

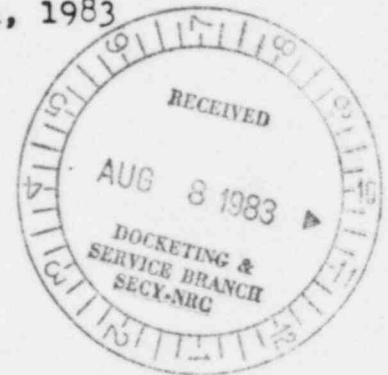
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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

August 4, 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' Fourth Set  
of Interrogatories, re Eddleman 75 and 83/84

This response is filed under an extension of time OK'd by  
Applicants' counsel Hill Carrow.

RESPONSE TO GENERAL INTERROGATORIES

4-1(a) Objection. The same objections made to General  
and in my response to Applicants Motion to Compel thereon  
Interrogatory 2 in my first two sets of answers are incorporated  
here by reference as if fully set out at this point.

In addition, this question's language "otherwise assisted  
you in answering" would call for identification of persons giving  
advice on strategy, legal theories, mental impressions and conclusions  
in making such advice; it would also call for work product relied  
upon to be identified as such. Both requests are objectionable  
on their facts under 10 CFR 2.740(b)(2).

Applicants show no exceptional circumstances (as required  
under Federal Rule of Civil Procedure 26(b)(4)(B) and 10 CFR 2.740(b)(2))  
as to need for identification of any persons this interrogatory asks  
about. Hoover vs. US Dept of Interior, 611 F2d 1132 at 1142, citing

Barkwell V. Sturm Ruger Co., 79 F.R.D. 444 at 446 (D. Alaska 1978) and US v. John R.-piquette Corp, 52 F.R.D. 370 at 373 (D. Mich. 1971). See also Perry v. W.S. Darley & Co., 54 F.R.D. 278 at 279-280; In re Sinking of Barge 'Ranger I', 92 F.R.D. 486, at 487-489.

Since none of the persons asked about in this general interrogatory was consulted other than in preparation for trial in this case, their identities are not discoverable. Ranger I, supra, at 489; Ager V. Jane C. Stormant Hospital, 622 F.2d 496 (1980) at 502-503.

Ager holds, at 503, that Rule 26(b)(4)(B) "precludes discovery against experts who were informally consulted in preparation for trial, but not retained or specially employed." As far as this and past sets of Applicants' interrogatories are concerned, none of the experts involved has been retained or specially employed. Thus, discovery of their identities is barred. See also Ager at 497 : determination of expert status rests first with the party resisting discovery; if opposing party requests in camera review and the expert is found to have been only informally consulted, discovery is barred.

4-1(b) Facts and factual opinions will be identified.

Objection: To disclosure of work product, legal theories, impressions, conclusions, legal theories, strategy advice and the like: Rules of NRC, 10 CFR 2.740(b)(2), preclude such discovery. Applicants show no unusual circumstances which might require disclosure of such information.

4-1(c) Objection:(1) as to those providing strategy advice, legal theories, impressions, conclusions and the like, since this information is not discoverable, the names of the person(s) providing it cannot be discoverable. Applicants show no unusual circumstances, which they must (see objections to parts (a) and (b) above), and no rationale whatsoever as to how the names of such persons might lead to admissible evidence which is not protected from discovery.

Objection:(2) to part (1) asking for expertise or facts supporting it. Determination of expertise is for the party resisting discovery. Ager, quoted above. Applicants have not requested in camera review by the Board of this determination. As noted above, all experts to which this interrogatory applies were informally consulted, not specially retained or employed. Where experts are informally consulted, no discovery is allowed. Ager, supra, at 503. Applicants haven't even attempted to make the proper showing required to get the names of people who were specially employed or retained, who are not going to testify at trial. (There are none such involved here). None of the other experts, informally consulted, is expected to testify at hearing in this case.

Federal Rules of Civil Procedure, 26(b)(4) says in part "(3) Experts informally consulted in preparation for trial but not retained. No discovery may be had of the names or views of experts in this category". See Ager at 500-502. Experts who receive no fees are considered to be informally consulted. Ager, 498-99. *See exception ibid. at 502* No discovery means Applicants aren't entitled to the information they seek.

The Court in Ager said "We agree with the District Court that this preclusion (in Rule 26(b)(4)(B)) not only encompasses information and opinions developed in anticipation of litigation, but also insulates discovery of the identity and other collateral information concerning experts consulted informally." (p.501, citations omitted) This includes "expertise and facts supporting hims (sic) expertise" (subpart (i) of 4-1(c)), facts "underlying any 'retained or specially employed status' " (subpart (ii), and explanation of the "need to withhold such person's identity" (subpart (iii)(A)).

