UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of

Northeast Utilities (Millstone Nuclear Station Unit 2)

Docket Number 50-336-OLA

Folder Number DPR-65

ASLB Panel 92-665-02-OLA (Spent Fuel Pool Design)

Declaration of Dr. Michio Kaku

I, Dr. Michio Kaku, this 23rd day of August, 1992, declare and state as follows:

1. I am a full professor of theoretical nuclear physics at the Graduate Center of the City University of New York and also the City College of New York. I received my B.A. degree in physics from Harvard University in 1968 (Phi Beta Kappa, *summa cum laude*). I received my Ph.D. in theoretical physics from the Lawrence Radiation Laboratory at the Univ. of Calif. at Berkeley in 1972. In 1972-3, I was a lecturer at Princeton University. Since 1973, I have been a professor at the City Univ. of New York. I have been a visiting professor at the following institutions: Institute for Advanced Study at Princeton (1990), New York University (1988), and the Calif. Inst. of Tech. (1976). I have written 7 books in physics, and published about 60 professional papers in standard physics journals. I have also contributed to 10 other books edited by fellow physicists. I am the author of *Nuclear Power: Both Sides*, which has become a standard textbook concerning the nuclear controversy on many college campuses. My most recent book is *Quantum Field Theory: a Modern Introduction* (to be published by Oxford Univ. Press.) and *Beyond Einstein: the*

Cosmic Quest for the Theory of the Universe (Bantam Books). I am also a Fellow of the American Physical Society, the largest organization of physicists in the U.S., which is an honor only held by the top 10% of physicists in this country.

2. I have read some, but not all, of the documents concerning Northeast's Utility's rearrangement of the spent fuel pool for Millstone Unit 2. I understand that Region I will be partitioned into Region A and B, resulting in a net replacement of fresh fuel with more depleted fuel. I understand that the rearrangement of the spent fuel was originally proposed as one way in which to compensate for the unexpected rate of degradation in the Boroflex boxes, and also because an error of 5% was found in Combustion Engineering's original computer calculation of the neutron reactivity, which resulted in k_{eff} exceeding the NRC 95/95 limit of .95 for the pool.

3. I am also aware of the utilities' main argument: that the rearrangement can only *reduce* the pool's storage capacity, and hence can only help make the pool less dangerous. Therefore it appears irrefutable that this rearrangement is in the interest of public safety. At first glance, this is an entirely reasonable assumption.

4. Unfortunately, a more careful reading of the documents does not bear this out. I believe that the optimism of the utility is premature. In fact, after having read some of the analysis of the spent fuel pool, I am rather disturbed at the sloppy methodology and hasty conclusions of the utility. I shall address three main areas (a) reanalysis of the criticality study, showing that the calculation of neutron reactivity may not be as rigorous as previously thought (b) reanalysis of the accident scenarios, showing that more realistic scenarios exist for a maximum credible accident which are much more serious than those analyzed in the FSAR (c) conclusions and recommendations for future action to correct some of the inadequacies of the utility's analysis.

Errors in Criticality Analysis

5. The rearrangement of the spent fuel pool may have a negative impact on safety for several reasons. First, the rearrangement allows for much more highly irradiated

spent fuel to be placed into the pool in Region B, which may increase the total radiation inventory. The rearrangement trades new, fresh fuel (which has very little accumulated waste products) for depleted fuel (which may contain millions of curies per fuel assembly). Thus, the severity of an accident at the spent fuel pool becomes significantly larger, raising the possibility that fission products may escape into the environment.

