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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMISSION

In the Matter of:	:Docket Nos. 50-336-LA and : 50-423-LA-2
DOMINION NUCLEAR CONNECTICUT, INC.	:ASLBP No. 00-783-09-LA
(Millstone Nuclear Power Station, Units 2 and 3)	:December 17, 2001

CONNECTICUT COALITION AGAINST MILLSTONE AND STAR FOUNDATION PETITION FOR RECONSIDERATION OF CLI-01-24

Introduction

Pursuant to 10 C.F.R. Section 2.771, the Connecticut Coalition Against Millstone ("CCAM") and STAR Foundation (collectively, "Petitioners") hereby petition the Commission for reconsideration of CLI-01-24, Memorandum and Order. (Denying Petitioners' proffered contention, denying the petition and terminating the proceeding)(December 5, 2001) The Commission should reconsider its ruling, reverse the Atomic Safety and Licensing Board decision, LBP-01-10, 53 NRC 173 (2001), accept the proffered contention and direct that a hearing be convened on the license amendment application.

I. Summary of Decision

A. Factual Background

This petition concerns the license amendment application of the licensee,

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Northeast Nuclear Energy Company ("NNECO"),[1] filed on February 22, 2000 to amend Operating License DPR-65 for Millstone Unit 2, and Operating License NPF-49 for Millstone Unit 3. The application requests approval to "relocate selected radiological effluent Technical Specifications and the associated bases to the Millstone Radiological Effluent Monitoring and Offsite Dose Calculation Manual in accordance with the Nuclear Regulatory Commission's Generic letter 89-01."

The Radiological Liquid and Gaseous Effluent Monitoring Instrumentation monitors routine radioactive releases from Millstone Units 2 and 3. The instrumentation provides a surveillance of potential release points and initiates automatic and trip functions which are intended to terminate the release prior to exceeding the limits of 110 CFR Part 20 (1993 version).

In its cover letter accompanying the application to the NRC, NNECO stated in part: "relocating requirements to NNECO-controlled documents will reduce costs by allowing NNECO to change the requirements without necessarily amending the license." The letter further states that the proposed changes "will not significantly increase the type and amounts of effluents that may be released off site. In addition, this amendment will not significantly increase individual or cumulative occupational radiation exposures."

The cover letter requests issuance of the license amendment by August 31, 2000. "The approval of this amendment is needed by this date to support the

[1] In the intervening time, Dominion Nuclear Connecticut, Inc. has assumed ownership and control of the Millstone Nuclear Power Station.

ongoing effort to eliminate Millstone Unit Nos. 2 and 3 dependence on the Millstone Unit No. 1 Stack Gas High Range Radiation Monitor."

B. Procedural Background

The Connecticut Coalition Against Millstone and STAR Foundation ("Petitioners") timely filed an intervention petition in response to the agency's notice of opportunity for hearing, 65 Fed. Reg. 48,744, 48,754 (Aug. 9, 2000). NNECO and NRC Staff filed answers to the intervention petition and, in response to the Board's scheduling order, October 27, 2000, Petitioners filed an Amended Petition on October 27, 2000 setting forth their contention as follows:

> "Relocating" the selected radiological effluent Technical Specifications and the associated Bases to the Millstone Radiological Effluent Monitoring and Offsite Dose Calculation Manual will deprive the public, and the membership of the Connecticut Coalition Against Millstone and STAR Foundation, of notice of proposed changes to the Millstone radiological liquid and gaseous effluent monitoring instrumentation. It will deprive them of the opportunity for hearing and to comment and object to changes, which can only be projected to lower standards of radiological effluent monitoring in the era of deregulation and electric restructuring. The amendment request is particularly objectionable in light of the levels of radiological effluent released to the environment by the Millstone reactors.
>
> This amendment will degrade protection of the public health and safety from radiological effluents. Even according to the applicant, NNECO, the amendment opens the door to increases in the type and amounts of effluents that may be released offsite as well as individual and cumulative occupational radiation exposures. NNECO's amendment request states that such increases will not be "significant." (Application, February 22, 2000, cover letter, page 3.) However, as there will be no opportunity for hearing or public comment, the public will be exposed to greater risk of radiation doses from the routine operation of the Millstone nuclear reactors if NNECO obtains the amendment requested. The Petitioners are prepared to establish through expert testimony that any increase in routine radiological effluent to the air and water by the Millstone reactors will

expose the public to greater risk of cancer, immunodeficiency diseases and other adverse health effects.[2]

The Board conducted a telephone prehearing conference on December 7, 2000, during which the Board heard oral argument on the issues of standing and the admissibility of the contention in this case.

