UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

April 20, 1983

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Glenn O. Bright
Dr. James H. Carpenter
James L. Kelley, Chairman

In the Matter of CAROLINA POWER AND LIGHT CO. et al. (Shearon Harris Nuclear Power Plant, Units 1 and 2)	Dockets 50-400 OL 50-401 OL ASLBP No. 82-468-01 OL

Wells Eddleman's Response to Applicants' Second Set of Interrogatories and Request for Production of Documents

This response is being filed under extensions of time negotiated with Applicants' counsel Flynn and O'Neill.

Documents requested by Applicants, and other documents responsive to the continuing interrogatories of Applicants' first set, will be delivered to Applicants at a mutually convenient time, probably April 8, 1983, based on my discussions with O'Neill. I plan to continue my present practice of making available longer documents for inspection and copying on loan to CP&L, and giving them copies of most shorter documents.

RESPONSE TO GENERAL INTERROGATORIES re Eddleman 29 and 37B:

1. a b c: responses included with answers to specific interrogatories. Generally, the persons whose work is cited in each contention would have first-hand knowledge of the facts in their work, and for some of these persons I have an address, usually in the documents cited.

2. My objection to General Interrogatory 2 in the Applicants' 1st set is incorporated here as if fully set out at this place.

DS03

With respect to radiation health effects, nuclear industry and government efforts to de-fund, fire, and otherwise trouble experts who find worse health effects than formerly claimed by government and industry are well-documented. Drs. Gofman and Tamplin had their funding cut off because of their work showing higher risks to the public from allowed levels of radiation from nuclear industry and military nuclear activities. See 'Population Control' Through Nuclear Pollution, 1970, pp 225, 221-227, and See Poisoned Power (1979 edition) and 117-120 and 153-155 pp 6-9,77-80,114-118,169,238-240 (Gofman & Tamplin), also "Population Control" through Nuclear Pollution (Tamplin & Gofman); "An Irreverent, Illustrated View of Nuclear Power"(Gofman) pp 62-63,130, 160-161,192-193 (the last 3 being mostly about the defunding of Dr. Thomas Mancuso after his studies showed increased radiation risks). re this, see also Hidden Power pp 150-151

Other examples include the funds cut-off to the Tri-State (Leukemia) Study (IDJ Bross, R. Bertell, et al), the elimination of Dr. K.Z. Morgan from the nuclear engineering dept at Georgia Institute of Technology, and quite possibly the incident in which Dr. Bertell was forced off the road by an object dropped in front of her car tire, and then questioned by an "official" looking vehicle's occupants, who it turned out weren't officials at all, and who haven't been identified (all this occurring after a death threat from an official of a New York electric utility against her, according to Dr. Bertell).

The firings of Dr. Carl Johnson in Colorado (who had exposed plutonium deaths around the Rocky Flats weapons plant) and of the public health official in Pennsylvania (Dr. McLeod)who agreed that Three Mile Island had had more health effects than the nuclear industry and the government claimed, are further documentation of industry/government retaliation against experts who disagree with them on radiation risks. Because of this extensive record of such intimidation (only partly described above), nonwitness experts' names must be protected in this proceeding if I am to have any access to expertise.

Further evidence of such a pattern of industry intimidation (often with government assistance) is discussed in (A) "The Texas Syndrome" describing the loss of jobs, income and job security by Charles Atchison, who revealed defects in pipe whip restraint welds at the Comanche Peak nuclear plant (copy attached as page 2B).

While the NLRB administrative law judges have ruled that Atchison was "properly reporting safety violations", an activity protected by law, and that he was being fired from other jobs as a result of being fired for such reporting of violations, "perpetuating a violation" of the 1978 whistleblower law "ad infinitum", Atchison is about to lose his house and faces years of appeals of these rulings, by the nuclear contractors and subcontractors who had been found in violation of the law protecting people who expose construction errors in nuclear plants.

Note that Atchison was fired for the second time after he testified under subpoena for intervenors in the Comanche Peak case before the NRC. One wonders, in the light of the case of William Smart at Callaway, and this case, how much the NRC is doing to protect people who bring such defects to light. As I understand it, the only way problems found by such persons ("Whistleblowers") can be litigated before the NRC is if they are made the basis of a contention by some intervenor, the NRC having basically told Boards to not consider such issues sua sponte. If intervenors like me are to have access to information from people working at Harris, we have to have the ability to protect the identities of sources who are otherwise unwilling to present information or detail where and when defects were incorporated into the plant. I've already talked to more than one who was unwilling to say anything if they were going to be identified, due to fear of job loss and being unable to find comparable paying work, much like Atchison.

Page 2B -- The Progressive, May 1983 (cover dated) issue
Received April 1983

The Texas Syndrome

FORT WORTH, TEXAS

Charles Atchison of Azle, Texas, never thought he would be a whistleblower—at least not in 1979, when he signed on with the Houston-based Brown & Root, Inc., prime contractor for the Comanche Peak nuclear power plant.

Today, the soft-spoken, affable Atchison is struggling to clear his work record as a quality control inspector and win the back pay and court costs awarded to him by the National Labor Relations Board. In three separate rulings, the NLRB found Brown & Root and two other nuclear contractors guilty of firing Atchison illegally. Two of the companies may have engaged in a conspiracy against Atchison, the NLRB says.

Atchison's work record at Brown & Root was filled with "good" to "excellent" evaluations, and he won several promotions to more responsible positions. But last April, he was suddenly fired and accused of "overinspecting and witchhunting."

