northwestern University, Chicago, IL

- *Fairewinds' Report: Vermont Yankee's Decommissioning As An Example of Nationwide Failures of Decommissioning Regulation presented to the Senate Committee for Natural Resources and Energy* April 22, 2015, Presentation Vermont Statehouse, Montpelier, VT
- *An Economic Analysis of the Cost of Nuclear Power* April 14, 2015, Presentation at the World Uranium Symposium, Quebec City, Quebec, Canada, Keynote Speaker
- *Commemoration of Meltdown at Fukushima Daiichi: 4-Years Later* March 11, 2015, Presentation to the House of Commons in London, England
- *Should Nuclear Energy Be Expanded to Help Create a More Sustainable Future?* November 20, 2014, Invited guest speaker in Debate at Hofstra University
- *Radiation Knows No Borders* August 2, 2014, Invited speaker at The Wave Conference, Life Chiropractic West, San Francisco, CA
- *Thirty-Five Years and Five Meltdowns Later: The Real Lessons of Three Mile Island* March 28, 2014, Three Mile Island at 35 (TMI@35) Symposium at Penn State, Harrisburg, PA, Keynote Speaker
- *The Nuclear Renaissance? Is It Too Big To Fail?* November 20, 2013, University North Carolina, Chapel Hill, NC.
- *Speaking Truth to Power* October 22, 2013 – Clarkson University, Potsdam, NY
- *The United States at A Crossroads: Two Futures* October 17 2013, Global Forum, Waitsfield, Vermont
- *A Road Less Taken: Energy Choices for the Future* – October 16, 2013, Johnson State College, Johnson, Vermont.
- *Fukushima: Ongoing Lessons for Boston* – October 9, 2013 – Boston, Massachusetts State House. Speakers were Arnie Gunderson, Former Japanese Prime Minister Naoto Kan, Former NRC Chair Gregory Jaczko, Former NRC Commissioner Peter Bradford, and Massachusetts State Senator Dan Wolf.
- *Fukushima: Ongoing Lessons for New York* – October 8, 2013 – New York City 82nd Street YMCA. Speakers were Arnie Gunderson, Riverkeeper President Paul Galley, Former Japanese Prime Minister Naoto Kan, Former NRC Chair Gregory Jaczko, Former NRC Commissioner Peter Bradford, and Ralph Nader.
- *Fukushima: Ongoing Lessons for California* – June 4, 2013 – New York City 82nd Street YMCA. Speakers were Arnie Gunderson, Riverkeeper President Paul Galley, Former Japanese Prime Minister Naoto Kan, Former NRC Chair Gregory Jaczko, Former NRC Commissioner Peter Bradford, and Friends of the Earth Nuclear Campaigner Kendra Ulrich.
- *What Did They Know and When? Fukushima Daiichi Before and After the Meltdowns*, Symposium: The Medical and Ecological Consequences of the Fukushima Nuclear Accident, The New York Academy of Medicine, New York City, NY, March 11, 2013
- *A Mountain of Waste 70 Years High*, Presentation: *Old and New Reactors*, University of Chicago, December 1, 2012
- Congressional Briefing September 20, 2012; invited by Representative Dennis Kucinich
- Presentations in Japan August/September 2012: Presentation at University of Tokyo (August 30, 2012), Presentation at Japanese Diet Building (members of the Japanese Legislature - August 31, 2012), Presentation to citizen groups in Niigata (September 1, 2012), Presentations to citizen groups in Kyoto (September 4, 2012), Presentation to Japanese Bar Association (September 2, 2012), and Presentation at the Tokyo Olympic Center (September 6, 2012)

- Multi-media Opera: *Curtain of Smoke*, by Filmmaker Karl Hoffman, Composer Andrea Molino, and Dramatist Guido Barbieri, Rome, Italy (2012-5-21,22)
- Curtain of Smoke Symposium (2012-5-21), with Dr. Sherri Ebadi 2004 Nobel Laureate
- The Italian National Press Club Rome (2012-5-21) with Dr. Sherri Ebadi 2004 Nobel Laureate: the relationship between nuclear power and nuclear weapons,
- Radio 3 Rome (2012-5-21) Discussion of Three Mile Island and the triple meltdown at Fukushima Daiichi (Japan),
- Sierra Club Panel Discussions (2012-5-5): Consequences of Fukushima Daiichi with Paul Gunter and Waste Disposal with Mary Olson,
- Physicians for Social Responsibility Seattle (2012-3-17),
- Fukushima Daiichi Forum with Chiho Kaneko, Brattleboro, VT (2012-3-11),
- Physicians for Global Responsibility Vancouver (2012-3-11) Skype Video Lecture,
- University of Vermont (2 – 2011),
- Boston Nuclear Forum, Boston Library (6/16/11),
- Duxbury Emergency Management (6/15/11),
- Vermont State Nuclear Advisory Panel (VSNAP),
- New Jersey Environmental Federation (5/14/11),
- Press Conference for Physicians for Social Responsibility (5/19/11),
- St. Johnsbury Academy – Nuclear Power 101.