Obviously, giving the resume of a person would make it much

easier to identify that person. Thus, the information re expertise leads, not to admissible evidence, but to non-discoverable information (the identity of the expert). The same is true of information concerning the need to withhold such person's identity. Explaining that need even in general terms like "fears retaliation by X", gives clues as to who the person is, or narrows the field of possible persons who fit the available information.

The Ager decision ruled non-witness experts' names non-discoverable because disclosure of their names would subvert "the protective provisions of the rule concerning facts known or opinions held by such experts" (p.503). By similar reasoning, the collateral information requested by Applicants in interrogatory 4-1(c) for non-witness experts, if provided, would allow Applicants to subvert the protection Ager and the federal rules give to the names of such experts. The court did not use this reasoning, but did bar the discovery of collateral information: "In sum, we hold that the identity, and other collateral information concerning an expert who is retained or specially employed in anticipation of litigation, but not expected to be called as a witness at trial, is not discoverable except ..."upon a showing of exceptional circumstances under which it is impractical for the party seeking discovery to obtain facts or opinions on the same subject by other means", which is a "heavy burden". (p.503). The protection of informally consulted persons, "no discovery", is even stronger.

4-1(c)(ii) there are no experts 'retained or specially employed' involved here. Objection as to disclosure of details underlying that status, see above. I also object to disclosure of any contractual or employment provisions for such persons. Only the fact that the person is 'retained or specially employed' is discoverable under Ager

without a showing that Applicants (the party seeking discovery) are unable to obtain "facts or opinions on the same subject by other means." Since Applicants have stated that they do have expertise and information available to them on all my contentions, including those asked about in this set of interrogatories, they cannot make such a showing.

Since without that showing, Applicants cannot get the names of any experts specially employed or retained in this proceeding, or knowledge of the facts or opinions known to such experts, there is no point in even asking this interrogatory. The answer cannot lead to admissible evidence because the route to evidence (through the name of the retained expert to info known to the expert or expert opinions) is barred by Applicants' having admitted access to facts and opinions on the same subject by other means.

(iii)(A) Objection. Need to withhold a person's name is collateral information the discovery of which for retained or specially employed experts is barred by Ager (see at 503) and by the facts discussed in the objection to (ii) above. All information concerning experts informally consulted is protected from discovery under the same decision. (see at 502) Thus for this set, discovery is totally barred on this matter. It could only arise if, on a

a showing of exceptional circumstances contrary to Applicants sworn response that they have access to expert opinions and information on each Eddleman contention in this case, the name of an expert specially retained or employed was ordered disclosed. Then I could object to that disclosure based on need to withhold the person's identity, but would seek that such information be examined in camera by the Board and not delivered to Applicants, since

(as noted above) the very information about why the person's identity needs to be withheld (especially if stated 'in detail' as Applicants ask) would tend to reveal that person's identity or make it much easier to figure out.

(iii)(B) Objection. The Board's 5-27-83 Order (see at 10-16) nowhere requires me to state the protection or privilege I rely on in withholding the identity of any non-witness expert. The licensing board upheld my position<sup>re experts</sup> except that it would allow a showing of "exceptional circumstances" with respect to a non-witness expert informally consulted (Order at 15). But Applicants' sworn response to my interrogatory G-5(a) is that they do have information and expertise available to them on all the Eddleman contentions admitted in this proceeding. As noted above (pp4-5) that precludes their being able to make such a showing. Therefore the requested information is irrelevant.

**I have a feeling this interrogatory may be an attempt to get me to weaken my position inadvertently through my lack of legal expertise.**

4-1(d): None. The licensing Board did not require me to identify such persons, only to demonstrate the applicability of another privilege if I did not. (5-27-83 at 16)

4-2(a) Documents including facts will be provided. Documents including work product, legal theories, impressions or other information non-discoverable under 2.740(b)(2) will have all such information deleted on copies supplied. Names non-discoverable will be deleted. Documents consisting solely of information non-discoverable under 2.740(b)(2) will not be identified. Identification of these documents is irrelevant since the information they contain is not discoverable

absent a showing of exceptional circumstances which Applicants cannot make under their responses to my interrogatory G-5(a).

(see above at 6, 4-5 for reasoning)

Documentary  
(b) Information not objected to above will be identified for each interrogatory response to which it relates.