His transgression was to report faulty welds in critical safety areas of the plant. "The defective welds were showing up in pipe whip restraints manufactured by Chicago Bridge & Iron in 1979," Atchison says. "I was told then by my supers not to report on vendor welds because they were 'outside my area of responsibility.'

"When the defects popped up again in 1980, I was again told to keep 'hands off,' but I couldn't . . . they were too obvious," says Atchison.

By the time he was fired, he had discovered that since 1977 the pipe whip restraints had been "installed to the wrong specs, and the NRC [Nuclear Regulatory Commission], as well as everyone else, had missed that," he says. "I told B&R [Brown & Root] that all of those installations should be inspected, and I told my supervisors that I would go to the NRC if they didn't do something."

FORT WORTH STAR-TELEGRAM

Charles Atchison, blacklisted by nuclear firms: 'I'm about to lose the first house I've ever owned.'

But Brown & Root wasn't interested in Atchison's findings, so "they fired the bearer of the bad news," he recalls. He took his case before the local NLRB, which ruled within weeks that Atchison had been dismissed illegally. He had been "properly reporting safety violations," an activity protected under a 1978 whistleblower statute. Brown & Root appealed, only to be overruled by Administrative Law Judge Ellin O'Shea, who accused the company of making "unconvincing, unbelievable and irrational charges" against Atchison. O'Shea ordered Brown & Root to reinstate Atchison with back pay, expenses, and full benefits.

"I'm still in a daze about what happened next," says Atchison. A Dallas antinuclear group, Citizens' Association for Sound Energy, enlisted him to testify at local Nuclear Regulatory Commission proceedings last July concerning the safety of Comanche Peak. But the day he was scheduled to testify, after being out of work for three months, he was suddenly hired by another nuclear contractor, Thompkins-Beckwith, Inc., for work at the Waterford III plant near New Orleans. Two days after reporting to work, he was called back to Fort Worth, under subpoena, to give his testimony before the NRC. He told his immediate boss at Thompkins-Beckwith, who gave him permission to leave. As soon as he returned to work, he was fired.

The events smacked of a conspiracy to prevent Atchison from giving his testimony. "The day of hiring of Mr. Atchison directly corresponded to the date of hearing at which Mr. Atchison was scheduled to testify," wrote NLRB regional director Thomas Killeen, "thus rendering him unavailable for testimony."

"It's a tightly knit group," Atchison's lawyer, Marshall Gilmore, says of the nuclear industry, "and in this case, obviously, Chuck was set up." The man who fired Atchison for the second time, Tony Orsini, says the forty-one-year-old inspector was dismissed because his "termination from B&R was not acceptable." The NLRB ordered Thompkins-Beckwith to reinstate Atchison with back pay and court expenses.

A week or so after being dismissed by Thompkins-Beckwith, Atchison was hired by a jobber in Dallas, Mercury of Norwood, another Waterford subcontractor. But Mercury of Norwood was told that Atchison was a "troublemaker," and within an hour he was fired, the NLRB noted.

Unfairly dismissed from one job, Atchison now was being fired from other jobs because of the initial injustice to him, thus "perpetuating a violation of the [whistleblower law] ad infinitum," the NLRB ruled. Once again, the board ordered a company to reinstate Atchison.

But the cases are far from closed, since all three companies continue to appeal the NLRB rulings. It could be years before final decisions are reached.

"I may win big down the line," Atchison says, "but in the meantime, I'm about to lose the first house my wife and I have ever owned, and I have a fourteen-year-old daughter who wants to quit school and go to work."

Atchison is currently employed by a small military contractor in Fort Worth. "I'm making about half what I would make in the nuclear industry and my new boss is restless 'cause I'm off so much dealing with these cases," he says. "Still, I'm going to try and see this all the way. Others are bound to benefit."

—BETTY BRINK

(Betty Brink is a free-lance writer from Texas who specializes in nuclear issues.)

May 1983 issue

The rapid loss of business by our security expert (Hawkeye) after qualifications were put into the record here (and not otherwise publicized or indeed mentioned to anyone except my attorney, by intervenors, so far as I am aware -- and I checked on this after this security firm withdrew, asking each security intervenor), shows the chilling effect on free access to information and views that the nuclear industry can and does exert. In order to develop a sound record, informed views (including those which may not agree with Applicants or NRC) are necessary; and I can make effective use of such views in filings, locating and interpreting information, cross-examiningx, and in other ways, without having to expose experts who have developed such views and information to the well-known nuclear industry pattern of trying to squelch (or worse) its scientific critics.

3. None at this point.

4. These documents, to the extent not noted in the contentions, will be identified for each contention below and made available to Applicants for inspection and copying under mutually agreed conditions.

5. Such documents will be indentified & made available per 4 above.

6. Objection to #2 above incorporated here by reference as if fully set out herein.

7. I have not identified any documents yet which I plan to offer as exhibits or use in cross-examination. I do rely on documents, as noted above, but have not yet planned exhibits or cross-examination to the extent of identifying which documents included above, or others I intend (or plan) to use in these ways.

RESPONSE TO INTERROGATORIES ON EDDLEMAN 29

G1 (a) Bruce Molholt, Ph.D., Director, Center for Environmental Health, 1315 Walnut St., Suite 1832, Philadelphia, PA 19107, has direct knowledge of his testimony in TMI Restart, his cross-examination of Dr. Tokuhata therein, and his opinions concerning certain findingxs of fact made in a partial initial decision by the ASLB in that proceeding. Please note that Dr. Molholt informed me orally in April or May 1982 that he might be moving from this address.