Educational videos on nuclear safety, reliability and engineering particularly Fukushima issues.

Videos may be viewed @ fairewinds.org (501c3 non-profit)

Expert commentary (many more unnamed): CNN (8), The John King Show (16), BBC, CBC, Russia Today, Democracy Now, Al Jazeera America, KPBS (Radio & TV) VPR, WPTZ, WCAX, WBAI, CCTV, NECN, Pacifica Radio, CBC (radio & TV) (4), Rachel Maddow Show, *Washington Post*, *New York Times*, *Tampa Bay Times*, *The Guardian*, *Bloomberg* (print & TV), *Reuters*, *Associated Press*, *The Global Post*, *Miami Herald*, *Orange County Times*, *LA Times*, *Al Jazeera* (print), *The Tennessean*, The Chris Martinson Show, *Mainichi News*, TBS Japan, *Gendai Magazine*, NHK television, *Scientific American*. *Huffington Post* (Paris) named [Fairewinds.com](http://fairewinds.com) the best go to site for information about the Fukushima Daiichi accident (5/9/11).

Special Remediation Expertise:

Director of Engineering, Vice President of Site Engineering, and the Senior Vice President of Engineering at Nuclear Energy Services (NES) Division of Penn Central Corporation (PCC)

- NES was a nuclear licensee that specialized in dismantlement and remediation of nuclear facilities and nuclear sites. Member of the radiation safety committee for this licensee.
- Department of Energy chose NES to write *DOE Decommissioning Handbook* because NES had a unique breadth and depth of nuclear engineers and nuclear physicists on staff.
- Personally, I wrote the “Small Bore Piping” chapter of the DOE’s first edition *Decommissioning Handbook*, personnel on my staff authored other sections, and I reviewed the entire *Decommissioning Handbook*.
- Served on the Connecticut Low Level Radioactive Waste Advisory Committee for 10 years from its inception.

- Managed groups performing analyses on dozens of dismantlement sites to thoroughly remove radioactive material from nuclear plants and their surrounding environment.
- Managed groups assisting in decommissioning the Shippingport nuclear power reactor. Shippingport was the first large nuclear power plant ever decommissioned. The decommissioning of Shippingport included remediation of the site after decommissioning.
- Managed groups conducting site characterizations (preliminary radiation surveys prior to commencement of removal of radiation) at the radioactively contaminated West Valley site in upstate New York.
- Personnel reporting to me assessed dismantlement of the Princeton Avenue Plutonium Lab in New Brunswick, NJ. The lab's dismantlement assessment was stopped when we uncovered extremely toxic and carcinogenic underground radioactive contamination.
- Personnel reporting to me worked on decontaminating radioactive thorium at the Cleveland Avenue nuclear licensee in Ohio. The thorium had been used as an alloy in turbine blades. During that project, previously undetected extremely toxic and carcinogenic radioactive contamination was discovered below ground after an aboveground gamma survey had purported that no residual radiation remained on site.

Teaching and Academic Administration Experience

University of Vermont Community Research Fellow, appointed January 2016

Rensselaer Polytechnic Institute (RPI) – Advanced Nuclear Reactor Physics Lab

Community College of Vermont – Mathematics Professor – 2007 through Spring 2013

Nuclear Engineering 1970 to Present

Expert witness testimony in nuclear litigation and administrative hearings in federal, international, and state court and to Nuclear Regulatory Commission, including but not limited to: Three Mile Island, US Federal Court, US NRC, NRC ASLB, ACRS, and Petition Review Board, California Public Utilities Commission, Canadian Nuclear Safety Commission, Diet (Parliament) Japan, Vermont State Legislature, Vermont State Public Service Board, Florida Public Service Board, Czech Senate, Connecticut State Legislature, Western Atlas Nuclear Litigation, U.S. Senate Nuclear Safety Hearings, Peach Bottom Nuclear Power Plant Litigation, and Office of the Inspector General NRC, and numerous Congressional Briefings and Hearings.