4-3(a) Objection. To the extent this interrogatory can be read to ask for work product, or other information including strategy, advice, legal theories and other matters protected from disclosure under 10 CFR 2.740(b)(2), no information will be provided. To the extent that this interrogatory seeks the names of experts or any collateral information about them (including that which might be used to help identify them or any of them), it is objected to because such information (A) is not discoverable under Ager, supra (see objections above, to 4-1(a),(c), etc); (B) is not discoverable because Applicants, in answer to G-5(a) of my interrogatories, preclude themselves being able to make the showing of exceptional circumstances required by 2.740(b)(2) and by Ager for experts specially retained and by the Board here (5-27-83 at 15-16). Reasoning the same as in (a) above, see above there and at p.6 and pp 4-5.

So far as I now know, there is no other information not identified or objected to above, used. Objection to identifying or collateral information the name of an expert as a "source" here is not necessary since the names of experts are asked about in interrogatories "above" in your questions, e.g. 4-2(a)<sup>(b)(c)</sup> etc. If any information source otherwise is used, answer or objection will be made where it is used.

4-3(b) See last sentence of response above, to 4-3(a).

RESPONSE TO INTERROGATORIES ON CONTENTION 75

75(4th)-1. From the FSAR, I can't get enough information to answer. Blocking the condenser would lead to venting steam to atmosphere (FSAR 10.1 and 10.4); to fully prevent access to the ultimate heat sink may require growth of Corbicula or other species including snails, (freshwater and brackish water species), periwinkles, limnaea, planorbis or physa (etc) in the heat exchangers of the ultimate heat sink to the auxiliary reservoir. In the opinion of expert "George Goe" ("GG:" will indicate this expert's opinions and judgments used in further answers herein), Corbicula can live in the Harris condenser and could tolerate chlorination as soon as they have any shell; the other species as well as Corbicula listed or described above could live in the ultimate heat sink heat exchanger which "GG" describes as "an incubator". The more alkaline the lake side of the exchanger, the worse, up to moderate levels of alkalinity.

As to the condenser, the intake water will contain organic matter which the Corbicula can feed on; "GG:" Applicants' intake and circulating systems provide no means to prevent this. The Corbicula or mussels (which are more tolerant of interface conditions) could block the condenser either by sheer presence of so many of them (they are extremely prolific and would be living in a warmed environment with a continuous circulating food supply), by dead individuals and their shells, or by a combination of living individuals attached to the walls, not attached to the walls, and shells of dead individuals. Other debris, for example snail egg masses that are a biochemical glue, could be pulled through Applicants' intake and help foul the condensers. All this per "GG:".

Once the condenser can't work, venting steam to atmosphere or using the alternate heat exchangers (which may well be fouled, see above) are the only options.

75(4th)-2(a) "GG:" Brackish water organisms can tolerate varying chlorine levels. Some marine organisms can tolerate far lower levels than found in the sea, especially if there is a chlorine gradient present and sodium present. Periwinkles, for example, could live with about 0.5 ppm chlorine. Although a maintained level of a few ppm chlorine would prevent growth of most organisms, those which can shut off contact with water (e.g. by closing their shells) can survive if the chlorination is not continuous, e.g. the hour a day in two 30 minute sweeps planned by Applicants. The eggs and larvae/embryo stages of the organisms (clams, snails, mussels, possibly others) identified under answer to 1 above (p.8) are impressively tough and can probably survive chlorination -- at least, enough would survive that growth would start up if chlorination stopped, and growth could occur with periodic chlorination for some individuals.

WE: All of the above assumes that chlorination is done regularly, and, e.g., doesn't stop during shutdowns or condenser maintenance. I have elsewhere noted Applicants' two-year-plus failure to chlorinate their RHR systems at Brunswick nuclear station, in spite of their having a plan and schedule for doing so, which lead to the filling of the <sup>RHR heat exchangers</sup> ~~condensers~~ there with mussels and mollusks, rendering them non-functional.

(b) Yes, the species are endemic to NC; biofouling by buildup of organisms, accelerating corrosion, and egg masses and detritus can occur ("GG:"); have not yet determined if endemic to SHNPP but all could be introduced via mud, boats, people, shell collections, seawater dumped or used at homes, fishing pails (with water), etc. Since they can be introduced, it almost doesn't matter if they are endemic near SHNPP now. GG: All these species are prolific.