On March 29, 2001, the Board issued a Memorandum and Order, LBP-01-10, dismissing the petition without addressing the issue of standing and terminating the proceeding upon a finding that the petitioners had failed to submit an admissible contention. In dissent, Judge Ann Marshall Young, Chair, concluded that (a) the Petitioner CCAM on behalf of its members had demonstrated standing in this proceeding under 10 CFR Section 2.714(d)(1)[3] and (b) the Petitioners had made the necessary minimal showing under 10 CFR Section 2.714(b)(2), (d)(2) and relevant case law, of the admissibility of their contention to demonstrate that further inquiry would be appropriate in this case.

On April 9, 20001, the petitioners petitioned the NRC for review of LBP-01-10.

The NRC released its Memorandum and Order, CLI-01-24, on December 5, 2001, affirming LBP-01-10.

II. The final decision is erroneous in failing to find as follows:

A. The Amended Petition presents a legally sufficient contention.

[2] The Amended Petition also incorporates the Declaration of Joseph Mangano, M.P.H., dated October 27, 2000.

[3] Petitioners continue to assert their claim that Petitioner STAR Foundation has also demonstrated standing on behalf of its members in these proceedings.

B. There is a significant safety justification that radiological effluent procedures be maintained in the Millstone Technical Specifications.

C. The potential for undetected and potentially preventable releases of radiation to the environment is a significant safety issue.

D. The decision assumes releases of radiation to the environment are safe if within the NRC's "allowable limits."

E. Both North Nuclear Energy Company and Dominion Resources, Inc. suffer from histories of providing false information to the NRC.

F. The decision disregards evidence of high cancer incidence in area surrounding Millstone.

G. The license amendment promotes a higher risk of failure to detect and prevent a radiation emission that might exceed NRC standards.

III. Grounds of the Petition: The Board Erred in Affirming the ASLB's Rejection of the Petitioners' Contention

A. The Contention Is Legally Sufficient

The NRC affirmed the ASLB's ruling that the Petitioners' proffered contention fails to meet the requirements of 10 CFR Section 2.714(b) and, accordingly, ruled it inadmissible. Petitioners' contention satisfies the criteria of 10 CFR Section 2.714(b), which provides in pertinent part as follows:

> (2) Each contention must consist of a specific statement of the issue of law or fact to be raised or controverted. In addition, the petitioner shall provide the following information with respect to each contention:
> (i) A brief explanation of the bases of the contention.
> (ii) A concise statement of the alleged facts or expert opinion which support the contention and on which the petitioner intends to rely in proving the contention at the hearing, together with references to those specific sources and documents of which the petitioner is aware and on

which petitioner intends to rely to establish those facts or expert opinion.

(iii) Sufficient information (which may include information pursuant to paragraphs (b)(2)(i) and (ii) of this section) to show that a genuine dispute exists with the applicant on a material issue of law or fact. This showing must include references to the specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute . . .

The Petitioners' contention does provide a specific statement of the issue of law or fact to be raised or controverted, as required by Section 2.714(b)(2). The specific statement is set forth in the first paragraph of the contention. The majority of the ASLB panel so concluded.

The Petitioners' contention does provide the information required by Sections 2.714(2)(i), (ii) and (iii). The information is provided in the second paragraph of the contention. The Board majority agreed that the second paragraph "sets out the bases for the contention in an attempt to comply" with such requirements.

On its face, while admittedly somewhat minimal, the contention satisfies the criteria of 20 CFR Section 2.714(b) and Section 2.714(b)(i), (ii) and (iii).

B. The Technical Specifications Are Required to Remain in the Technical Specifications Because They Are Safety Significant.

Because the license amendment involves the potential for increased risk of undetected and preventable releases of radiation into the environment, such as might exceed allowable limits, they are legally required to remain in Technical Specifications.

As Judge Young accurately noted, NNECO's counsel acknowledged during the December 2000 conference a potential increased risk to the public from radiation doses if this amendment is allowed. ("The Applicant's Counsel

acknowledged that 'a surveillance requirement [relating to a monitoring instrument] might conceivably be changed down the road,' which, if something else failed and surveillance were somehow to become unduly lax, ' because of the reduced surveillance, fails to pick up [a] release.')

