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Elizabeth S. Bowers, Esq., Chairman
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U. S. Atomic Energy Commission
Washington, D. C. 20545

Mr. Glenn O. Bright
Atomic Safety and Licensing Board
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dr. E. Leonard Cheatum, Director
Institute of National Resources
University of Georgia
Athens, Georgia 30601

In the Matter of Tennessee Valley Authority
(Bellefonte Nuclear Plant, Units 1 and 2)
Docket Nos 50-438 and 50-439

Dear Members of the Board:

In the course of the proceedings last week, the staff offered in evidence the deposition of Dr. Clyde W. Voigtlander. We had only one copy at that time but advised the Board that we would supply sufficient copies on our return to the office. I enclose a copy for each member of the Board.

Sincerely,

William D. Paton
Counsel for AEC Regulatory Staff

Enclosure: As stated

cc w/enclosure:
Hugh K. Clark, Esq.
Dr. John H. Manley
Robert H. Marquis, Esq.
David G. Powell, Esq.
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Atomic Safety and Licensing Board Panel
Atomic Safety and Licensing Appeal Board
Mr. Frank W. Karas

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DATE ➤	7/15/74					

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UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

In the matter of:	:	
TENNESSEE VALLEY AUTHORITY (Bellefonte Nuclear Plant, Units 1 and 2(	:	Docket Nos. 50-438 50-439

DEPOSITION OF CLYDE VOIGTLANDER

The deposition of Clyde Voigtlander was taken before Patricia McEvers, Court Reporter and Notary Public at Large for the State of Tennessee, at 8:30 a.m., in Conference Room A, New Sprankle Building, 508 Union Avenue, Knoxville, Tennessee, on the 14th day of June, 1974, when there were present on behalf of the parties:

WILLIAM D. PATON, Esquire, and HOWARD WILCHINS, Esquire, Office of the General Counsel, U. S. Atomic Energy Commission, Bethesda, Maryland, on behalf of the AEC Regulatory Staff;

DAVID POWELL, Esquire, New Sprankle Building, 508 Union Avenue, Knoxville, Tennessee, on behalf of the Tennessee Valley Authority.

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Clyde Voigtlander	3	

P R O C E E D I N G S

Whereupon,

CLYDE VOIGTLANDER

was called as a witness and, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PATON:

Q Would you state your name for the record, sir?

A Clyde William Voigtlander, V-o-i-g-t-l-a-n-d-e-r.

Q Dr. Voigtlander, you are employed by TVA?

A That is correct.

Q In what capacity?

A My title is Senior Aquatic Ecologist for the Fisheries and Water Fowl Resources Branch, Division of Forestry, Fisheries and Wildlife Development of TVA, stationed in Norris, Tennessee.

I am charged with the overall technical but not administrative supervision of all branch investigative programs in aquatic ecology, this to include all site assessment, nuclear plant monitoring, et cetera.

Q What is your education, sir?

A I received a Bachelor Of Science degree with majors in biology and chemistry from Wisconsin State University at Eau Claire, E-a-u-C-l-a-i-r-e. I received a Master of Science and a Ph.D. degree in zoology with emphasis in aquatic

ecology from the University of Wisconsin at Madison.

MR. PATON: Off the record.

(Discussion off the record.)

BY MR. PATON:

Q What is your responsibility, sir, with regard to the Bellefonte Nuclear Plant?

A I was the initial person in our branch to begin the data analysis, the preparation and review of the Draft Environment Impact Statement. I have had the responsibility with respect to designing or providing our branch input into the integrated monitoring program for Bellefonte Nuclear Plant and I also acted as branch representative in the preparation and interdisciplinary review of the Environmental Impact Statement. I have also provided responses to other agencies, comments and questions, during the review period of the Draft Environmental Statement.

Q Have you been involved in studies that relate to the design of the intake structure?

A Yes, sir.

Q What has been your involvement in that matter?

A The involvement began with providing estimates of possible ecological impact for all of the alternative cooling system designs considered for the Bellefonte Plant. With regard to the intake design specifically, I provided data and conducted discussions with engineers in TVA regarding

the design of the proposed intake and the alternate designs.

More recently, I have been the principal branch liaison in the cooperative investigation -- strike that "cooperative" please -- can we go off the record, please?

MR. PATON: Off the record.

(Discussion off the record.)