In addition, the authors of the documents listed below have first-hand knowledge of the preparation of those documents, and of those facts which they personally determined.

(b) In addition to the documents referenced in Eddleman 29 (one of which, it appears, addresses TLDBs (Joint Contention , Steucek et al letter 3-30-82 to Health Physics Journal, at pp 6-9), underestimate of I-131 releases in "normal operation" of nuclear plants is shown in TOWARD A REALISTIC FISSION DOSE ESTIMATE (LAND Educational Associates Foundation, 3368 Oak Ave, Stevens Point, WI 54481) (copy provided of relevant table to Applicants). Dr. John Gofman was chief consultant on this study. The relevant fact is that the whole body and bone doses from I-131, Sr-890 and Cs-137 is much higher than NRC estimates. This data was derived from milk monitoring data. Since NRC has discontinued the requirement for milk monitoring around nuclear plants (I filed timely comments against this change), it is much harder to get the data now for a similar sxtudy of Harris or CP&L's existing n-plants (or the VC Summer and N Anna plants, which are operating (so to speak) and are similar to Harris per the FSAR). The higher dose from the levels of I-131 in Wisconsin, 1963-76, combined with the study's analysis of radiation levels rising with nuclear power development (more plants) which is not attributable to nuclear weapons testing, shows that nuclear plants have emitted excessive levels of I-131 to the environment.

There is also a one-page letter from Dr. Molholt to me which mostly identifies the documents below, but also names at least one person not consulted (to the best of my recollection) in preparing this contention. If I cannot negotiate this point successfully with Applicants, I object here to disclosure of this document because it provides no information not in the disclosure below except for the identity of 2 persons referred to above and some information NOT provided to me, and the identity of each person is Privileged under my objection to General Interrogatory 2 above (incoprorated here as if fully set out at this point). The information I have not used, or identifieation of it, is not relevant. NOTE: copy of letter w/o names sent to O'Neill 4-15-83.

TMI-restart- copy lent to Applicants

(2) Molholt testimony outline p.19 shows continued evidence of excess hypothyroidism downwind of the Peach Bottom reactor after the 1-131 released from TMI had decayed away to insignificance, i.e. in the first 8 months of 1980.

Note also on page 19 underestimation of delivered I-131 dose by ignoring inhalation pathway. P.18 covers fetal hypersensitivity to 131-I.

(3) Letters by Kirk, and by [redacted] Field, Field, Zegers & Steucek, the latter, pp 6-9 (Health Physics) detailing reasons to use vole or other animal thyroids to monitor I-131 in the environment (seek also Kirk letter pp 3-4). See also Field et al Table 1, p.12. Note the statement (Field et al p.8) that the dose to vole thyroid at Site III was much above that estimated for humans (NUREG-0558, p.75). This indicates that underestimates of radioiodine levels in biota may well be taking place under non-accident conditions also.

(4) "NRC's GROSS UNDERESTIMATION OF THE RADIOACTIVE RELEASES AND POPULATION DOSES DURING THE TMI-2 ACCIDENT" (excerpts from review published in Nuclear Engineering, vol. 26, no. 3) by Seo Takeshi, Kyoto University Nuclear Reactor Laboratory, Kyoto, Japan.

This shows, first, that NRC TLD's through 4-6/7 1979 at TMI came up with doses over 60% higher (5300/3300) and 75% higher (2800/1600) than utility TLDs. Given a TLD accuracy of 30%, the probability of such discrepancies being random is negligible, given the sample sizes (1st ration: NRC 37, utility 20),(2d ratio NRC 30, utility 15). Note that these are collective dose estimates, not summations of the TLD readings. This discrepancy in monitoring is substantial, but relates more to the joint contentions on TLDs.

Second, re radioiodines (see pp 2-4), the grab samples and estimates from TLD data agree well (Figure 2), but the vent monitors are not functional for about 3 weeks after the accident (ibid). The noble gas underestimate (for release) is 4.5 times (given at top of p.4, evidently omitted at top of p.3), based on the TLD data and Seo's analysis of it, pp1-2.

Third, Seo's analysis of radioiodine levels in filters (pp 3-4) points to the lack of a decay curve prior to the quicker change of filter cartridges 4-14-79 through 4-20 (and continuing to be often more frequent than before 4-12, throuth 4-30. Seo states (p.3) "It is clear that during the period before April 14 the average sampling intervals were seven to eight times longer than those during the period after April 14. Also it should be noted that after the sampling intervals became shorter, the declining gradient of the release rate was at a higher level by several tenfolds from that for the period between March 28 and April 14). Seo computes an underestimate of 364 times in radioiodine releases, due to the failure of filters (cartridges) to trap all the radioiodine going through them.

By estimating the gradient of release backwards at the Apr 14-20 rate, or at the halflife of 131-I (8 days) the initial release

level comes out, at a minimum, at over 100 uCi/sec, (halflife extrap) to 2500 u Ci/sec (decay curve extrapolation). Seo indicates that as many as 64000 Ci of I-131 may have been released. Dose estimates made by the NRC do not appear to follow the available data on I-131 releases.

(5) there is testimony (NCUC Docket E-100 sub 35, witness Smith or Dominoski, both residents near TMI) of a "metallic taste" one of them felt during the accident. Iodine, as I noted in testimony in the same hearing, has a metallic taste. I have not determined the minimum amount of iodine that can be tasted, particularly if it is airborne, but given the intense radioactivity of 131-I (halflife around 730,000 seconds) even a minuscule amount could be a significant quantity of radioactivity in curies.

