Docket Nos. 52-025-COL and 52-026-COL
BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE
EXHIBIT ONE

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the matter of		
Southern Nuclear Operating Company	)	Docket Nos. 52-025-COL and
	)	52-026-COL
Vogtle Electric Generating Plant, Units 3&4	)	ASLBP No. 09-873-01-COL-BD01
Combined License Application	)	August 13, 2010

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

I, Arnold Gundersen, declare as follows:

1. My name is Arnold Gundersen. I am over the age of 18-years-old.

2. The Blue Ridge Environmental Defense League (BREDL) has retained me as an expert witness in the above captioned matter, and my declaration is intended to support the Contentions of Blue Ridge Environmental Defense League.

3. I earned my Bachelor's Degree in Nuclear Engineering from Rensselaer Polytechnic Institute (RPI) cum laude. I earned my Master's Degree in Nuclear Engineering from RPI via an Atomic Energy Commission Fellowship.

4. 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 2.

5. I have qualified as an expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), the State of Vermont Public Service Board, the State of Vermont Environmental Court, and the Florida Public Service Commission.

6. I am an author of the first edition of the Department of Energy (DOE) Decommissioning Handbook.

7. As an appointee of Vermont State Legislature for the past two years, I am 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.

8. I have more than 38-years of professional nuclear experience *including and not limited to*: Nuclear Power Operations, Nuclear Safety Assessments, Nuclear Power Management, Nuclear Quality Assurance, Archival Storage and Document Control, NRC Regulations and Enforcement, Licensing, Engineering Management, Contract Administration, Reliability Engineering, In-service Inspection, Thermohydraulics, Criticality Analysis, Radioactive Waste Processes, Decommissioning, Waste Disposal, Cooling Tower Operation, Cooling Tower Plumes, Consumptive Water Use, Source Term Reconstruction, Dose Assessment, Technical Patents, Structural Engineering Assessments, Nuclear Fuel Rack Design and Manufacturing, Nuclear Equipment Design and Manufacturing, Public Relations, Prudency Defense, Employee Awareness Programs, and Whistleblower Protection.

9. My declaration is intended to support Contentions of the Blue Ridge Environmental Defense League and is specific to issues regarding the Combined License Application (COLA), of the Southern Nuclear Operating Company for the Vogtle Electric Generating Plant, Units 3&4.

BACKGROUND

10. On April 21, 2010, the AP1000 Oversight Group, represented by Attorney John Runkle, submitted the *AP1000 Containment Leakage Report Fairewinds Associates*

- *Gundersen, Hausler, 4-21-2010* by Fairewinds Associates, Inc. to the NRC, attached as Exhibit 3.

11. In response to an invitation from the NRC Advisory Committee on Reactor Safeguards (ACRS), Attorney John Runkle and I made an hour and 15 minute presentation to the ACRS on June 25, 2010. The PowerPoint presentation PDF is attached herein as Exhibit 4 and the relevant portion of the ACRS transcript from our presentation to the ACRS is attached as Exhibit 5. The PowerPoint slide show and accompanying audio transcript of the meeting and discussion may be viewed at http://fairewinds.com/content/ap1000-nuclear-design-flaw-addressed-to-nrc-acrs

NEW CONTENTION

12. In the United States, each of the 104 commercial nuclear power plants has a reactor that is fully encased by a containment system.

13. The primary containment system is usually steel or a combination of steel and concrete. Historically the containment system has a secondary system designed to collect any radiation that leaks out and subsequently releases those gases through a stack only after the radioactivity is filtered to specific limits designed to protect public health and safety.

14. In direct contrast to the containment system design of the currently operating nuclear power plants, the Vogtle AP1000 is unique among all other operating pressurized water reactors (PWR's) in that its containment has only a single barrier.

15. Moreover, behind this single barrier there is an air gap that has been specifically designed to pull any air or gases that enter the gap and release them directly into the environment.

16. I named the phenomena of pulling air or gases into the annular gap and wafting them out into the environment as the *chimney effect* in the report I wrote entitled, *AP1000 Containment Leakage Report Fairewinds Associates - Gundersen, Hausler, 4-21-2010* that was presented to the ACRS via a PowerPoint presentation June 25,

2010. My report is Exhibit 3.

17. Nuclear power plant containment systems have a long history of degradation, cracking, and through-wall holes. While there is no single source that identifies all of these containment system problems, I estimate that there have been at least 80-significant cases of containment degradation on United States (U.S.) nuclear reactors during the last several decades. Of these 80 or more incidents, approximately 40 incidents are directly related to failure of the concrete, and approximately 40 incidents of containment system failure are related to failure of the steel.

18. Despite the history of containment integrity failure, Westinghouse has assumed that there is a zero percent probability that its new AP1000 design will fail in an accident scenario and would release any radioactive isotopes.