6. The main justification for making the rearrangement is that it reduces the storage capacity. However, it may turn out it may not reduce the neutron reactivity to below the level required by the NRC, which is .95. It may turn out that *both* a completely loaded Region I and II as well as the "reduced" Region A,B,C will have k_{eff} greater than the NRC 95/95 limit of $k_{eff} = .95$, because of unexpected degradation of the Boroflex boxes and errors made in the criticality study. It is conceivable that the "reduction" in k_{eff} made by the rearrangement may not be sufficient to reduce k_{eff} down to .95. For example, the NITWAL-KENO-5a recalculation of the neutron reactivity for the old Region 1 configuration estimated that $k_{eff} = .9812$, which exceeded the .95 limit. It is therefore entirely conceivable that a correct calculation of k_{eff} for both Region 1 as well as for Region A and B will show that k_{eff} still exceeds the NRC limit of .95.

7. k_{eff} may be greater than .95 because no one knows precisely how much degradation has occurred within the Boroflex boxes. Only 16% of the Boroflex boxes have actually been examined, which is too small to give an accurate picture of the true nature of the degradation. The utility has made an estimate of the corrected neutron reactivity levels by making "conservative" guesses about the the average presence of gaps within the entire pond, i.e. that these hypothetical gaps were randomly distributed. However, it may turn out that more Boroflex degradation has occurred than expected, or that Boroflex gaps have been concentrated in certain areas, making local distribution of neutrons much higher than the computer calculation for the

entire pool. As a result, it seems prudent for the utility to throw away its earlier calculation and actually examine all Boroflex boxes to determine the true extent of degradation, rather than making unwarranted assumptions.

8. What is disturbing is that actual examination of the Boroflex boxes show a large amount of erosion, beyond the gaps found in earlier observations at other reactor sites. Since nothing is known about the full extent of erosion among the various Boroflex boxes, the computer calculations may be totally obsolete. The neutron reactivity studies may not be modeling the actual state of the Boroflex boxes, where an unknown about of degradation is causing gaps as well as unexpected erosion. Until an inspection is made of all the Boroflex boxes, all computer programs are suspect.

9. The main problem facing any calculation of neutron reactivity is whether one can properly model the distribution function of neutrons $\phi(x, y, z, t)$ in the presence of the high absorbing Boroflex boxes. The earlier calculation by CE did not, and hence caused the problem in the first place. Unfortunately, the diffusion method often used in these kinds of study is not ideally suited in calculating neutron reactivity with thin, highly absorbing boxes. There are too many hidden assumptions which may break down in the presence of highly absorbing boxes.

9. One of the problems is that the utility has not yet given me or the citizens of Connecticut a complete copy of their computer codes and calculations. Therefore, it is impossible for anyone to impartially evaluate the effectiveness of their computer calculations and, more importantly, their assumptions. Until this is done, it is their word against the word of their critics. Although the utility cites the public record concerning the benchmarking of certain experiments performed to check the computer analysis, usually these benchmarked studies are highly idealized experiments that may have little to do with the actual problem in question. For example, the reports admit that very little actual experimental data exists on performing benchmark calculations with highly absorbing Boroflex boxes. Therefore until a detailed description is given

of the computer calculation and the assumptions behind it, the summary of the results provided by the utility is of little use.

10. Given the sensitive nature of the problem and the large fission product inventory of the spent fuel pond, it is essential to examine the assumptions inherent in such a calculation. This is important because the neutron density function $\phi(x, y, z, t)$ is extremely sensitive to the presence of high density neutron absorption boxes. The diffusion equation, in fact, may not be able to properly take into account such factors.

From the limited amount of information provided to me, I can draw certain conclusions concerning the accuracy of the calculation:

(a) the calculation assumes that neutrons in a spent fuel pool behave very much like a gas, in which the neutrons do not travel very fast or very far and are mainly governed by elastic collisions. In particular, one assumes Fick's principle that the flux is proportional to the gradient of the neutron density:

$$\vec{J} = D\vec{\nabla}\phi \tag{0.1}$$

However, this assumption is only true if the neutrons obey the kinetics commonly found in ideal gases, with thermalization and perfectly elastic collisions among the neutrons. In real life, this assumption is violated by many factors, such as the presence of very fast neutrons which do not act like an ideal gas and can quickly travel across the entire spent fuel pond without many collisions. In particular, Fick's principle may be violated in the presence of highly absorbing Boroflex boxes. In the presence of thin absorbers, there are large uncertainties in the gradient of the neutron density function. This would render much of the utility's computer calculations rather useless.