(6) The tendency of epoxy (typo in contention 29,"exposy", i.e. epoxies) to dissociate under conditions of heat, moisture, pressure or radiation (or any combination of these) is documented by the Union of Concerned Scientists re containment penetrations. I have not located this document, but recall using it in preparing Eddleman 29.

(7) The tendency of PVC to embrittle under radiation is documented by Gillen and Clough, et al e.g. in NUREG/CR 2877 (SAND 81-2613) p.1-2 (test descriptions pp 2-9) conclusions pp 14-28. Tables I and II (pp24-25) show that radiation exposure followed by elevated temperature produces the worst effect of reducing tensile elongation (i.e. embrittling) PVC, and that gamma radiation and heat in air likewise produce the worst effect on PVC in this respect. I used a Science News article concerning this work in preparing Eddleman 11 and this is where the PVC problem in Eddleman 29 (1st paragraph, supplement 5-14-82, p.93) came from. See also (8) below for supplement to (a) and (c) re this. Authors here: Gillen, Clough, Lowell H. Jones.

(8) Further work on the degradation of PVC is in NUREG/CR 2763,

8-14, Table 4, Figure 2, and SAND82-1071, see pp iii, 1-2, and especially 21-24. The swelling effect shown for PVC where oxygen levels lower (p. iii, p. 11, pp13-14 and figure 3.) The large changes in PVC material volume would preclude its use as a tight sealer in general, for if it were not enclosed on all sides, such an expansion could readily distort or crack open gaps in the opening or fittings being sealed, and if it were totally enclosed, if the expansion occurred it would totally distort the enclosure. All these have the potential to create leaks bypassing the relevant filters, as alleged in Eddleman 29, at p.93 and 94 (item F). So do the eventualities in the reference under 7. above, through embrittlement, cracking, separation of PVC sealers from edges they seal between or along, and so on. (a) Supplement: authors are Gillen, Clough, Ganouna-Cohen, Chenion, & Delmas re 8.

(8)

The difficulty caused by the conditions cited in (7) above is that if normal radioiodine releases are indeed low, they can be systematically degrading the sealers (PVC, epoxy, and the other materials in ref. &7 (polyethylene) -- as well as those in NUREG/CR 2157 (1981) which demonstrate the same type problems with more rapid degradation in lower-radiation environments, per amount of radiation received, than if the radiation is given all at once, for ehtylene propylene rubber, cross-linked polyolefin insulations, chloroprene and chlorosulfonated polyetylene), as can exposure to other radioactive materials in the gas stream through the filters and other radioiodine absorbers, and from an particles (radioactive) deposited around sealers or due to velocity drop ahead of the filters, vibration shaking them off filter surfaces, or leaks around the seals that hold the filters in place, or around non-sealing filter mounts. Embrittled sealers cannot seal as well as more flexible sealing material; it may crack, pull away from the sides or surfaces of the section(s) being sealed, leaving gaps; it may develop holes, or warp and swell so as to open gaps beside it; ends under tension

may simply retract, leaving holes and gaps, as tensile elongation and resiliency are reduced; selective embrittlement of edges or faces of a sealer facing the airstream or exposed to radioactive material as particles deposited, dripping liquids (in the case of high humidity or of liquid droplets of radioactive materials, e.g. organic iodines) may cause those sections of sealer to twist or warp or swell, any of which can impair the seal effectiveness by opening holes or gaps around it -- in the extreme case, embrittled and stiffened sections could lift the sealer out of its normal path, leaving a hole. Finally, all these forms of embrittlement increase the likelihood of gaps being formed when filters or other iodine trapping mechanisms are replaced, since the embrittled sealer's tendencies to warp, twist, or stick to the exchanged piece of filter or equipment as it is being removed, can all create gaps, and the motion of removal may open cracks in embrittled sealers or allow a tensioned sealer or portion thereof to move freely, opening cracks or gaps, or pulling away from the surfaces to be sealed. I have observed the effects listed in the last sentence in air conditioning and air handling systems (nonradioactive) and can attest to how difficult it is to maintain a seal when the sealer around a filter being changed is embrittled.

(9) FSAR TMI-62 states that (item 3) there is no capability of sampling vacuum pump effluents for particulates and radioiodines "duex to the high humidity". The effect of humidity on the other particulate and radioiodine monitors for release points 1,2,5 and 5A is not discussed there. Thus, it appears Applicants concede an inability to detect radioiodine releases in normal operation. Moreover, p. TMI-61 states (item 3) that the condensate vacuum pump effluent stream noble gas monitors will have "details on these monitors ... provided in a future FSAR amendment." Further, at p. TMI-63, it is stated that a reliable method of monitoring the

31 atmospheric steam dump valves, steam generator safety relief valves, power operated relief valves (such as stuck open at TMI and Ginna, see NUREG-0600 and NUREG-0909), and release points of secondary steam from the auxiliary feedwater pump turbine. CP&L states it will continue to review these potential release points, which number 31 per unit (62 for 2 units, or 124 for 4 units as the FSAR says). Note that these are steam release valves, so humidity should be a definite problem in monitoring these release points for radioiodine and for particulates (per p TMI-61, referenced above, FSAR).

(c) facts specified are stated above. Other facts may be included in one or more documents I have not yet located, or in documents I believe were used in preparing Eddleman 30, and which are identified in the Molholt letter I sent a copy of to O'Neill (Applicants' counsel) on 4-15-83.