Nuclear Engineering, Safety, and Reliability Expert Witness 1990 to Present

- Fairewinds Associates, Inc – Chief Engineer, 2005 to Present
- Arnold Gundersen, Nuclear Safety Consultant and Energy Advisor, 1995 to 2005
- GMA – 1990 to 1995, including expert witness testimony regarding the accident at Three Mile Island.

Nuclear Energy Services, Division of PCC (Fortune 500 company) 1979 to 1990

Corporate Officer and Senior Vice President - Technical Services – Responsible for overall performance of the company's Inservice Inspection (ASME XI), Quality Assurance (SNTC 1A), and Staff Augmentation Business Units – up to 300 employees at various nuclear sites.

Senior Vice President of Engineering – Responsible for the overall performance of the company's Site Engineering, Boston Design Engineering and Engineered Products Business Units. Integrated the Danbury based, Boston based and site engineering functions to provide products such as fuel racks, nozzle dams, and transfer mechanisms and services such as materials management and procedure development.

Vice President of Engineering Services – Responsible for the overall performance of the company's field engineering, operations engineering, and engineered products services. Integrated the Danbury-based and field-based engineering functions to provide numerous products and services required by nuclear utilities, including patents for engineered products.

General Manager of Field Engineering – Managed and directed NES' multi-disciplined field engineering staff on location at various nuclear plant sites. Site activities included structural analysis, procedure development, technical specifications and training. Have personally applied for and received one patent.

Director of General Engineering – Managed and directed the Danbury based engineering staff. Staff disciplines included structural, nuclear, mechanical and systems engineering. Responsible for assignment of personnel as well as scheduling, cost performance, and technical assessment by staff on assigned projects. This staff provided major engineering support to the company's nuclear waste management, spent fuel storage racks, and engineering consulting programs.

New York State Electric and Gas Corporation (NYSE&G) — 1976 to 1979

Reliability Engineering Supervisor – Organized and supervised reliability engineers to upgrade performance levels on seven operating coal units and one that was under construction. Applied analytical techniques and good engineering judgments to improve capacity factors by reducing mean time to repair and by increasing mean time between failures.

Lead Power Systems Engineer – Supervised the preparation of proposals, bid evaluation, negotiation and administration of contracts for two 1300 MW NSSS Units including nuclear fuel, and solid-state control rooms. Represented corporation at numerous public forums including TV and radio on sensitive utility issues. Responsible for all nuclear and BOP portions of a PSAR, Environmental Report, and Early Site Review.

Northeast Utilities Service Corporation (NU) — 1972 to 1976

Engineer – Nuclear Engineer assigned to Millstone Unit 2 during start-up phase. Lead the high velocity flush and chemical cleaning of condensate and feedwater systems and obtained discharge permit for chemicals. Developed Quality Assurance Category 1 Material, Equipment and Parts List. Modified fuel pool cooling system at Connecticut Yankee, steam generator blowdown system and diesel generator lube oil system for Millstone. Evaluated Technical Specification Change Requests.

Associate Engineer – Nuclear Engineer assigned to Montague Units 1 & 2. Interface Engineer with NSSS vendor, performed containment leak rate analysis, assisted in

preparation of PSAR and performed radiological health analysis of plant. Performed environmental radiation survey of Connecticut Yankee. Performed chloride intrusion transient analysis for Millstone Unit 1 feedwater system. Prepared Millstone Unit 1 off-gas modification licensing document and Environmental Report Amendments 1 & 2.

Rensselaer Polytechnic Institute (RPI) — 1971 to 1972

Critical Facility Reactor Operator, Instructor – Licensed AEC Reactor Operator instructing students and utility reactor operator trainees in start-up through full power operation of a reactor.

Public Service Electric and Gas (PSE&G) — 1970

Assistant Engineer – Performed shielding design of radwaste and auxiliary buildings for Newbold Island Units 1 & 2, including development of computer codes.