"GG:"

(c) Impossible to completely specify. The egg and embryo stages of most of these organisms can tolerate dryness, heat, chemicals and possibly freezing; mussels can tolerate oxygen and some dryness if periodic; for the brackish and marine organisms, insufficient Cl and Na would be critical; 1 ppm is needed (or a gradient including this level) for most marine organisms; some, like periwinkle, can tolerate 0.5 ppm; for brackish water organisms, the limits can be lower. WE: Applicants' documents show levels of 6.9 to 0.2 ppm with a residual level inside the plant of 0.5 ppm chlorine. They also use sodium hydroxide in the plant. "GG:" NaOH will give sodium ions that the salt-tolerant organisms need. the work of A. Krogh gives the details about ion metabolism of such creatures.

75-(4th)-3(a) Yes. (WE and "GG:")

"GG:"

(b) mussels, other clams, freshwater snails, and other species listed or described in response to 75-1 above can do it. Egg cases/ masses of freshwater snails are in a biological medium that is a very good glue -- can coat intake screens and be pulled inside the plant to foul surfaces. A heat exchanger is an ideal environment for mussels. Circulated water, warmth, oxygen (aeration in cooling towers) is also ideal for mollusks (snails etc); good for clams etc.

As noted above, these creatures are endemic to NC and can easily be introduced to the Harris plant if not there already. See p. 12

The environmental conditions of a complex ecosystem like the cooling towers/power-plant/lake is subject to numerous influences. Analysis down to the finest detail (ecological, energy, biochemical, biophysical, etc) is necessary to assure that imbalances won't lead, e.g., to a snail bloom or disproportionate increase in clams or mussels. Such an analysis would have to be a systems analysis with full consideration of criticalities, cascade phenomena,

all possible perturbations of the system (including those from the plant operating, starting up, shutting down, shifting power, as well as weather, biological and ecological perturbations, nutrient levels, organic inputs, energy input/output and so on), with the use of catastrophe theory since these are not the kinds of ecosystems that can be analyzed by linear or higher-order functions. Cascaded phenomena necessitate the use of catastrophe theory (which is a mathematical theory not necessarily tied to catastrophe, but able to analyze cascades and phenomena where changes are not tied to past phenomena in simple fashion and are not reversible, e.g. as in population blooms of snails or clams or mussels). It is necessary to do such an analysis to preclude the result of a bloomed (rapid increase in) population of creatures that can biofoul the Harris condenser and RHR and heat sinks of any kind that have any connection to lakes.

(c) "GG:" Without the analysis described sketchily above (as to what methods and fineness of detail required and some data required), no simple answer to this question is possible. The organisms involved are quite prolific and they or their embryo/egg phases can survive significant environmental changes of all sorts (as stated in response to 2(a) above, p.9). There is no simple way, including chlorination of unspecified periodicity or chlorination or the periodicity planned by Applicants, to guarantee these organisms will not survive. They will surely be able to survive in the Harris lakes (with the possible exception of those for which there isn't enough NaCl, though salt levels in the Harris lakes have not been analyzed (salt level info WE; rest: "GG")). Only periwinkles and marine and some brackish water organisms would require salt.

The question is so general that this is the best answer we can now give. To the extent it calls for research, WE objects. I don't have to do this kind of extensive research to answer.

Supplement to 3(b) and objection: Mussels, snails are endemic to SHNPP area. There are many species. Likewise for clams able to live in fresh water; there are about 50,000 kinds of mollusks. Freshwater slugs are also endemic to SHNPP area -- again, many kinds. Limnaea, a bivalve, may be here; planorbis and physa are possibilities.

The methods of biofouling are as described above, plus the bodies and eggs of slugs (which would be killed by chlorine in the plant, but which could get through the intake screens).

Answer to (c) applies to these -- can't specify conditions under which they couldn't survive without complex analysis; above answers give what we know.

Objection: To providing a list of the species involved; to providing detailed information for each species. We do not have the information in this form; it would be burdensome in the extreme to produce it (reviewing thousands of species, field surveys, doing my own field surveys or having them done, doing considerable research). The general answers above are what we know, and apply generally to the species under the conditions given (e.g. freshwater, certain chlorine levels, etc).

"GG:"

75-4th-4(a) Snails, clams (incl Corbicula), slugs, and other organisms which have an attaching foot or can cement themselves in place. Objection: To providing a list. Burdensome. See 3(b) p.12.

(b) "GG:" In general, those that can attach would have no trouble attaching to the metal or concrete (pipe walls) inside the plant.<sup>WE</sup> In addition to this opinion, which "GG" believes is common knowledge, the TVA Corbicula expert whose paper CP&L supplied me mentions attachment of them twice. I already gave Hill Carrow the references in a meeting in June (the 13th). Objection: To doing further research or answering for each species

The above answer (75-4th-4(b)), p.12) applies to species so characterized. It's what we know.