2(a) information provided above. (3) None so far. (4) identified below if not already identified above. (5) identified below. (6) identified below except for names of any persons providing information -- on this point, my objection to general interrogatory 2 above is incorporated here by reference as if fully set out here including the objection to general interrogatory 2 in response to the Applicants' first set of interrogatories to me. (7) none so far.

29-1: The FSAR and the ER, and possibly others not known to me.

29-2: I can't be sure without more information from Applicants, on which I am now conducting discovery.

29-3: Basis so far is the basis of the contention 29, that Applicants cannot detect radioiodine releases from numerous points, and radioiodine filtering and trapping devices may not be able to continuously trap radioiodines to the levels Applicants state, due to not enough filters/traps, and due to leaks past the filters/traps, e.g. due to seal failure. See above re G1-b and c.

29-4. Yes.

29-5. These are stated (ER amendment 5, section 5.2.3.2) to be maximum values calculated from a diffusion model for annual average . This model does not take into account rainout, snow, or the tendency of plumes in the lee of powerplant structures to be much more cohesive than models had indicated. (The data of Pisiello et al on Kr-85 releases from TMI-2 are also relevant here -- they found the plume touching down on the ground, with concentrations much higher than NRC had predicted by its modeling, which is no doubt similar to Applicants' modeling for Harris). Further, these values depend on the Harris source term, which has apparently been revised, and on which I am sending interrogatories.

Radioiodines occur as elemental I, organic iodine, hypoiodous acid and possibly in other forms. The particulate and soluble forms of these (including the element, organic, and HOI forms) can readily be captured in the nucleation of rain or snow, or by falling snowflakes or rain drops, or in the nucleation or fall of ice crystals and hail, including accretion on hail or ice crystals or snowflakes. Thus, rainout and snow can bring considerably greater concentrations of radioiodines to earth than Applicants predict. I need considerably more data to quantify this relationship, but the burden of proof is not on me.

The source term may not take into account variations in plant radioiodine releases, releases through release points Applicants do not or have not monitored, and so on. The revised source term came to me as numbers without an explanation or basis so I cannot answer this question in more detail without discovery of Applicants.

29-6. I do not know how accurate Applicants' meteorological data is. I presume this question really asks, am I challenging their <u>use</u> of this data. I will require discovery on the data itself; the method

of use of the data is deficient as noted above; further, I do not believe that there is a sufficient period of data for Harris to include all the variations that could be expected during the term of the Harris license. The site data tells nothing about rainout, snow and other precipitation offsite (indeed, for rain, in this area, the data may differ for points as little as 100 yards apart; for snow and other precipitation, I do not know the variability to be expected with location around the Harris plant. Applicants have indicated in one of their filings to me that the hilly terrain around Harris would be expected to introduce considerable variation in wind and weather. (b) see above. (c) see above.

29-7(a) as noted above, the source term has recently been revised upon what basis I don't really know. I am conducting discovery on the new source term and its basis. (b) see (a). Table 5.2.2-2, as I understand it, does not concern normal concentrations of radioiodines at the plant boundary, but maximum ones. (c) see (a)

29-8. It appears that Table 5.2.2-3 has been deleted from the ER, by amendment 5. I require discovery to answer this question, for both (a) and (b).

29-9: See above.

29-10(a) I'm not sure which of the models this guide approves that Applicants used. I'll conduct discovery on this. (b) However, the cooling pond models described on pages 1.113-26 through 37 are stated to apply best to long half-life materials (which I-129 is, but I-131 and most other radioiodines are not), and none of these models allow nonuniform concentrations at the surface, or stratification/turnover which is to be expected in a lake as deep as the Harris lake. As to the numerical models, pp 38 through 41, only one-dimensional diffusion is addressed (ref. 57) and the applicability is stated to be less if there is stratification and turnover. In sum, no model in that reg guide

for impoundments appears to be appropriate for Harris's reservoir. (b) to the extent I have the info now, see above. (c) I have not determined this, but the ability to handle short-halflife substances like I-131 is a preprequisite to the adequacy of any such model for radioiodine levels. Flow patterns and evaporation and chemical interactions of iodine with other material (e.g. decaying organic matter, water, chlorine and hydrazine and ammenia, etc) should also be modeled, as dispersion amounts to a spread of the chemical.

29-11(a) To the extent I now know Applicants' analysis, I think my principal disagreements are stated above, but I am conducting discovery on a number of issues relating to this contention and may well find that other disagreements arise from the information so discovered, e.g. the source term, Applicants' analysis and experiments, their definition of normal operation, and so on. (b) see (a) above.

29-12(a) ER section 5.2.4 consists of one page stating that for both liquid and gaseous pathways the "usage factors and dose calculational models were taken from NRC Regulatory Guide 1.109", and that atmospheric dispersion anddeposition rate factors were used for gaseous pathways from Table 5.2.2-1. I have discussed my disagreements with the model and assumptions by which these dispersion rates were derived, above, re 29-3, 29-5, 29-6; deposition models are probably wrong if they rely on the AEC experiments which were discussed in the 11-11-79 /WAshington Post, which stated NRC was still using the results of fraudulent AEC experiments in which deposition and uptake or radionuclides were determ'ned in sterilized soil (baked at 400 F and irradiated with UV, so no microorganisms) which had been selected for its low adsorption and absorption of radionuclides, further using full grown plants and transplanting them into such soil and then assessing radionuclide uptake after only 3 days.