NNECO's counsel also acknowledged than an increased release of radiological effluent that could lead to an immediate danger to public health or safety - as a result of a failure to "catch" a result because of a reduced surveillance schedule, for example - "could not be categorically discounted."

NRC Staff's expert, Stephen Klementowicz, postulated various changes which could occur if the amendment were granted which would not be subject to public notice or a hearing, including a change in setpoint levels, a reduction in surveillance frequency or a reduction in the frequency of checking monitor readouts.

Thus, as Judge Young noted, a less frequent monitoring could possibly result in a failure to detect and address an accidental abnormal release of radiological effluent as quickly or effectively as on an unchanged, more frequent schedule.

As Judge Young correctly summarized:

"The relevant area that appears to be in question in this proceeding is that area in which effluents that are not in the high range of possible effluent releases might still increase to the point that they would exceed the limits of Appendix I to 10 CFR Part 50, resulting not from the sort of major accident that would produce high-range releases but rather from some other cause, such as a relatively minor accidental or other failure of equipment, accompanied by a failure to detect and

correct as quickly the increased release, by virtue of changed surveillance schedules or setpoints (or placement of monitors at inappropriate release points) as well as failure of whatever redundant systems exist to detect and/or stop such "moderately excessive" releases."

C. The Decision Errs In Failing To Address Millstone Realities

The NRC decision erroneously accepts on their face NNECO's statements that the application does not involve any change to plant operation, radiation monitoring, or radiological effluent releases. The decision refuses to speculate what the applicant intends to achieve if the application is granted.

However, NNECO's cover letter dated February 22, 2000 accompanying its application boldly acknowledges that "relocating" the Technical Specifications to licensee-controlled documents "will improve the process of **changing** these specifications." (Emphasis added.)

Thus, at the very time NNECO submitted the application, it clearly contemplated changing the specifications. The petitioners' concerns about potential changes to Millstone radiological effluent monitoring are thus shown not to be speculative at all. Indeed, the desire to make changes without going through the public notice process appears to be a primary motivating factor driving the license application process.

Moreover, the NRC decision manifests a complete lack of awareness of Millstone's notoriety as a leading emitter of radionuclides into the environment. The NRC appears to be unaware of Millstone's notoriety as the "dirtiest" reactor

complex in the United States in terms of its admitted discharges of cesium-127 and cobalt-60.[4]

The NRC decision professes an unawareness of practices at Millstone which involve potential criminal misconduct leading to unnecessary and preventable releases of radiation into the environment.[5] These activities apparently evaded the review of NRC inspectors and reviewers, notwithstanding the NRC's statement at 22 that "the NRC will receive annual reports of effluent monitoring, see 10 C.F.R Section 50.36a(a)(2), and **is prepared to take action if necessary**." (Emphasis added.)[6]

IV. Relief Sought

The Petitioners are prepared to present the evidence of their expert, Joseph Mangano, M.P.H., who has studied health records of residents of the affected community, that Millstone radiological emissions are associated with an epidemic of cancers and other serious health disorders in the surrounding area.

The Petitioners wish to preserve the right to protest proposed changes in radiological effluent monitoring and instrumentation beforehand in a meaningful way to **avoid** increased, unnecessary, avoidable doses which may exceed "allowable" limits.. They can only have a role if notice and opportunity for a hearing are available in the license amendment process.

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[4] See Statement of Dr. Christopher Busby prepared for presentation to the Superior Court of the State of Connecticut in March 2001 in Connecticut Coalition Against Millstone et al. v. Arthur J. Rocque, Jr., et al,CV 01 - 805868, a copy of which is annexed hereto.

[5] See, e.g., Testimony of Clarence O. Reynolds presented at proceedings in Connecticut Coalition Against Millstone v. Department of Public Utility Control, et al., Superior Court of the State of Connecticut, CV 01 506963, March 12, 2001.

[6] The specific action taken by the licensee with respect to Mr. Reynolds, who exposed NNECO's illegal practices with regard to radiological emissions at Millstone, is that he was fired from his employment at Millstone.