Objection to "all facts" request: To research all these facts would be burdensome. Applicants can look up which organisms can attach as readily as we can. There are a massive amount of facts about the attachment of organisms which are readily available to Applicants to research. We don't have to do research to answer questions. If I get more information, I'll supply it.

75-4th (5)(a): "GG:" This question is so vague it is very difficult to answer with any exactitude. The timing, amount, concentration, extent in time of application, and period for chlorine is not given. Gradients of chlorine are not addressed. No light levels or exposure to sunlight are given. The presence of chemicals that can react with chlorine is not specified. Diffusion curves, decomposition curves, oxygen levels, recirculation not given. Nevertheless, here's a response based on this vague question:

Slugs will probably die. If there's a chlorine gradient, clams and anything else with a shell can just close up and could probably survive. Clam foot cement is not destructible by chlorine. (So, even if the clam dies, it stays attached).

The glochidia, eggs and embryo stages of the organisms identified in response to the above interrogatories can probably survive chlorine applications at any level Applicants have described for Harris. At least, some will survive. These organisms are very prolific.

(b) The question is so vague it is impossible to state "all facts". "GG:" The facts are given in (a) above and other responses above; these are also my opinions as an expert.

Objection: To research to further answer. Applicants have their own experts & researchers who can do it as easily as we can.

RESPONSES ON 83/84

83/84-4th(1)(a) Yes.

(b) I'm still trying to find the reference. I anticipate producing a supplement on carcinogens soon, in response to past interrogatories on this contention (there are lots), and will try to cover this in that supplement.

"GG:" For any carcinogen, there is no aqueous concentration below which it cannot "elicit a cancerous response in humans". A single molecule can cause or promote a cancer. There is great complexity in the reactions of chlorine in bio-systems with organics, and it is very difficult to analyze (emphasis "GG"s). Thus you cannot specify such a level (other than zero).

4th  
(2)(a) WE & "GG": Yes. But see (c) below.

(b) "GG:" It can occur wherever light is not, given the presence of ammonia and chlorine. WE: Applicants claim light levels will be very low in the lower parts of the reservoir.

"GG:" If it's a muddy lake,  $\text{NCl}_3$  can be present.

(c) Note ("GG:") that organic matter can react with  $\text{NCl}_3$  in the absence of light.

"GG:"  
83-84-4th(3)(a) Question is virtually incomprehensibly vague. However, it appears to imply the presence of organic carbon and 0.2 mg/l (ppm) free available chlorine as assumptions. Under these conditions, halogenated organic compounds can form. Only one molecule would be necessary to cause a cancer; higher concentrations simply increase the risk.

"GG:"  
(b) Chlorine is highly reactive -- especially free available chlorine. It reacts with organic compounds. Cancers can be caused by incredibly small amounts of chlorinated organic chemicals,

e.g. chlorinated dioxins, kepone. The resulting cancers can take 20 years to show up. Single ion can have cascaded effects that can shut down cells, kill them possibly, and cause mutations, and trigger or promote cancer. See later answers, e.g.

to 4(b), 5(b) & (c), 6(c) (b), 8(e)19(e), 11(a), 12(a), 13(a) & (b),

WE Carcinogenicity of dioxin is also admitted in EPA draft report on dioxin risks. A level of 1 trillionth of a gram per cubic foot (about  $3 \times 10^{-14}$  kg/m<sup>3</sup> or g/l) can cause 9 cases of cancer per 100,000 persons exposed. The assessment for dioxins in water was that any more than  $2.1 \times 10^{-18}$  parts dioxin per part of water is an unacceptable risk to humans. These are for chlorinated dioxins. As noted above, we think the risk levels should be lower, but note that one molecule of a dioxin can have a molecular weight of around 200 to 400. Thus, one molecule of dioxin in a gram of water is about  $2 \times 10^{-21}$  parts by weight, so the EPA unacceptable risk level is about 1000 molecules per milliliter. We think one molecule of a chlorinated dioxin is an excessive risk. See discussion above and as referenced. There are over 70 chlorinated dioxins, of which apparently the most toxic is 2,3,7,8 TCDD.

83/84-4th-4(a) What regulations? This question is hypothetical and very vague. There may be no regulations, e.g. for dioxins (chlorinated) or for other dangerous chlorinated chemicals at Harris, including carcinogenic ones.

"GG:" Nevertheless, the answer is Yes. Dioxin and kepone are carcinogenic in far smaller quantities than these regulations now set. A single molecule event can cause cancer (one molecule can cause it). One ion can punch through membranes on nerve cells and cause cascaded reactions (including disease and disorders). Cascaded reactions in cells and the human body can involve serious trouble.