The problems with such an approach are legion and I'll try to lay out the major ones: killing the microorganisms removes the first biological level of concentration (and maybe several levels) for radionuclides; baking removes water from the soil, and water is the means of much chemical acitivity and the basis of microorganism motion and life in the soil; transplanted plants often go into shock and thus do not take up chemicals from the soil the way a plant grown in place would; three days is far shorter than the growing life of most plants, especially most plants eaten by humans and animals that humans eat. In addition, the work of Franke et al (NRC translation 520) shows that transfer factors used by NRC are much less than those reported in the literature (see p.33,45,59,65,67,70-73, esp note re goat milk on 72,80,87-88,97,99 (see 98), 100-106,108-109, 110,113, 114-115, and refernences dited therein).

The statement about direct radiation in 5.2.4.3 gives no basis; since I-131 and other radioiodines in the plant are gamma emitters, direct radiation from them should be calculated and included, and the shielding of the resins, filters and other items absorbing radioiodines in the plant, as well as the sites of such in operation and when they have been removed and are stored as radioactive waste, should be analyzed.

As to regulatory guide 1.109, I assume Applicants used Appendices C and E for radioiodines. The $C_i^G(r,\theta)$ therein appears to ignore rainout and precipitation (in section 1); ditto for $X_i(r,\theta)$ in section 2. At p. 1.109-26, the use of 1.1 for 10,000/8760 gives about a 4% under estimate. (10,000 is $10^{12}/10^8$); same page, wet deposition is not included for radioiodines; the nuclide concentrations in milk appear to depend on a deposition rate and a C_i^V that also ignore rainout/precipitation, and NRC appears to be using the lower transfer factors critiqued

in NRC translation 520, above. There are a number of other defects, e.g. Table E-7 says no data for iodine dose to the lung, though this air pathway would be critical for dose to the lung, and iodine can form tiny particles that deposit well in the deep lung, and is a gamma emitter for I-131 and other isotopes. However, the major problem from ER 5.2.4 is that there is nothing that tells me what and how the data CP&L used were applied. I need discovery to answer this, as a one page "description" of such a complex calculation is hopelessly inadequate to even evaluate. I do not maintain that I have here gotten all the problems with Reg. Guide 1.109 down, just the main ones I have identified so far.

I do not believe that my disagreements with calculation of maximum doses to individuals from all pathways are relevant to this contention; but most of the criticisms above apply to nuclides besides I-131, as you can see by reading NRC translation 520 in full.

(b) basis is provided above "analytic" i.e. it's my analysis or the analysis of the authors of the cited works.

29-13(a) Yes, although that doesn't mention Appendix I. (b) see above.

29-14(a) Yes. (b) I have not prepared a dose estimate of my own, but the radioiodine doses are clearly underestimated for the reasons given above.

29-15(a)Yes, it appears to not comply with the $1000/person rem rule for reducing exposures (Appendix I, sec II.D; it does not appear to comply with Sec III B thereof; sorry, it appears Harris is exempt from II.D if it complies with the staff position in RM 50-2. This doesn't mean I concede that Harris does comply to that standard for radioiodines or anything else. (b) If Harris exposures are calculated for present uses, the rapid expansion of Cary and other towns downwind, and the tendency of people to grow more vegetables for themselves,

are not sufficiently taken into account, and section 5.2.4 and Table 5.2.5-2 makes no reference to such monitoring programs as App I, III B, requires. I also disagree in that the use of "dose" in Table 5.2.5-2 is proper where Appendix I requires "dose or dose commitment". Table 5.2.5-2 does not appear to consider dose commitments, for radio-iodines or anything else. Nothing in this response should be taken to mean I agree with any calculation or number given for SHNPP in Table 5.2.5-2. Finally, if the realistic estimate of radio-iodine or other doses exceeded the Staff Rm-50-2 guidelines, then Harris would have to comply with section II.D of Appendix I to 10 CFR 50. I am not certain what "the use" of the Appendix I guidelines is in the Table 5.2.5-2.

29-16

I don't have a transcript of the special prehearing conference, but I don't recall saying that Applicants "have not demonstrated that normal radioiodine releases will not exceed Appendix I limitations". I believe that's the Board's rewording of my contention 29, which says that the"ER... C. Underestimates the radioiodine releases in normal operation and the health effects thereof." I may have referenced Appendix I in cross-reference, since a contention may allege a violation of a specific NRC rule.

At any rate, I think the quote means that Applicants have not validly shown that normal Harris radioiodine releases will not exceed Appendix I limitations.

29-17. Using the maximum amounts of radioiodine which could be released during normal operations (non-emergency), demonstrated on a conservative and fully valid basis that radioiodine (all isotopes, including those produced by decay of other isotopes, e.g. noble gases, xenon isotopes, particulates) will not exceed the dose and dose commitment limitations of Appendix I in any event. Conservative basis means that the largest transfer and deposition factors known are used in the analysis, rainout is fully accounted for, added gardening near

Harris is fully accounted for, and that the requirements of Appendix I sections II.D and III.B are fully complied with if such analysis demonstrates that they are required by Appendix I to be complied with. Soil permeability, runoff, and evapoxtransipiration, lung dose, and all possible release and uptake pathways should be fully factored into the analysis

Soil permeability ✓

RESPONSE RE 37 B

G1-a I relied on my memory of papers by Bross, Bertell, and others; I believe Bertell has moved to Torpnto; Bross, so far as I know, is still at Roswell Park Memorial Inst. (b), (c) see contention 37B and response to G-5 below.

G02 Objection, same as to G-2 above, incorporated by reference here in fully.