(b) If one assumes Fick's principle, then the next assumption is that the neutron density function obeys a diffusion equation, which is a second order partial differential equation based on the net conservation of the neutron population within a small spherical volume. Unfortunately, the diffusion equation cannot be solved exactly.

Lacking an analytical solution, one must make even more assumptions concerning the neutron distribution function. Usually, a computer calculation divides space-time up into finite intervals. However, the lattice or cell approximation, again, may break down in the presence of thin, highly absorbing Boroflex boxes, especially if the width of the boxes are smaller than lattice size. If the lattice size is too large, then absorbing boxes cannot be modeled correctly. But if the lattice size is small, then this requires much more computational power and time.

(c) The next assumption is that one can break up the energy spectrum into discrete chunks, or "groups," and then write the net conservation of neutron number between all the various discrete groups. Ultimately, the neutron calculations are performed on the multi-group equations, such as:

$$D_g \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \right) \phi_g - \sum_{ag} \phi_g - \sum_{h=g+1}^{N} \sum_{g \to h} \phi_g + \sum_{h=1}^{g-1} \sum_{h \to g} \phi_h = -s_g \qquad (0.2)$$

for the gth group, where eventually $N \to \infty$, where $\sum_{g \to h}$ are the group transfer cross sections, and where D_g is the inverse of the transport cross section. Ideally, N, the number of partitions of the energy, should be as high as possible, preferably in the thousands. The problem is that the calculation is based on the assumption that $N = 27$, which is not a very large number in which to partition the energy spectrum of the neutrons. Given the nature highly absorbing borated walls, it would seem more appropriate to approximate infinity with the number $N = 200$ or 500 at the very minimum, rather than 27, which is too small to take into consideration the small edge effects that may occur around the boxes. Moreover, in the presence of very high levels of neutron absorption, the concept of buckling becomes less relevant and the neutron diffusion equation itself begins to break down, so even if $N \to \infty$, the results for the neutron density will be incorrect.

(d) There is also the assumption that Monte Carlo simulations can, in fact, provide reasonable estimates of neutron reactivity. The point of introducing Monte Carlo simulations is that they can reduce the number of computations necessary to perform a difficult calculations by several orders of magnitudes. However, there is a price that one pays. The Monte Carlo simulation is crucially dependent on the number of cycles or iterations that are performed to approximate the neutron reactivity. If the number is small, then the Monte Carlo calculation will not converge very well to the correct result. Because of the unusual geometry introduced in Region A and B, one suspects that an unusually large number of iterations will be necessary to provide any reasonable approximation. Furthermore, there is the temptation to use shortcuts to reduce the number of iterations. For example, apparently the original CE calculation arrived at an erroneous value for k_{eff} because it tried to use the buckling as a way in which to reduce the number of iterations between the spectral and spatial portions of the multi-group calculation.

11. The point I am raising is that there are a large number of assumptions that are hidden behind any neutron reactivity calculation, and all these assumptions are, in turn, sensitive to the presence of highly absorbing borated thin walls. A strong case can be made that too many approximations are made in the computer algorithm to give reliable figures. And the benchmarked experiments, in particular, may be useless because they are too idealized to describe the system at hand. To revolve these uncertainties, NU must be willing to make public its computer codes and the assumptions that are behind them. Otherwise, their claims are just a matter of speculation, rather than science.