19. Since the AP1000 has no concrete in its containment system, the remainder of my analysis will address the 40 instances of steel corrosion and steel cracking in U.S. nuclear reactor containment systems.

20. My research indicates that there are four causative factors for steel containment or containment liner failure. These factors are:
    - 20.1. corrosion of the steel,
    - 20.2. inadequate inspections,
    - 20.3. cracking of the steel, and
    - 20.4. protective coating failures.

21. Additionally, although in some cases the steel liner or containment did not rust through completely, in many other cases there was a complete penetration of either the containment liner or the containment itself.

22. As I discussed in great detail in my attached report, there have been rust-related holes discovered in the liners at Brunswick, DC Cook, Beaver Valley, and other reactors. These holes have been complete penetrations through the steel liners that have had a secondary concrete containment behind them.

23. The NRC Staff's response to these through-wall penetrations of the steel containment is that the secondary containment system would have protected public health and safety by preventing any outside leakage of radioactive material.

24. Additionally, there have also been numerous recorded instances reporting that containment liners have thinned to a level below the regulated minimum-wall thickness and at the same time the protective coatings on the outside of the steel containment system have also failed.

25. In addition to the reported liner failures, there have also been repeated through-wall cracks in thicker containments that happen to be quite similar in design to the AP1000 containment. The through-wall cracks that have heretofore been uncovered have occurred at Hatch 1, Hatch 2, and Fitzpatrick.

26. These through-wall crack failures in the containment are not due to rust but are cracks that have developed over a long period of time due to thermal stress.

27. Therefore, the first item of great concern is that each of the liner or containment failures that have been uncovered to date shares a significant common element. The significant common element is that in every case, the American Society of Mechanical Engineers (ASME) inspection techniques have failed to detect any problem until a crack or hole has in fact become a through-wall failure.

27.1. As I discussed in my June 25 presentation to the ACRS (Exhibit 4), in each instance the nuclear licensee firmly believed that ASME inspections alone were a reliable method of assessing containment integrity. Moreover, even the NRC had concurred that ASME inspections by themselves were a reliable method of determining containment integrity.

27.2. Instead, through-wall cracks and holes have developed without warning in containment systems monitored by ASME inspections thus proving that the use of ASME inspections to monitor containment integrity is a wholly inadequate methodology.

28. The second item of major concern regarding containment integrity is the nuclear industry's belief in the viability of protective coatings as a reliable barrier in the protection of public health and safety, when in fact the protective coatings applied to containment systems have a significant history of abject failure.

28.1. In the Fairewinds Associates, Inc PowerPoint presentation to the ACRS (Exhibit 4), I alerted the NRC to the significant failure rate of protective coatings.

28.2. Although protective coating applications have been failing for more than 10-years, the NRC continues to approve these coatings and nuclear power plant licensees continue to claim that these protective coatings are an effective barrier to unmonitored radiation releases.

28.3. Finally, even the NRC Inspector General faults the NRC for not adequately evaluating the veracity of nuclear power plant licensee claims that these protective coatings aid in maintaining containment integrity prior to the NRC approval of nuclear power plant license extensions for an additional 20-years of operation. (Inspector General Report OIG-07-A-15)

29. The Vogtle AP1000 nuclear power plant design is directly and significantly impacted by the nuclear industry's experience of through wall cracks, liner failures, and through-wall rust holes.

30. As I stated earlier in this declaration, existing U.S. operating nuclear power plants have reactors that are backed up by a secondary containment system. In effect such a containment system functions like a double-hulled oil tanker in that if one hull fails, there is a second hull intact to protect the cargo. Similarly, the AP1000 design is comparable to only a single hulled vessel. Thus, in the event of a crack during an AP1000 Loss of Coolant Accident, radioactive gases would leak directly into the environment because they would be wafted out of the containment vessel via the chimney effect I discuss in detail in Exhibits 3 and 4.

31. In lay terminology, *single failure proof* means that a failure caused by a single event will not immediately cascade into failure of the whole system. By design, emergency equipment in a nuclear power plant is expected to be redundant and therefore guarantee that if one emergency system fails to shut down the reactor or cool the fuel, then a second emergency system would take over and complete that critical function. The design of the Vogtle AP1000 containment system is not a single failure proof system. As both Vogtle 3 and 4 are currently designed, if a crack or a hole should develop, radioactive material will leak directly into the environment.

32. To compensate for Vogtle's flaw in containment integrity, the industry and the NRC staff are claiming that protective coatings and the ASME inspection program are mitigating factors that would assure protection of public health and safety in the case of an accident in the single-hulled Vogtle design. However, the data reviewed does not substantiate this industry claim, and instead confirms what the industry knows to be true, that both protective coatings and ASME containment inspection programs have been proven to be wholly inadequate. Due to Vogtle's coating and inspection problems on its proposed Units 3 and 4, critical measures that are discussed in my conclusion must be implement at Vogtle.