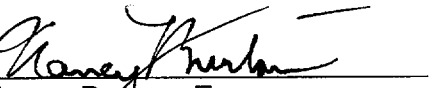
Accordingly, this petition presents issues of the highest safety significance to the affected community.

As in Perry I, "[a]lthough future changes to the [radiological effluent monitoring instrumentation] are by no means certain, the likelihood of changes cannot be discounted, particularly when a goal of the license amendment is to ['reduce costs by allowing NNECO to change the requirements without necessarily amending the license']." (Citing Judge Young's dissenting ruling, at 39)

As in Perry I, a "fair reading of the petitioners' claims indicates that, at bottom, [they] fear that if they are deprived of the opportunity to challenge future proposals to alter the [radiological effluent monitoring instrumentation], the surveillance of [routine radiological releases] may become lax and prevent detection of [increased releases] of radioactive fission products into the environment [that could endanger their health and safety.]," (Id. at 39-40)

The NRC has seriously erred in affirming the Atomic Safety and Licensing Board's dismissal of the petition in this matter. For the foregoing reasons, the petitioners respectfully request that the NRC grant their petition for reconsideration, reconsider its ruling, reverse the Atomic Safety and Licensing Board decision, LBP-01-10, 53 NRC 173 (2001), accept the proffered contention and direct that a hearing be convened on the license amendment application.

THE PETITIONERS

By: 

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of:	:	Docket No. 50-336
	:	Docket No. 50-423
DOMINION NUCLEAR	:	
CONNECTICUT, INC.	:	
(Millstone Nuclear	:	
Power Station,	:	
Unit Nos. 2 and 3)	:	December 17, 2001

CERTIFICATE OF SERVICE

This is to certify that a copy of the "Connecticut Coalition Against Millstone and STAR Foundation Petition for Reconsideration of CLI-01-24"was emailed to the Office of the Secretary, U.S. Nuclear Regulatory Commission (HEARINGDOCKET@nrc.gov) and sent via U.S. Mail, postage pre-paid to the following on December 17, 2001:

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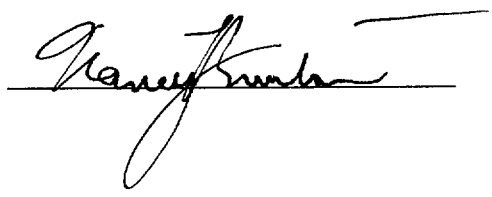

Statement of Chris Busby in Relation to the Millstone Reactor and its effect on local health in populations living near the sea and river estuaries.
26th March 2001

I, Christopher Charles Busby, of Green Audit, 38 Queen Street, Aberystwyth, SY23 1PU UK , state as follows:

1. I hold a First Class Honours degree in Chemistry from the University of London, and also a PhD in Chemical Physics. I trained as a spectroscopist and worked as a senior scientist in the pharmaceutical industry investigating drug-receptor interactions. This gave me insights into the ways in which very small concentrations of certain chemicals affected living systems. I also worked as a Research Fellow in research which examined physical interactions of energy within micro-structures and this enabled me to understand some of the processes occurring when ionizing radiation interacts with matter. I was elected to the Royal Society of Chemistry in 1974, and am presently a member of the International Society for Environmental Epidemiology. I am the National Speaker on Science and Technology for the Green Party of England and Wales. I am the UK representative of the European Committee on Radiation Risk, based in Brussels. I am scientific director of the independent environmental research company, Green Audit, and scientific advisor to the Low Level Radiation Campaign.

2. I have given expert evidence on the health effects of low level exposure to ionizing radiation to the European Parliament on three occasions and am presently funded by the Green/EFA Group in the European Parliament to advise on radiation risk models. I have also given two invited expert presentations on radiation risk to the Royal Society (Committee on Depleted Uranium).

3. I am asked to give my opinion as to the likely effects of chemical and radioactive discharges from the Millstone Nuclear Plant near Waterford CT upon both aquatic and coastal life and human populations living in areas affected by these discharges. Whilst it is clear that the chemicals discharged, particularly hydrazine, have the capacity to cause a wide range of harmful effects, including cancer, to marine life or people who are exposed, it has been known since the 1960s that the effects of chemical pollution are greatly augmented by exposure to ionizing radiation. As Rachel Carson pointed out, in 'Silent Spring' the chemicals and radiation work synergistically with a result that is greater than the sum of the individual effects.