For example, if the affected cell is a sperm or an ovum, genetic defects or birth defects can result.

(b) "GG:" See response to (a) above. A lifetime of experience dealing with carcinogenesis and ecosystems biology underlies the answer and it is impossible to specify all facts supporting it. The assumptions made are not known to be true by either WE or "GG". "GG:" There is also the matter of effluents being bio-concentrated and of reactions within bacteria, algae, and other living organisms that take in chlorinated chemicals discharged by Harris or produced at Harris. The potential range of such reactions is very large as is the number and type of potential products. More detail in answers to 83/84-6th parts below.

The impossibility to specify all facts (stated above) is an objection. Reason is that we don't have time to do the work to dig out all the facts the expert knows and which inform the expert judgment. The basis for the answer is reasonably given; though more facts do support it, it's burdensome and requiring us to undertake research to list them all.

83/84-4th-5(a) We assume that you mean the concentrations in the effluents by themselves; otherwise this would be a duplicate of the question 4(a) above for chlorinated chemicals. Again, this question is so vague that we cannot give a general answer that covers all the possibilities. What effluents? What regulations? We provide the following information as an attempt to respond:

"GG:" All radioactive effluents are carcinogens, in any quantity; trihalomethanes are; others -- see response to 8(a) & 9(a) below. WE: Analysis incomplete. Would need to run Thilly forward-mutation test on all the effluent species to answer ("GG:" this test is the one you need to run as the Ames back-mutation test will also

"GG:" (provided the info) pick up mutagens and some toxins). See past response on the enhanced toxicity and mobility of chlorinated compounds, as it affects their ability to be carcinogenic (increases it). Chlorine reacts to form numerous stable compounds with organic matter (e.g. as found in lake water to be drawn in for cooling tower use at Harris).

The above answer and others herein are based on WE's understanding from Applicants' counsel Hill Carrow (8/1/83 by phone) that the words "cause carcinogenicity" means "start a cancer" or "cause a cancer". "GG"s opinions and judgments use that meaning.

"GG:"  
(b) In addition to the known carcinogenicity of chemicals referenced or and radiochemicals cited above, it is known that  $\text{OCl}^-$  is a promoter of cancer. This hypochlorite ion is what Applicants will be chlorinating with at Harris.

"GG:"  
(c) Impossible to specify all the effluents due to reaction among them; this requires extensive analysis and research. Once you identify all the possible effluent species you need to run a Thilly forward-mutation test (under good scientific practice) on each one to see if it's carcinogenic. If it is, one molecule is all it takes to cause or promote cancer. See responses to 4(a) and (b) above, pp 15-16. Time of exposure -- irrelevant if there is exposure internally (to a cell or the body).

(d) "GG:" If an organism has an immune system, as fish, birds, and mammals do, then that organism has a cancer process like the one in humans. If an organism has no immune system, result of exposure will probably be (direct) death, not a cancer.

The information is the same as for humans as stated and referenced above. As you move up the food chain(s), concentrations of these chlorinated and other chemicals increase. It only takes one

molecule to cause (or promote) cancer.

Fish use their skin as an effective "lung" which takes up chemicals from and exchanges ions with water. There is also the problem of chemical reactions with chlorine (and ammonia and hydrazine) and organic chemicals inside bacteria, algae or other living creatures, which can form carcinogenic chemicals.

See response to parts of 11 below re bacteria (etc) "helper effects" which are ways these reactions can be facilitated by living creatures and their biochemistry and uptake of compounds present in their food or water..

Objection: To listing species. I've already resolved this once with Applicants. Anything that has an immune system and takes in water or food containing these chemicals (carcinogens) can get cancer. The chemicals can also cause disease or death in all living beings, with or without immune systems. (This is also opinion of "GG")

83/84-4th-6(a) "GG:" Depends on energy state of the products. Some are stable. Stable compounds are formed by chlorine in reaction with organic matter (as will occur at Harris). Stable ones will persist into the Cape Fear; less stable ones may persist into the lake. Dioxins and kepone are quite stable, to give some examples. WE: So are PCBs.

Objection: To listing. It's burdensome and requires research Applicants can as easily do themselves into the stability of various chlorinated compounds.

(i) see above too; free chlorine and chlorine residuals will enter the reservoir. (ii) see above too; "GG:" free chlorine should not make it to the Cape Fear. But its compounds can, and can react there.