CONCLUSION

33. My report to the NRC and presentation to the ACRS concerning industry problems with containment integrity directly addresses containment integrity for the AP1000. With the current AP1000 design, the evidence reviewed shows that there is a significant likelihood of post-accident radioactive isotopic leakage into the environment that will exceed design bases values. Equally important, nuclear engineer and analyst Dr. Gianni Petrangeli has suggested that there is a 46% probability that containment leakage in new reactors could exceed technical specification values during an accident by a factor of 10.

34. Neither the NRC nor the applicant SNC have evaluated the likelihood of a through-wall containment leak at Vogtle that could lead to greater-than-design-basis isotopic leakage in the event of an accident:

34.1. Industry experience indicates through-wall cracking has occurred repeatedly in existing containment systems.

34.2. Industry experience indicates through-wall rust has occurred repeatedly in existing containment systems.

34.3. Industry experience indicates ASME inspection programs have failed to detect cracks and rust holes.

34.4. Industry experience indicates that protective coatings have failed in containment systems.

35. Despite these known failure mechanisms and burgeoning history of containment failure, Southern Nuclear Operating Company assumes the probability for a containment breach at Vogtle to be zero. SNC's assumption regarding Vogtle is not consistent with the historical evidence.

36. Moreover, SNC's proposed Vogtle AP1000 design exacerbates the dispersion of radioactive material during and after an accident.

37. In conclusion, the reactor containment system proposed at Vogtle creates a unique, unanalyzed risk to public health and safety, and there is inadequate assurance that radiation releases during and following an accident will ever meet 10CFR100 accident exposure limits.

38. Clearly, the design changes I discussed during my meeting with the ACRS requiring a filtered ventilation system must be implemented.

39. Fairewinds' Report (Exhibit 3) and PowerPoint presentation to the ACRS (Exhibit 4) clearly establish that existing ASME XI inspection programs for containments and containment liners on operating reactors have a long history of failing to detect incipient cracks or rust until the metal has been completely breached. Yet in Chapter 6 of the Vogtle COL application, the Applicant relies only upon meeting these criteria that have already failed in the past. Given the Vogtle Unit 3 and 4's unique

containment design, the existing inspection regime suggested by the applicant does not provide adequate margins of safety. In addition to the inspections suggested in SNC's COLA, a 100% volumetric inspection of the containment from the inside of the containment once every refueling outage should be required by the ASLB and NRC in order to assure that through-wall propagation of holes or cracks is not occurring.

40. The Fairewinds Associates' Report (Exhibit 3) and Fairewinds' PowerPoint presentation to the ACRS (Exhibit 4) clearly establish that existing ASTM coating application programs and ASTM coating monitoring programs for containment systems and containment liners on operating reactors have a long history of failing to prevent incipient rust until the metal has been completely breached. Page 18 of the Fairewinds' Report (Exhibit 3) clearly indicates that "While coatings can provide some protection when properly applied, there is no assurance that field application can be completely successful...." PowerPoint slide number 8 of Exhibit 4 shows field applied coating failures that the NRC allowed to exist for more than 10-years.

41. Yet in Chapter 6 of the Vogtle COLA, the Applicant relies only upon meeting ASTM D5144-08, ASTM D5163-05a, and ASTM D7167-05. These policies have already failed in the past as indicated in Exhibits 3 and 4. Given that the containment and attached hangers will be welded in the field and coatings will also be applied in the field after welding is completed, the existing coating application and inspection regime suggested by the applicant does not provide adequate margins of safety in Vogtle Units 3 and 4.

42. The applicant bases the adequacy of its coating program on claims that periodic external visual examinations. The annular gap outside the containment provides limited access for personnel and the environmental conditions in the gap are not conducive to long term occupancy. Access ports have been provided for limited visual inspections, however full 360-degree visual inspections of the hangers that are attached to the containment will be nearly impossible to achieve. As discussed in Exhibit 3, these hangers are the most likely location for corrosion to begin, yet are

most difficult to examine. Additionally, coatings will only be applied to a depth of six inches below floor level, and crevices in that area are likely to create rust deposits near the floor similar to those that recently occurred at the Salem PWR.

43. Access problems will definitely limit visual inspections and the frequency of inspections planned by SNC is not adequate to prevent rust propagation. Therefore, for all these reasons, continuous external monitoring of the containment coating by robotic means is required to assure rust will not develop. Additionally, along with the continuous external robotic monitoring, the containment system must also be examined with internal volumetric exams as discussed in #39 of this declaration.

44. Finally, given the probability of gaseous release of radioactive isotopes in the event of an accident, the Vogtle emergency planning zones and the owner-controlled exclusion zones must be expanded.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this day, August 12, 2010 at Burlington, Vermont.

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Arnold Gundersen, MSNE
Chief Engineer, Fairewinds Associates, Inc