THE WITNESS: More recently, I have been TVA's representative, working out with the AEC Regulatory Staff the design and analysis ~~of data,~~ of sampling and data regarding larval fish and their possible entrainment by the proposed Bellefonte intake.

BY MR. PATON:

Q Would you tell us, for the purposes of that study, what you mean by larval fish?

A Larval fish arecommonly defined as fish from the time they first hatch, until the time that they are completely free swimming, and are no longer at the mercy of low velocity water currents. For all intents and purposes, we are talking about fish not exceeding a length of 25 millimeters, total length.

Q Have you been involved in a number of meetings with AEC representatives regarding this particular subject?

A That is correct.

Q And was there an agreement involving a sampling program that you have recently undertaken?

A Yes. There was substantial agreement between AEC Regulatory Staff and TVA, regarding the sampling design. The discussions that were held produced a general sampling outline which we then agreed might be modified somewhat, based on what we originally find, what we would originally find down at the site.

Q Have you proceeded with some work under that sampling program?

A Yes. We initiated sampling on the 26 of March 1974, and have continued sampling each week up until the present time.

Q Now, would you describe the purpose of the sampling? What is it you expect to learn?

A The purpose of the sampling is to estimate the percentage of fish, of larval fish, which would be entrained, the percentage being a comparison of what is entrained versus that part of the total larval fish population that is being transported past the plant.

Q Do you assume for the purposes of your study that all of the larval fish that will be entrained,will be killed?

A Yes.

Q Do you have an opinion as to whether or not that is, in fact, the case?

A Inasmuch as Bellefonte is designed to operate with cooling towers, I believe that to be true, that all larval fish entering the plant will be killed. They will represent a loss

to the system.

Q Can you tell us the results of your sampling to date?

A Yes. The results to date can best be characterized as being inconclusive with respect to the impact of the proposed intake. We are in the process or have been in the process this year, of exploring the area and trying out several types of sampling gear. We have gained experience. The results we have right now are highly variable and it is not possible at this time to make any conclusion as to what the percentage of entrainment is likely to be over a long period.

The only conclusion we can make at this time, is that the sampling design must be changed slightly.

MR. PATON: Let's go off the record.

(Discussion off the record.)

MR. PATON: Back on the record.

BY MR. PATON:

Q Dr. Voigtlander, in your study, am I correct that you used some figures you obtained from Dr. Stolzenbach concerning river flow?

A That is correct.

Q Would you state for the record the essential numbers that you used that you obtained from him?

A The results of the study performed under Dr. Stolzenbach's direction indicate that the flow in the overbank area is of the order of 100 to 150 cubic feet per second and that

the flow in the channel, taken at the same time or measured at the same time, is approximately 40,000 cubic feet per second, and that these two flows, for the purposes of the studies that are being done under my direction, these flows are essentially independent. They do not mix. They can be treated as independent streams.

Q From his study, did you assume that the water recruited by the intake structure came entirely from the over-bank area?

A That is correct.

Q Do you have an opinion as to the quantity of the flow in mid-channel during the spawning season?

A Yes.

Q What is your opinion?

A According to the data that were presented in the Final Environmental Statement on Tellico Dam, the average flow in the channel

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A. According to the data that were presented in the TVA Final Environmental Statement on Bellefonte, the average flow in the channel during the period November through April was 27,100 cubic feet per second. The average flow from May through October was 44,200 cubic feet per second.

Q. Let's go off the record. I'm sorry.

A. I'm developing -- there's a reason for doing this, if I may. If you want to go off the record, fine.

Q. Let's go off the record and I'll ask you a question.

(Discussion off the record.)

MR. PATON: On the record.

Q. Go ahead.

A. Inasmuch as the spawning season approximately spans the period from mid March through mid July, in main stream reservoirs in the Tennessee Valley, the average flow would be approximately the average between the two numbers, and this would be approximately 35,000 cubic feet per second.

Q. Now, Dr. Voigtlander, would you explain in very general terms how you used the information you obtained from Dr. Stolzenbach, in combination with the information you obtained, in arriving at your conclusion as to the percentage of larval fish that would be entrained, just in general terms.

A. If one knows the flows in the two streams that are being considered, and if one has good bathymetric data, it is possible to establish factors for given entrainment percentages.

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These factors are simple ratios of the density of entrainable organisms in the overbank, divided by the density of entrainable organisms in the channel passing the plant. These factors can be calculated for any set of flow data, and for any percentage or range of percentages that one wants to deal with, and the data to date have been calculated on this basis.