(b) there may be some confusion caused by the word "persist" persist for how long? indefinitely? Free chlorine will not persist indefinitely; "GG:" It'll go into the air. Residual chlorine and chlorinated chemicals can either persist or react indefinitely in the reservoir unless they release chlorine to the air or are moved out of the reservoir, e.g. into the Cape Fear.

Combined chlorine stays in the water. Chlorine compounds formed in dark places in the plant can be stable through the lake and to the river.

As to the specifics inquired about in (i) through (iv) that seeks research by use which CP&L can do as well. To the extent not answered above, we answer "GG:" evaporation is irrelevant since many chlorine compounds don't evaporate at all; and I object to doing the research for CP&L which has extensive resources and has experts and information available on this subject. (see their response to my general interrogatory 5(a)).

(c) Answer and objection are same as to (b) above. Stable compounds will get into the river. Free chlorine will not get that far if the lake is aerated (as we expect it will be). Compounds and chlorine in organisms can get into the river from the plant and the cooling lake whenever water is discharged from the lake.

83/84-4th-7(a). We haven't done this analysis. It's irrelevant for two reasons: "GG:" the compounds formed by chlorine in the presence of organic matter from a lake (or in the Harris plant) are different from those that would be formed in a swimming pool or municipal water system where that organic matter should be removed before chlorination. Available organics, especially ones from matter decaying in the lake, make the compounds people are exposed to different in these scenarios.

WE: Second reason it's irrelevant is that a comparison of one risk to another is improper. The added risk due to Harris is there regardless of what level of other risks people are exposed to.

83/84-4th-8(a) "GG:" (and WE concurs) All the radioactive ones, trihalomethanes, toluene, dioxins (chlorinated), kepone. Of these, trihalomethanes are suspected carcinogens and the others are. If any 1,4 dioxane is discharged, it is an extreme carcinogen too. (A supplement on carcinogens is coming). Note that the chemicals in SHNPP discharges can include products of reactions in the plant. This could lead to many carcinogens being present, especially chlorinated ones. WE believes (basis, the article not yet found) that  $\text{NHCl}_2$ ,  $\text{NH}_2\text{Cl}$  and  $\text{NCl}_3$  are carcinogens.

(b) Burdensome. Objection: The information is readily available in the literature and we have not assembled it.

(c) We have not established levels. Analysis not complete yet. "GG:" As noted in above response, this is a very complex analysis, which may well be beyond the resources WE has available.

(d) Look at (c).

(e) "GG:" Depends on statistics of exposure. From a systems viewpoint (the correct one to use) there is no way to specify such a level for compounds to which humans are exposed.

(f) Expert opinion; common knowledge in science; research on one-molecule and one-ion events in carcinogenesis and cascaded reactions.

(g) A lifetime of experience in modeling, dynamics of ecosystems, cascaded systems, biology and carcinogenesis (among other things), underlies the expert opinions. Burdensome to separate out the specific facts; objection to that and to revealing information which would tend to identify the expert "GG:" who believes that

the above info will not reveal "GG"s identity and supplied it for this answer explicitly on that basis.

83/84-4th-9(a) "GG:" (and WE) All of them.

(b) "GG:" All radioactive materials are carcinogens. In addition, trihalomethanes, chlorinated dioxins, chemicals identified in above responses, tritium inducing breaks in DNA (this last is also expert opinion of "Wes Woe" who has been informally consulted re power plant effluents and other matters not inquired about here).

WE: See also NRC response to Eddleman interrogatories on this contention, June, 1983. I see no need to retype the info here.

(c) Objection: Haven't done the research, and much of the info I possess was supplied by CP&L. They can research it as well as I can. A list of other carcinogens is coming in a supplement. -- WE.

(d) Look at (c).

83.84-4th-10(a) Objection: to making a list: Burdensome and I haven't done the research; info is equally available to CP&L. I still have to locate some documents re this.

PARTIAL ANSWER: Generally, chlorinated organics, heavy metals, coal particulates (U, Pb, CR, Cd, As, etc) see documents identified for Eddleman 8F, 6-20-83 filing re DEIS. Above is opinion of "GG" as to carcinogenicity or suspected carcinogenicity (suspected applies to the chlorinated organics that are not carcinogens known).

(b) Sources cited, see also response to 8(f) and (g) p 20 above. Objection: Carcinogenicity information is readily available in public literature. I shouldn't have to look it up for CP&L.

(c) a new list will be in a supplement when I have time to dig the information out of sources. Objection: To listing concentrations

the reactions are complex and concentrations are not fixed. See 83/84-1(b) response above for expert opinion on this.