4. My researches have concentrated on exposure to ionizing radiation from isotopes discharged from nuclear sites, and it is this I will concentrate upon. However, these nuclear sites also discharge large quantities of chemical solvents and other chemicals which may cause or increase the rate of progression of tumours, and it should be assumed that the effects I will describe include the combination of chemicals and radioisotopes which are released from all nuclear power stations in varying proportions.

5. Since I will be addressing low-level radiation I will begin by defining this. Low level radiation is defined as exposure doses below or comparable with those given by natural background (i.e. below 5mSv). I have studied the health effects of low-level exposure to ionizing radiation since 1987 and in 1995 was funded by the Joseph Rowntree Charitable Trust to produce a book 'Wings of Death' which outlines the early results of my researches. In essence, it argues that exposure to low levels of man-made radioisotopes cause cancer and a range of genetic-damage based illnesses at levels far exceeding those predicted by the present radiation risk models and statutory frameworks. The reason for the error lies principally in the averaging methods used to calculate dose.

6. The methods used to calculate dose involve averaging the energy transfer which occurs on exposure to unit mass of tissue. This method has the advantage of utility and may be accurate when applied to external irradiation, such as that occurring in exposure to atomic bomb flashes or X-ray machines. However it is wrong to use it to establish risk from internal (ingested or inhaled) radioactive atoms or particles which may give very high local energy density. This is like comparing the energy transferred when warming oneself in front of a fire with eating a hot coal. The dose is the same, but the effect very different.

7. The main reason for the difference in health effect between internal particle doses and external averaged doses is described by the 'Second Event Theory', a concept I developed in 1987. Briefly, cellular DNA is the target for ionizing radiation and the results of exposure are somatic mutations. It is the DNA mutations which lead to cancer and other illnesses. In the last 20 years research has shown that cells have the ability to repair mutations, and when a sub-lethal 'hit' occurs the cell is forced into an irreversible 8-hour repair replication sequence during which it cannot effect a second repair to any damage it receives. Thus any fractionation of dose involving two hits to a single cell inside an 8-hour period results in a very high probability of introducing an invisible mutation which is not subsequently repaired. Such events are vanishingly unlikely from external radiation exposure below 1mSv (i.e. natural background) but may be conferred by internal particle doses or from exposure to certain sequentially decaying man-made radioisotopes.

8. Since 1952, the planet has been increasingly contaminated by man-made radioisotopes in atomic and particulate form from atmospheric weapons tests, nuclear accidents and licensed released from nuclear power stations and reprocessing plants. The health effects of exposure to these substances have been discounted by the nuclear regulators and their scientists, particularly the International Committee for Radiological Protection (ICRP) on whose models most statutory frameworks are based. These models are almost exclusively based on the cancer yield of the Hiroshima bomb survivors and do not address other non-cancer illness.

9. However, the models have been increasingly under attack in the last twenty years, especially since the discovery of childhood leukemia and cancer clusters near many sources of man-made radioactive contamination. For example, the nuclear fuel reprocessing plant at Sellafield in Cumbria UK had an associated leukemia risk in children of 10-fold in 1983. Similar excesses were discovered at two other reprocessing plants in Europe. The conventional Hiroshima based risk model cannot predict the high leukemia yield for the doses calculated in the affected children by a factor of between 100 and 300-fold. Such an error has been deemed impossible by the authorities and so radiation has been excluded as a cause on this basis.

10. In the last 15 years, following the Chernobyl accident, it was discovered that there was a sharp rise in infant leukemia in the group of children who were in the womb at the time of the fallout and internal contamination due to the food chain inputs of radioisotopes. Through an analysis of infant leukemia in Wales and Scotland together with reported excess leukemia in similar groups from Germany, Greece and the US, I was able to show that the combined data defined a mis-match between the predictions of the ICRP and the observed leukemia yield of upwards of 100-fold. Because of the large dataset and the five countries, the probability of the effect being a chance one could be shown to be less than one in ten billion. Because there could be no other competing explanation for the findings, this study showed unequivocally that the errors of 100- fold suggested by the nuclear site clusters discovered in the 1980s were real errors and that the operating models of the ICRP were unsafe when applied to internal radiation. The study was published in the peer-review journal, 'Energy and Environment' in June 2001.