12. The fact that the presence of highly absorbing boxes can render a neutron reactivity calculation useless is amply demonstrated by the original error made in the CE calculation. It was precisely the presence of these highly absorbing materials that made certain approximations incorrect, such as errors introduced by replacing the total neutron cross section with the transport neutron cross section, and incorrectly

handling the buckling term. Both errors are highly sensitive to the presence of the thin, highly absorbing Boroflex boxes and high levels of neutron absorbing materials. The errors may seem small (5%) but they are not small when one considers that they may lead to a violation of the .95 limit and create a spent fuel pool which is dangerously close to achieving criticality, in which case uncontrolled amounts of radiation and heat may eventually be released.

Maximum Credible Accidents

13. The rearrangement advocated by NU will increase the fission product inventory of the spent fuel pool, so it is vital that one analyze the maximum credible accident. There are 5×10^6 curies per fuel assembly after 21 days decay, according to NU, and there will be on the order of 10^3 fuel assemblies in the pool. So the amount of radioactivity in the pool, roughly speaking, will be on the order of 10^9 curies, or one billion curies, which is on the order of magnitude of a nuclear reactor core inventory. So one should treat this problem with the same critical analysis given to power reactor accidents. (One should keep in mind that the amount of radiation released by the Chernobyl accident was measured in millions of curies, not billions. There is more radiation stored in the spent fuel pond that the radiation released by the Chernobyl reactor.)

14. The utility states that the FSAR's accident analysis provides an upper limit to what might happen at an accident at the spent fuel site. The maximum accident, they claim, is the dropping of a fuel casket, weighing 200,000 pounds, causing the breaking of 587 fuel assemblies. However, the effect of this accident is mitigated because most of the impact takes place in water. The presence of cooling water acts to shield the outside from radiation and dissolve water-soluble fission products from the broken assemblies, so the radiation damage is rather limited. The FSAR estimated a 241 mrem dose, which is insignificant and well within 10 CFR Part 100 limits. I do not believe that this is the maximum credible accident.

15. A preview of what might eventually lead to a maximum credible accident, or beyond design basis accident, occurred just a few weeks ago, when the unexpected happened. On July 6, 1992, at the Millstone 2 spent fuel pool, there was some loss of power to the circulating pumps. Without these pumps to circulate water, temperatures began to rise, and water levels began to drop in the pool about 3 feet. Water apparently backed up into the reactor containment, causing the sump pumps to kick on. Water eventually had to pumped from the reactor containment back into the spent fuel pool. Although no fuel assemblies were uncovered, this accident reveals that an accident involving a dangerous loss of cooling water at a spent fuel pool is possible.

16. This accident is also important because it demonstrates how vulnerable spent fuel pools are to a loss of water. By NU's own estimate, it only takes on the order of 10 hours or so for the spent fuel pool to reach the boiling point of water if the pumps were to fail. This, in turn, can cause a disastrous overheating of the pool and eventual uncovering of the fuel assemblies.

17. In reality, a more realistic model than cask failure is provided by the Brown's Ferry accident, where multiple failures and human failures were reported because a worker carelessly used candle light to search for a leak, and wound up setting off a major conflagration in the insulation. The uncontrolled fire caused major loss of control of the reactor and an ominous drop in cooling water. The accident overwhelmed the local emergency teams on the site, until it was finally put out by the local fire department. This accident scenario, which caused major damage to the safely systems, millions in repair costs, and almost initiated a LOCA, was never anticipated by the industry.

18. The faulty assumption in the FSAR is that accident scenarios are only initiated by "single event failure," such as the dropping of a single fuel assembly or cask. However, this is highly idealized. In actual reality, all major accidents of the past,

such as TMI, Chernobyl, Fermi-I, SL-1, Brown's Ferry, EBR-I, Dresden, etc., were caused by multiple mode failures coupled with human failure and design flaws. In fact, no where in the entire accident record do we have an actual major accident proceeding according to the idealized predictions of WASH-1400. The celebrated "double-ended guillotine break in the cold-leg pipe of the primary system," intensively studied in reactor accident courses, has never occurred in history, while the bulk of actual accidents is based on multiple mode and human failures.