I also object because it's burdensome. Our position is that if the chemical occurs in any concentration (other than zero) it increases the risk to humans and other living things from cancer and disease. (WE and "GG").

(d) Look at (c) and responses above re carcinogenesis.

"GG:"

(e) See response to 8(e) p.20 above. Can't specify any level without extensive tests (e.g. Thilly forward-mutation test on every compound present or possible) and a bio- and eco-systems approach. One molecule is enough to initiate or promote cancer.

You are dealing with cascaded ecosystems and biosystems here, so effects can be very large from a tiny cause.

(f) Objection, burdensome. "GG:" We'd have to list libraries full. See above responses for answer and position/opinion re carcinogenesis etc.

(g) Objection, burdensome. See objection to (f) above and expert opinion there. Partial answer: "GG:" The history of that field is (extensive). For example, the work of Lavori, the statistician, re cadmium -- good example of tiny cause with complex effects. See also the work of Rene Thom et al on catastrophe theory; this field encompasses chemistry, biology and physics.

Lifetime of experience of "GG" underlies this opinion and those inquired about in this interrogatory. I object to detailing it as (1) burdensome (2) likely to reveal the identity of "GG", which Applicants are not entitled to. Since this collateral information would tend to identify "GG", its disclosure is prohibited under Ager, see objections above, p 503 etc. Applicants have experts and info available to them on this subject, and "GG" is only being informally consulted, so (same case) they can't get identification of "GG" at all.

83/84-4th-11(a). "GG" Impossible to specify due to complexity of possible reactions and vagueness of question. A joint reaction (or reaction sequence) would be possible, especially in bacteria. See response to (c) below.

(b) Look at (a) and (c).

(c) "GG:" Bacteria concentrate many compounds, working from the parts per million level at the interface. Closed system in the bacteria can allow further concentration and reactions.

Potential and photoactivated reactions -- too many possibilities to analyze a level of concentration of (i) (ii) or (iii) for. Depends on temperatures, time, helper cell phenomena, other bacteria effects (e.g. concentration), bioconverter reactions; ammonia forms complexes with metals (e.g. Hg, Cd, Cu, Ni, Fe, etc); Chlorine and hydrazine will always react. Ammonia and chloramines can react with oxygen in organic compounds and biosystems.

The above is common knowledge in biochemistry and systems.

Objection.: To doing the research needed to answer the question literally. It's burdensome, we haven't done it, and CP&L can do their own research with their vast resources.

(e) Objection: Burdensome. "GG"'s lifetime of experience in the field -- see (10(e) and 8(e)) above. (partial answer)

83/84-4th-12(a). Hill Carrow, counsel for Applicants, told me 8.1.83 that the "concentration ... (I) recommend" means "recommend or recognize as safe". WE & "GG:" None.

"GG:" What you need is a different type of discharging system to eliminate discharge of these compounds. A standing aeration tank in full light (with argon lamps etc to duplicate solar

spectrum at night) will probably take care of the chlorine. Stable compounds will be harder to eliminate.  
(b) See answers above re concentrations. One molecule's too much. This is opinion of "GG" as well as WE.

83/84-4th-13(a). This is vague as to the standards, but we can answer. "GG" and WE: Yes. Chlorinated compounds are a risk at any level. So are radioactive materials.

(b) Objection, burdensome. For radioactive materials see Gofman, Radiation and Human Health; Caldicott, Nuclear Madness; Nader & Abbotts, The Menace of Atomic Energy; EAF, Accidents Will Happen; Berger, Nuclear power, the Unviable Option; Olson, Unacceptable Risk; for chlorinated chemicals see the literature on carcinogenicity; solubility enhancement and reactivity caused by chlorination well known. Opinion of "GG". Existence of cascade phenomena, anaphylactic shock, venoms etc. \* 83.84-4th-14(a)(1) Haw River Assembly study; NC DNPCD monitoring;

(ii) UNC monitoring for Corps of Engineers (iii) DNRCD monitoring? (iv),(v) not sure; there would be non-point runoff and coal particulates at any rate.

(b) Don't have them in hand -- will look and supplement.

\*continuation of 13(b) above: chemicals like venoms triggering complex events in biosystems; chemical and ion interference with these and fertilization; similar phenomena support the single-event being enough to cause cancer or promote it.

I hereby affirm that the above answers are true and correct to the best of my knowledge and belief. I will lend CP&L any documents identified above for inspection and copying. Contact me for time and place agreement on reasonable terms.

August 4, 1983

*Wells Eddleman*  
Wells Eddleman