G-3 None yet. G-4 None G-5(a) The Nuclear Worker and Ionizing Radiation, by Rosalie Bertell, Ph.D., American Industrial Hygiene Assn Journal May 1979 (vol 40, pp 395-401, and comments, ibid, 10-79 pp 916-922. Causes of death therein include homicide and suicide as well as accelerated aging, non-malignant gastrointestinal diseases, cardiovascular diseases, bronchitis, other circulatory diseases, diabetes, stroke, hypertension, all cancers, atherosclerosis, allergies, and asthma, (as well as increased risk of cancer death or leukemia from persons who have acquired asthma, allergies, heart disease, diabetes, or bacterial and viral diseases (due to reduced immune response) caused by radiation themselves), "mild mutations in germ cells" (p.399), pneumonia, dysentery, hives, eczema, rheumatic fever, genetic diseases. also NON-malignant respiratory diseases
(b) see specific responses, besides G-5(a) and G-1(b) and (c).
6. I recall none, and have found none so far. 7. None so far.

SPECIFIC INTERROGATORIES: 37-B-1. See response toG5(a) above. In addition, I have attempted to locate lists of the diseases involved. Gofman 81, Radiation and Human Health, pp840-849, 850-853, refers to 700 dominant genetic diseases (p.851) as well as recessive an fregularly inherited diseases. I did about a day's library research trying to

find good lists of these diseases, and although the results were not that good, even with help from reference librarians at the UNC Health Sciences Library (Chapel Hill, NC), here are the results:
I also have this title ending "Inherited Disease
The Metabolic Basis of Genetic Diseases, 5th ed, 1983, 5 authors and over 100 contribors I'd guess, lists, pp 39-59, many genetic diseases. All of these may be caused by the radiation mechanisms
See also Tables 1-4 (p.14) and 1-5(pp 15-16)
discussed by Gofman (as cited above) and by Porter, Heredity & Disease, pp 20-29 and 30-76, and An ABC of Medical Genetics (if my notes are right)31-49 and 54-60. Other such diseases are noted and described in Clinical Genetics - A Source Book for Physicians (ed. Jackson & Schimke, 1979) pp 33-244, 246-7 (list of pharmacogenetic conditions), 261 (list of vitamin related genetic diseases), and pp 269-594; list, pp xi-xiv of Genetic & Malformation Syndromes in Clinical Medicine, Nyhan & Sakati 1976; Genetic Disorders of Man (1970) pp 107-980; Progress in Clinical and Bio. Research volume 32 (1978) pp 27-306 and 523-732; list of Diabetes related disorders, p 746 ibid; list of HLA related disorders pp 746-47; Porter, Heredity & Disease (1968) (pp 20-29 and 30-76 re causal mechanisms; pp 86-137, 154-242, 243-304, and 309-342 re genetic diseases, pp 307-308 re ionizing radiation; UNSCEAR 1977, Tables 1-8 (pp 514-519) and 10, p.520, list genetic diseases considered in that report; genetic diseases as mentioned in pp 441-468 of H. Harris, The Principles of Human Bio-Chemical Genetics (1980).

Additional discussion of failure modes is in Chapter 9, & pp 88-106 in C. Auerbach, F.R.S., Genetics in the Atomic Age (1965) and pp 9-10 of the 1983 edition of Metabolic Basis of Inherited Disease (op cit) (compare Gofman, pp792-796,817-820,826-839,840-846, 846-47, 848-849, 850-53,100-101, 766-69, 790-91,838-9,721-4,773-776, 82-84,401-2, 408-9,410-411,769,771, 780,844, 570, 572, 832-5, & Chapters 21 and 22 to the extent not cited above).

ICRP Publication 18 (1972) pp 28-29 and 32-33 states that there is a constant and maximum RBE for radiation for causing mutation at low dose rates.

Gofman references VA McCusick, 1978, Mendelian Inheritance in Man (sic) and states that reference catalogs 700 autosomal dominant diseases (p.850); also references Table 50, p 539 of UNSCEAR 1977 (op cit); (lists of genetic diseases of concern).

Gofman 81, op cit, p. 102: "leukemia and virtually all solid cancers can be caused by radiation" (he states that almost all authorities agree on this point). See also, re causation, JH Edwards, Cost of Mutation, pp 465-483 in Genetic Damage in Man (sic) Caused by Environmental Agents (1979). This last gets into the effects too.

Further reference on life shortening effect of radiation: Cellular Basis and Aetiology of Late Somatic Effects of Ionizing Radiation, pp 313-316 (Lindop & Rotblat); pp 285-94 (Upton, Kastenbaum & Conklin), pp 273-275 Table I (R H. Mole), life shortening effect for mice 7, 17, ~~x~~ 23,25 and 41% of 5 groups' life expectancy before irradiation.

'77 UNSCEAR p. 519 references #'s 566, 576, 586 and 587; 586 is the 1962 UNSCEAR report; 587 is UNSCEAR 1966 (supplement 14); 576 is Trimble and Doughty, The amount of hereditary disease in human populations, Ann Human Genetics (London) 38: 199-223 (1974); 566 is A.C. Stevenson, The load of hereditary defects in human populations, Radiation Research Supplement 1: 306-325 (1959); also relevant is Vogel & Rathenberg (ref 599) Spontaneous mutation in man (sic) Ch.5 pp 223-318 in Advances in Human Genetics, vol 5, 1975.

See also Gofman (op cit) pp 42-101, re doses and genetic damage mechanisms; pp 42-52 and 102-555,578-618,660-706 re cancer induction; see also Chapter 19 re x-rays;;719-739 re genetic damage mechanisms.