19. A more realistic maximum credible accident might be a loss of cooling water, causing overheating of the pond. This common mode failure might be initiated by a single event (fire, chemical explosion, sabotage, earthquake, airplane crash, lightning bolts) which causes multiple failures. Given the ample precedent of previous accidents, one can assume that a fire or chemical explosion can cause major damage to the reactor building, causing an evacuation of the site. Electrical power is lost and the spent fuel pool is unsupervised, and within hours the temperature rises sufficiently fast to cause boil off and rapid evaporation, eventually uncovering the fuel rods.

20. Without circulating cooling water, the temperature rises rapidly. Within 10 hours, boiling may occur as temperatures rise to 212° F degrees. At 360° F, radio-iodine in the rods begins to boil and leak out. At 1250° and 1800°, radio-cesium and tellurium begin to boil. At 1200°, ballooning and distortion of the zirconium cladding occurs, releasing fission products into the water. Radioactive xenon and krypton gases are then released directly into the environment. At 1400°, the cladding swells and finally ruptures. At 1800°, the zirconium starts to oxidize rapidly, creating large quantities of hydrogen gas via the metal-air and metal-water reaction. Then any flame or spark can create an hydrogen gas explosion that will pulverize most of the fuel assemblies, causing highly radioactive debris to escape into the environment.

21. The hydrogen gas explosion scenario has ample precedent. On the afternoon of the first day of the TMI accident in March, 1979, enough hydrogen gas from zirconium

oxidation was released into the containment from the oxidation of zirconium to cause an explosion. Fortunately, the containment was able to withstand the impact of this hydrogen gas explosion. A hydrogen gas explosion has also been implicated in the Chernobyl accident.

22. In addition, sabotage cannot be ruled out. In fact, we have several highly publicized cases where sabotage was either carried out or was shown to be possible. At one reactor site, disgruntled workers walked up, unimpeded, to the spent fuel pool and poured sodium hydroxide directly into it. Fortunately, these workers did not know enough about reactor physics to cause major damage. Although the sodium hydroxide could be cleaned up, without any damage to the fuel rods, a more skilled worker might have, for example, released certain valves and lowered the water level, or simply dynamited the spent fuel pool. In real life, and not the relatively sterile world of "single-event tree analysis," individual workers get angry during strikes and will sometimes deliberately damage sensitive equipment in unforeseen ways.

23. On another occasion, safety officials, in a test, placed a gun in a suitcase (sealed in plastic so no one could get hurt). They then, with relative ease, walked with the briefcase past the security guards and entered the control room of the reactor. Had they been real terrorists, they could easily have seized control of the nuclear power plant and performed unlimited mayhem, i.e. unscramming the reactor, shutting off the HPI and LPI within the ECCS, etc.

24. One should not dismiss lightly the statement made recently by a representative of the Yugoslavian government that they will deliberately sabotage nuclear power plants in the West if force is used against Yugoslavia. National governments, with all their resources, can cause damage far in excess of the damage caused by individual workers. If the crisis worsens, then every reactor is fair game.

25. One should not dismiss the possibility of an earthquake, which may set off multiple mode failure within the reactor and the spent fuel pond. NU's own analysis

considers earthquake damage resulting from stresses which cause .09 g acceleration in the horizontal direction, and .06 g acceleration in the vertical direction. However, these stresses are far below the actual stresses found near large earthquakes, which can cause accelerations approaching 1 g. Although earthquakes are unlikely, no one knows how to predict their frequency in the Northeast. Unlike the San Andreas fault, which is a clean, isolated fault line where paleo-seismology can estimate the rough cycle time for earthquakes, earthquakes in the Northeast do not lie along such simple earthquake faults. The area is much more irregular, meaning that paleo-seismology does not give an indication of the frequency of earthquakes in the Northeast. The point is that an earthquake can set off a common mode failure, resulting in a scenario which can damage valves, pumps, set off fires, etc. which may cause the spent fuel pool to leak or lose water.