11. Since 1997 I have been supported by the government of the Republic of Ireland to investigate the incidence of cancer in populations living near the Irish Sea. I have been able to use two datasets, that of the Wales Cancer Registry 1974-89 and that of the Irish Cancer Registry 1994-1996. For both countries, small area data was used to define cancer risk by distance from the sea. This risk was calculated as Standardised Incidence Ratio which is defined as: Observed number of cancer cases divided by the expected number of cancer cases. This latter was calculated from the appropriate national age specific rates and the small area census populations.

12. Results indicated quite specific effects existed in relation to proximity to the sea. The highest cancer risks were in the population living within 1km of the sea, and were driven by seaside towns close to large areas of radioactively contaminated intertidal sediment. In Wales, an example was the town of Bangor, close to the mud bank called the 'Lavan Sands' where concentrations of Caesium-137 and Plutonium-239 had been regularly measured by government survey teams. The origin of this material was Sellafield, 70 miles to the north. The relative risk of childhood cancer in Bangor was over ten, based on national averages. This means that there some cause existed there which resulted in ten times more cancer in children than there would be in an another equivalent town where no such cause

existed. There were also significantly elevated levels of breast cancer, leukemia, colon cancer and all cancers. The risk trend with distance from the sea was quiet specific, falling off sharply inside the first few kilometres and then flattening out.

13. Similar effects existed in the Irish data. Here I was also able to compare the east and west coasts and show that the uncontaminated west coast did not exhibit any coastal effect.

14. The overall results could be interpreted most easily by looking at the studies which examined the dispersion of radioisotopes released to the sea from the Sellafield pipeline. I examined marine charts of the Irish Sea and tidal stream atlases. I also examined many reports of measurements which showed the dispersion of radioactivity from Sellafield. All studies agreed that the movement was not described well by distance from the source but by the movement of fine sediments in the Irish Sea. The radioactive material was shown to bind preferentially to fine silts and it was discovered that it was the tidal energy conditions which define where these silts finish up. Thus areas of low tidal energy (gyres, bays, mud-flats, estuaries, tidal rivers, inlets) are where the highest levels of radiation are measured. These are also the areas where I found that local populations showed highest cancer levels.

15. A number of published studies in the 1980s drew attention to the phenomenon of sea-to-land transfer of radioactive material from the intertidal zone. Thus the trend in airborne Plutonium trapped in muslin screens placed at different distances from the Irish Sea shows the same rapid fall off in the first few kilometres with flattening thereafter found in my cancer data results. In addition, Plutonium and Caesium-137 has been measured in autopsy specimens from England and shows a correlation with distance from the Irish Sea. Highest levels are found in the lymph nodes draining the lung, indicating that inhalation is the exposure route. The decay of plutonium concentration with distance from the sea follows the same trend as the trend in sodium chloride particles. I show a map of the USA for which this trend has been established.

16. Thus the hypothesis which I developed to explain my findings was that radioactive particles which became concentrated in intertidal sediment were driven ashore by wind and wave action in the coastal zone and became inhaled by local people. The translocation of such radioactive particles to the lymphatic system via the lungs caused high local doses to various tissues which were supplied with lymphatic vessels. I assumed that the external risk models were in error by 100-fold for this type of exposure, a figure needed to explain the Sellafield leukemia cluster but one ultimately justified by the Chernobyl infant leukemias. It therefore follows that a test of this hypothesis would be to examine other coastal sites where similar conditions exist. The requirements are high population density living near intertidal sediment which has been contaminated with radioactive discharged from a nuclear site. At least two such test sites exist in the UK and I went and looked at cancer mortality near these.

17. I therefore looked at two nuclear sites near mud banks in the UK using the small area cancer mortality data obtained from the Office for National Statistics. I will briefly describe the results which are of interest in the present case. The first nuclear site is the Power Station Complex at Hinkley Point in Somerset. There are two reactors there, A and B. The first is a MAGNOX type and the second an AGR. However, the radionuclide emissions from the complex have the same materials in them that are released from Millstone, it is just the quantities and proportions that differ. I attach evidence of this from the tables given in the UNSCEAR 1993 report to the General Assembly of the United Nations.