401-02, 766, 843, 851-2,

37(B)-2. There is no level below which the risk of any of these diseases is not increased. See Morgan, Bull. At. Sci. Sept 1978 (which I have a copy of, I believe, but have not located) Rotblat, ibid, (articles); Gofman 81 (cited above) at pp408-9,843,733,738,758-9 re genetic injury,374,378,385,409-11,388,485-7,405-7, 409385-6, 412-15, 534,309,292-3,589-90,884,370-374 re cancers, etc.; Bertell, The Nuclear Worker and Ionizing Radiation, op cit, pp 398,399,400; comments 918, 921,922 9no threshold for health effects); IDJ Bross and D.L. Driscoll, Direct Estimates of Low-Level Radiation Risks of Lung Cancer at Two NRC-Compliant Nuclear Installations: Why Are the New Risk Estimates 20 to 200 times the Old Official Estimates? (Yale J. of Biology and Medicine 54: 317-328 (1981). H.H. Rossi (Yale J. of Biology & Med 54: 340-341, points out that the energy received by a given cell will be the same below a certain dose threshold for both gamma and neutron radiation. Thus, as long as there is any dose (i.e. any radiation absorbed by a human cell, from external or internal sources) there will be some effect.

37-B(3): The above references (see also re 37B-1) give the dose-response effects as currently known. The estimates are in some cases 5, 10 (Morgan/Rotblat), or 20-200 (Bross & Driscoll) times the "official" estimates of NRC, BEIR, UNSCEAR, et al. Gofman points out (pp848-49)(op cit) underestimate factors of ?, 6 to 20, unspecified (since BEIR and UNSCEAR make no separate estimates for deletions, translocations, and trisomy-21), and (850-853 on potential tremendous underestimate for genetic effects of deletions; pp 846-47 (6 to 100 factor of underestimation for mutations, pointing out that balancing selection is not demonstrated for any irregularly inherited disease); Bertell gives elevated risk estimates for the additional causes of death she identifies (most are in the references to her paper); elevated cancer risks, see Gofman, chapters 3,4,5,6,7,8,9,10,11,

12,13,14,15,16,17,18,19,20 covers increased cancer risks (and other disease risks, to some extent). I believe this covers all the diseases and classes above, but I have not yet had time to search all the information I possess to see if additional information is there.

37-B(4)(a) Yes, Applicants', BEIR's, and NRC Staff's.

(b) estimates of risk that omit increased incidence of any disease mentioned in response to 37-B-1 above; estimates of cancer risk per person rem for external and internal exposure; BEIR estimates as reported by Gofman, Table 76, pp848-49, and by UNSCEAR, dito, and in the associated commentary pp 707-853; estimates of cancer induction risk, v. Morgan and Rotblat's articles in 1978 (sept) Bulletin of Atomic Scientists, and v. Gofman's cancer dose estimates, op cit, 117-118,420,365-67, 285,455, 118,235,324,294-304,285-6,287-8,276-84, 339-42,347,354,454, 659,305-8,532-4,561,574311-13,356,453,305-6, 307,308-9,439,458-9,52506,534,543-51,571,585-87,587-88,289-93, 590-94,617-18,47-49,291-93,404-5,135-44,144-46,154,272,274-5,328, 131-138, 134-44, 328-9, 365, 325-28, etc. 464-468

Also per Bross & Driscoll, Mancuso-Stewart-Kneale studies cited by them and by Bertell, and per Bertell's paper, the risk per exposure to radiation, and the omission of non-cancer, non-genetic risks from all or any estimates. BEIR-III's overall estimates of risk of death from radiation, per person-rem or per rem; NRC's or Applicants' use of any of the above in computing costs and benefits or preparing environmental assessments or safety analyses for Harris.

BEIR omission of mild mutation effects, ref Bertell p 22.

37-B-5. The word "victim" is not in 37-B as proffered or as admitted. I believe you are asking about the pain and suffering aspect of 37B as discussed at the July 1982 and Feb 1983 special prehearing conferences. In that connection, a "victim" is a person who has any of the diseases mentioned in response to 37-B-1 above, especially cancer of any sort (including leukemia), but including all the genetic diseases and other diseases listed or characterized in response to 37-B-1.

37-B-6. I have not made such an estimate. I can characterize an accurate estimate as follows: one which, giving the benefit of the doubt in all cases to the additional protection of human health (i.e. where two estimates of human health effects or more are available, use the highest such estimate), based on the maximum allowable releases of direct radiation and all forms of radioactive material from the Harris plants over their operating lifetime as estimated by Applicants (maximum lifetime estimate Applicants have made), computes the largest number of persons who will be (or can be expected to be) victims (as defined above) of each such disease or defect due to releases of direct radiation and radioactive material from Harris. References for benefit of the doubt, Bertell op cit p 40D and 922. Bross & Driscoll, p 326; Gofman 544, 546; see also NRC translation 520, as cited above.

PRODUCTION OF DOCUMENTS

Applicants' attorneys stated in July 1982 that they had the Gofman 81 book, Radiation and Human Health, and returned a copy I had given them for their use. Therefore I assume I don't need to supply it. Other documents which I reference above, which I possess a copy of, will be loaned to Applicants for inspection and copying at a mutually agreeable time and place. Since I have no business in Raleigh next week, I request they call me at 919-286-3076 to arrange a pickup in Durham. As per our agreement, NRC documents identified herein will not be supplied.

I hereby affirm that the above responses are correct to the best of my present knowledge except for those matters stated upon information and belief, and I believe those to be true.

Wells Eddleman

This 22d day of April 1982