26. In 1975, there were two landmark studies done on nuclear accidents, WASH-1400 and the American Physical Society Light Water Reactor Safety Report study (published in the *Reviews of Modern Physics*, 47, 1, p. S1-S-123.). They took a major step forward in calculating what might happen if *all* safety systems failed at a nuclear power plant, regardless of how unlikely that might be. They calculated what might happen if up to 75% of the core inventory of a reactor breached the containment and was released into the environment. This was important because, before then, the nuclear industry insisted that "defense in depth" was sufficient to render such catastrophic accidents impossible, so therefore there was no need to analyze such accidents. Since then, because of the FOIA, we know that during the height of the TMI accident, the NRC Commissioners secretly discussed whether WASH-1400 scenarios could actually happen if the reactor went out of control. The "impossible" accident scenarios of WASH-1400 suddenly became the main topic of conversation at one of their important meetings during the crisis. We also had graphic proof of the usefulness of such studies when the Chernobyl accident released over 5% of its core

inventory over the Ukraine.

27. As a consequence, I believe that the NU should do the counterpart of WASH-1400 and the APS study, i.e., it should calculate what might happen if 75% of the inventory of fission products from the spent fuel pool were released into the environment. Specifically, it should calculate the density function of the fission products released in an accident by solving the standard diffusion equation:

$$K\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)\chi(x,y,z,t)=\frac{\partial\chi(x,y,z,t)}{\partial t} \qquad (0.3)$$

whose solution is the standard Gaussian distribution for each fission product:

$$\chi(x,y,z,t)=\frac{Q}{(4\pi t)^{3/2}(K_x K_y K_z)^{1/2}}\exp\left[-\frac{1}{4t}\left(\frac{(x-ut)^2}{K_x}+\frac{y^2}{K_y}+\frac{z^2}{K_z}\right)\right] \qquad (0.4)$$

where K_i are related to the standard Pasquill coefficients.

28. The proposed study should calculate the deposition of fission products over Connecticut, given the fact that the radioactive plume will rotate, much like a lighthouse, because of changing wind patterns over time. Then the study should calculate the fission product density deposited on the ground and the rate at which ingestion of these radioactive products takes place into the human body. We can then calculate the total ingestion of fission products (in person rems) by the population by integrating the density function over the deposition area:

$$D=\int_{-\theta/2}^{\theta/2}d\theta\int_0^\infty \chi(r,t)\,pbF\,rdr=\frac{pQbF}{v_d+\lambda_d H}\left[1-\exp\left(-\lambda_f-\lambda_d/u\right)R\right] \qquad (0.5)$$

where p is the average population density of Connecticut, b is the breathing rate, and F is the dose conversion factor in rem per curie inhaled.

From this, one can truly estimate the real impact of a spent fuel pool accident.

Conclusion and Recommendations

29. In conclusion, I am not so optimistic that the rearranged spent fuel pool, when fully loaded in the future, will meet the criteria that $k_{eff} < .95$. Although the utility states that reducing fresh fuel in the spent fuel site can only reduce the neutron levels, I am not convinced. The assumptions behind the computer calculations are not sufficiently reliable, especially in the presence of the highly absorbing Boroflex boxes. In fact, many of the assumptions behind neutron transport theory begin to break down precisely because of the presence of highly absorbing thin walls. One's conclusions are only as valid as one's assumptions. Or, as they say in the industry, "garbage in, garbage out." This discussion is not purely academic, because the fission product inventory of the pool will eventually reach one billion curies, which is comparable to what is found in a nuclear power plant.