Media Organizations - including and not limited to:

Featured Nuclear Safety and Reliability Expert (1990 to present) for Television, Newspaper, Radio, & Internet – Including, and not limited to: CNN: JohnKingUSA, CNN News, Earth Matters; DemocracyNow, NECN, WPTZ VT, WTNH, VPTV, WCAX, RT, CTV (Canada), CCTV Burlington, VT, ABC, TBS/Japan, Bloomberg: EnergyNow, KPBS, Japan National Press Club (Tokyo), Italy National Press Club (Rome), The Crusaders, Front Page, Five O'Clock Shadow: Robert Knight, Mark Johnson Show, Steve West Show, Anthony Polina Show, WKVT, WDEV, WVPR, WZBG CT, Seven Days, AP News Service, Houston Chronicle, Christian Science Monitor, Reuters, The Global Post, International Herald, The Guardian, New York Times, Washington Post, LA Times, Miami Herald, St. Petersburg Times, Brattleboro Reformer, Rutland Herald, Times-Argus, Burlington Free Press, Litchfield County Times, The News Times, The New Milford Times, Hartford Current, New London Day, Vermont Daily Briefing, Green Mountain Daily, EcoReview, Huffington Post, DailyKos, Voice of Orange County, AlterNet, Common Dreams, Gendai Media, Truthout, Progressive Radio Network, Project Censored and numerous other national and international blogs

Public Service, Cultural, and Community Activities

2008 to Present –Fairewinds Energy Education Corp 501(C)3 non-profit board member

2005 to Present – Public presentations and panel discussions on nuclear power safety, reliability, economics, waste disposal, and decommissioning at numerous universities and colleges in the US, Canada, and Japan – including: Northwestern University, Life Chiropractic West, Middlebury College, McGill University, Hofstra University, New York School of Medicine, Cal Poly, Sonoma State, Amherst College, University of Vermont, Vermont Law School, Tokyo University, and before the Nuclear Regulatory Commission in hearings, Federal Court, Town and City Select Boards, Legal Panels, Local Schools, and via National & International Media: Television, Radio, Print, & Internet.

2007-2008 – Energy Production – created concept of Solar Panels on Burlington High School; worked with Burlington Electric Department and Burlington Board of Education Technology Committee on Grant for installation of solar collectors for Burlington Electric peak summer use; Grant was developed with assistance from Senator Sanders.

Vermont State Legislature – Public Testimony to Legislative Committees regarding nuclear power and energy issues

NNSN – National Nuclear Safety Network, Founding Advisory Board Member, meetings with
and testimony to the Nuclear Regulatory Commission Inspector General (NRC IG)
New York State Electric & Gas (NYSE&G) Speakers Club speaking about nuclear waste issues.
Northeast Utilities Representative Conducting Public Lectures on Nuclear Safety Issues with the
Northeast Utilities Speakers Bureau

End

VY Decommissioning Fund

Thousands of 2011 dollars

Scenario 1, 2012 Shutdown, SAFSTOR, p.61

Fuel Offsite 2045

		5.0		3.0		
	Year	Start of year fund balance	2012 SD Entergy Costs 2012 \$	2015 SD Inflated Costs	End of year fund balance	
1	2012		65,407			
2	2013		104,154			
3	2014	660,000	34,692		660,000	660.000
4	2015	693,000	34,692	71,294	621,706	621.706
5	2016	652,792	34,787	116,652	536,139	536.139
6	2017	562,946	16,733	39,896	523,050	523.050
7	2018	549,203	3,332	40,937	508,266	508.266
8	2019	533,680	3,332	42,092	491,587	491.587
9	2020	516,167	3,332	20,749	495,418	495.418
10	2021	520,189	3,332	4,232	515,957	515.957
11	2022	541,755	3,332	4,332	537,423	537.423
12	2023	564,294	31,238	4,432	559,863	559.863
13	2024	587,856	66,444	4,532	583,325	583.325
14	2025	612,491	103,880	4,631	607,859	607.859
15	2026	638,252	71,672	44,358	593,894	593.894
16	2027	623,589	71,048	96,344	527,245	527.245
17	2028	553,607	51,357	153,742	399,865	399.865
18	2029	419,858	32,021	108,225	311,634	311.634
19	2030	327,215	22,668	109,414	217,801	217.801
20	2031	228,691		80,630	148,061	148.061
21	2032	155,464		51,234	104,230	104.230
22	2033	109,442		36,949	72,493	72.493
23	2034	76,118		0	76,118	76.118
24	2035	79,924		0	79,924	79.924
25	2036	83,920		0	83,920	83.920
26	2037	88,116		0	88,116	88.116
27	2038	92,522		0	92,522	92.522