18. Releases to the sea from the Hinkley point reactors, which began operation in 1967, become attached to fine sediments on a very extensive offshore mud bank called the Steart Flats. The town closest to the Steart Flats, Burnham on Sea, was found to have more than twice the national average breast cancer mortality in the period 1995-1999. All-malignancy and prostate cancer mortality are also both significantly high. In addition the trend of these cancers with distance from the mud falls off in the same way as I found in Wales and in Ireland. The effect is statistically significant. Measurements made by MAFF show that the mud bank is indeed contaminated with material from the reactor discharges. In addition, official measurements show that the mud is about twice as radioactive (external gamma ray dose rate) than the inland areas. I presented a review of this work to the EU funded ASPIS conference on the Island of Kos last year (Is Cancer an Environmental Disease?) and has been accepted for publication in the proceedings of the conference and will appear next year.

19. I have also very recently examined breast cancer mortality in a similar study near the Bradwell reactor in Essex. This reactor is on a tidal inlet, the Blackwater. Results show the same effect. There is a doubling of breast cancer mortality risk in the town of Maldon adjacent to the mud, and the map shows general excess breast cancer mortality risk in this inlet as compared with the next inlet south where there is no nuclear power station.

20. I have examined data relating to radioactive discharges from the Millstone site. This is given in the UNSCEAR 1993 report, referred to above. Tables 34 to 66 of that publication show that for the representative major releases the plant is the worst of all Pressurised Water Reactors in the US. For example, for Cobalt-60 releases in 1988, 29.7% of all Co-60 released by all the 57 PWRs in the US came from Millstone. The mean Co-60 release from the 57 PWRs was 5.8GBq (standard deviation $\sigma = 5.8$) For the isotope Caesium-137, the discharges from Millstone amounted to 26% of all the Caesium-137 discharges form the 57 PWRs (mean = 44.62GBq; $\sigma = 4.62$) Thus the mean discharges of these tow dangerous gamma emitters is more than 5 standard deviations from the mean. Since it is now universally accepted that all radiation doses carry finite risk of cancer, this is a

serious breach of the internationally accepted ALARA principle that doses should be kept as low as possible. In addition to Co-60 and Cs-137, Millstone releases very large amounts of Tritium, an isotope of hydrogen that forms radioactive water and is incorporated very easily into marine animals, where it carries finite risk of cancer.

21. In further evidence that Millstone is particularly dirty, I have seen a copy of a letter from Senator Lieberman to the chairman of the NRC dated December 22nd 1993 in which the Senator draws attention to a confidential industry evaluation which maintains that the station 'has taken insufficient action to minimise the volume and radioactivity of liquid waste releases'. He points out that this is in contradiction to the published NRC report which states that the 'operation exceeded regulatory requirements' and that the effluent was 'effectively monitored and controlled'.

22. I have examined marine charts of the area near Millstone (e.g. Maptech Vol 1 Edn 5,: Long Island Sound, Chart #27 Stratford Shoals to Newport Rhode Island from Waterproof Charts Inc, Punta Gorda, Fla). I have also examined the tidal stream atlas for the area (Eldridge Tide and Pilot Book 2001 Boston, MA. In addition I have spoken with a local fisherman, Mr Joe Besade, who has knowledge of the area and conditions. I conclude that there are significant differences between the tidal conditions in the area and those which exist in the areas in the UK which I have studies. In particular, the tidal energy in the Millstone area is greater and the tidal range less. Thus there are fewer large areas of accretion zone intertidal sediment on the coast, indeed much of the coastal zone bottom is sandy gravel. However, patches of mud likely to contain radioisotopes seem to exist in narrow inlets and in the tidal rivers which carry tidal deposits up to 15 miles inland. Supporting evidence for this belief is to be found in a report in 1999 which drew attention to the presence of Cobalt-60 in mud in Jordan Cove. (Gaboury Benoit in 'Estuaries' 1999). In addition, there is mud in slightly deeper water, according to Mr Besade, who states that a special type of mud anchor, a mushroom, is needed to moor boats.

23. Although the sediment conditions are not quite the same, and this may mean that the discharges have not concentrated to quite the same extent as in the UK cases, the populations living close to the sea in the area are very much greater. And so the overall risk of cancer may be very great.

24. The main differences in radioisotopes between Millstone and Hinkley/ Bradwell/ Oldbury etc are that the releases from Millstone have much higher levels of the gamma emitter Cobalt-60 and also Tritium. I would expect this to have an effect on the spectrum of cancers and the yield but cannot predict what this might be. Tritium levels are also high in surface sea water in the Bristol Channel near small areas where I have established that excess breast cancer mortality occurs.