30. The previous reactivity study by CE done on the spent fuel pool was in error by 5%, mainly because of the difficulty in modeling the Boroflex boxes by the neutron diffusion equation. I am not convinced that the newer neutron reactivity study is sensitive enough to truly calculate the effect of neutron absorption by the Boroflex boxes, especially because of the degradation and unexpected erosion of the boxes (whose full extent has never been determined by the utility). The neutron reactivity calculations using Monte techniques studies have inherent uncertainties in them (given the assumptions inherent within the model) that may be too large to make reliable estimates of k_{eff} for the fully loaded pool.

31. Given the fact that more spent fuel will be stored at the site, near populated areas, with about one billion curies of fission products, I think that NU should model a more realistic accident scenario. It should abandon the simplistic single mode failure model (which has never happened in a major nuclear accident) and adopt a more flexible and realistic multimode failure/human failure model, which agrees more with the history of past nuclear melting incidents and fission product release accidents.

32. Specifically, a credible scenario exists in which the water level drops danger-

ously in the pool. For example, a fire or chemical explosion may cause an evacuation of the site, leading to a power failure. Without anyone monitoring the pool, one can imagine the water level dropping due to leaks, boil off, and evaporation as the temperature rises. It only takes about 10 hours to cause boiling within the spent fuel pool. When the fuel assemblies are uncovered, the temperature may be sufficient to cause hydrogen gas generation and then an explosion, dispersion large amounts of fission products into the environment.

33. In light of these difficulties, I would like to make several recommendations:

First, that the utility carry out a full-scale evaluation of the Boroflex boxes to check for new gaps as well as measure the rate of erosion. Until this is done, all computer programs are largely useless. The utility should also perform rigorous benchmark studies using Boroflex boxes with the the actual geometry found in the spent fuel pool, not just idealizations of the geometry.

34. Second, the utility should carry out the reasonable demands of citizens groups, such as releasing a copy of its neutron reactivity calculation, and placing neutron detectors around and inside the pool. This is reasonable, since detectors have a proven worth. For example, the presence of such a detector (which could measure the level of water at TMI) could have prevented an accident which has already cost GPU \$1.5 billion. Neutron counters could give a rough indication of whether the pool had higher-than-expected neutron reactivity before an accident goes out of control.

35. Third, the NU should be required to do a realistic analysis of a maximum credible accident, i.e. the release of 75% of the fission product inventory into the environment. Like existing studies of nuclear reactors, one should assume that all safety systems are somehow voided, and that large amounts of fission products escape into the environment in the form of a plume. Since the distribution of fission products is different from a conventional nuclear reactor, one should obtain different results for a spent fuel accident. The fact that, 50 years into the nuclear age, such as basic study

for a spent fuel site does not exist is a testament to the fact that nuclear waste has always been given low priority. However, now that nuclear power plants are gradually filling up spent fuel sites and are beginning to consolidate and repackage spent fuel, it is vital that such a study be done.

36. Until these recommendations are carried out, I cannot truthfully state that a fully loaded spent fuel pool in the new rearrangement is safe. On the contrary, it may even prove to be a health hazard.

I declare, subject to the pain and penalty of perjury, the foregoing is true and correct, to the best of my knowledge.

Signed

8/23/92

Michio Kaku, Ph.D

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of

NORTHEAST NUCLEAR ENERGY COMPANY

(Millstone Nuclear Power Station,
Unit No. 2)

Docket No.(s) 50-336-OLA

CERTIFICATE OF SERVICE

I hereby state that copies of the foregoing CCMN Contentions + supporting documents have been served upon the following persons by U.S. mail, first class, except as otherwise noted

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of NORTHEAST NUCLEAR ENERGY COMPANY (Millstone Nuclear Power Station, Unit No. 2)	Docket No.(s) 50-336-OLA

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I hereby certify that copies of the foregoing LTR MARUCCI TO LB DTD 8/24 have been served upon the following persons by U.S. mail, first class, except as otherwise noted and in accordance with the requirements of 10 CFR Sec. 2.712.

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28 day of August 1992

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