25. Prior to my study of Burnham on Sea (near Hinkley) and Maldon (near Bradwell) there was anecdotal evidence of excess breast cancer. This apparently is true of Millstone. I have seen a book 'Millstone and Me' in which there a number of accounts of cancer clusters near the inlets where I should have predicted high levels of radioisotopes. There is, however some further information. The State of Connecticut Tumour Registry reported in 1995 a study of cancer incidence in four towns which fit my criterion of large population in proximity to radioactively contaminated sediment. These were Waterford, New London, East Lyme and Groton. Results showed that between 1989 and 1991 there was a significant excess risk for all cancers (1.08; $p<.05$), female breast cancer (1.20; $p<.05$), and uterine cancer (1.29; $p<.05$) In addition there were non-significant excess risks for ovary cancer (1.35), and thyroid cancer (1.60).

26. In addition, there is a pointer from a study made by the National Cancer Institute into cancer incidence in New London County (Jablon et al. 1990) before and after the operation of the Millstone plant began, results given below:

All cancers New London County Standardised Incidence Ratio

Period	Cases	Incidence Ratio
1966-70 (before startup)	2790	0.91
1971-75 (after startup)	3363	0.96
1976-80	4029	0.99
81-84	3595	0.99
89-91 (3-years)	1478	1.02

27. Also there is evidence that the iodine releases from the plant may have caused increases in thyroid cancer. This is taken from a paper by J Mangano in 1996 showing Thyroid cancer in New London County.

Period	Cases	Crude rates
51-55	15	1.91
56-60	14	1.57
61-65	17	1.71
66-70	17	1.54
71-75	20	1.72
76-80	38	3.21
81-85	42	3.45
86-90	62	4.93
91-93	51	6.69

24. I finally conclude that sufficient evidence exists for me to believe that the operation of the Millstone plant, like the nuclear power stations operating near the sea in the UK, has caused increases in cancer in local populations through similar mechanisms. The Millstone reactors are licensed to release radioisotopes on the basis of erroneous models for radiation risk which significantly understate their true risk.

At very minimum, the case outlined here should be examined in relation to the plant, and measurements of local cancer rates should be made and examined in relation to measurements of radioisotopes in persons, marine samples, sediments and air.

25. Since human cancer data is readily available, and human cancer is a major human concern, my studies have concentrated on this as an indicator of impact. There are few tables of cancer in fish, and there is no oyster cancer registry. However, the primary impact is a mutation in a living cell and this will occur whatever the cell belongs to. Thus the discovery of human cancer increases correlated with radioactive discharges to the sea points to a very much more profound effect on the animals and plants which live in the sea and which are in contact with the radioactive particles. Many creatures (oysters, clams etc) routinely filter and incorporate radioactive particles from the mud. Impacts will include cancer but also, more significantly, will include developmental abnormalities, foetal death and sterility and genetic damage. I have no doubt that the operation of the Millstone plant has and will continue to cause irreversible harm to life in the coastal zone bordering it and in the rivers and inlets opening into Long Island Sound.

SUMMARY POINTS

- Evidence for the United Nations show that Millstone is the dirtiest reactor complex in the US, accounting for about one third of all the major liquid discharge isotopes (Caesium-137 and Cobalt-60) from the 57 Pressurized Water Reactors in the US.

- Recent research on power reactors and nuclear sites near the sea in the UK shows the existence of a sea-coast effect on cancer in four separate areas where man-made radioisotopes have been measured in intertidal sediment. Persons living within 1km of the sea have a significantly higher risk of cancer, particularly breast cancer.

- The explanation of the effect is that sea-to-land transfer of the radioactivity results in inhalation of the material and contamination of the lymphatic system. This results in high local tissue dose, a circumstance not covered by the present external radiation based risk models.

- Recent published analysis of infant leukemia increases in the group of children who were in the womb over the period of the Chernobyl fallout indicates unequivocally that the present external radiation risk models are incorrect by a factor of at least 100-fold.

- Comparisons of the releases from Millstone, and also the particular tidal conditions in Long Island Sound with the UK studies of similar power reactors also releasing a range of the same isotopes, strongly suggest that the

discharges from the site have caused cancer in local coastal populations and irreparable harm to marine and coastal life.