Q Is it correct that as a result of your computations you calculated that if the population density for larval fish was approximately fourteen times higher in the overbank area, that you estimate that five percent of the total larval fish population passing the plant would be entrained?

A Yes. To restate, if the ratio between overbank and channel densities of larval fish is fourteen or less, then entrainment is five percent or less.

Q And what was your comparative population density for a result of twenty-five percent entrainment?

A If the factor -- strike that. If the ratio of overbank to channel concentrations exceeds 89, then entrainment is estimated to exceed twenty-five percent.

Q Did you obtain as a result of your sampling program a number of comparative population density figures?

A Yes, we obtained comparisons between overbank and channel concentrations for six dates. That was six dates to date beginning with the 30th of April and extending through the 4th of June.

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Q Would you give us for each of those dates what your figure was?

A Yes; for April 30th the ratio was 1.1; for May the 6th, the ratio was 0.5; for May the 14th, the ratio was 9.5; for May 21st, the ratio was 49.6; for May 30th, the ratio was 180.1, and for June the 4th, the ratio was 10.0.

Q Are you able to draw any conclusions from those figures, sir?

A Not with respect to the impact of the proposed intake.

Q The sampling that you have just discussed,was that taken during the day?

A Yes.

Q Did you also do some night sampling?

A Yes, we instituted night sampling on the last date which I have given you, that is June 4th. This was done to allow us to compare densities of larval fish that we observed during the day time with those that would be present in the same habitat at night. However, the data that I have read into the record represent only daytime samples.

Q From your night sampling were you able to arrive at any conclusions that you could not obtain from your day sampling?

A In answering that it is important to recognize that we are sampling at least three very distinct habitat types out in the channel. We are sampling an in-shore area,that is an

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area that is shallow and which is bordered on one side by either the bank of an island or by the far shore. We are sampling an open water area and sampling near the surface, which represents a totally different set of conditions for fish; and we are also sampling at a deep stratum, that is at a depth of approximately five meters in the water column.

We find on the basis of the one set of comparative samples that we have analyzed at this time that densities probably are not appreciably different in the shallow in-shore line habitat during the day versus the night. We find that there are differences in the channel, the open water areas in the channel and at the deep areas, differences which may be appreciable and which will require us at this point to do day and night sampling for the remainder of this season and for whatever is done next year.

Q Can you state in your professional opinion what you would expect to find by way of relative productivity and population between the overbank area and mid channel?

A In general the productivity, if one defines it as the density of larval fish, is in most cases likely to be higher in overbank areas than it is out in the channel.

Q Can you quantify that in any way?

A We have stated in the TVA draft and Final Environmental Statement -- (pause) Well, I can't find it now. We have stated with respect to the Bellefonte Environmental State-

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ment that our experience on Wheeler Reservoir in northern Alabama indicates that shore line concentrations exceed- channel concentrations and deep concentrations by a factor of ten. That needs to be qualified in that those data are from some fairly specific habitat types. The sampling for the most part in Wheeler was also done in what is probably a more productive area with respect to the production of fish, and that Wheeler is also considered to be a more productive reservoir generally in terms of its over all biology.

Q There has been no previous sampling for this type of information in the Guntersville Reservoir to your knowledge?

A There were one set of samples taken which represent one date in June of 1972.

Q Did you take those samples or --

A Yes, I was present and assisted in taking them.

Q Do you recall what that result was?

A The samples in question were taken on June 21, 1972 at night. They represented five samples taken in Bellefonte Reservoir proper, and one set of samples taken in the Mud Creek enbayment whose mouth is approximately 2.7 river miles above the proposed plant site. The results of the one day, or the one night's samples indicated that densities were on the order of 400 in the shore line habitat and ranged from ten to 74 in the channel habitat.

Q Are you now following the same sampling methods that

were used at that time, generally?

A. Generally speaking, yes, although we have since that time gained in experience with the particular sampling methods we used, and we have also instituted the use of two additional sampling methods.

Q. Sir, you have discussed with representatives of the AEC that the sampling methods that you had previously agreed on should be changed, is that correct?

A. The sampling methods, if you are speaking of the types of gear we employ to do the actual physical sampling will not change. The way in which we use them, that is the areas in the reservoir near the plant which we sample, will change.

Q. The location of the sampling?

A. Yes, the location of the sampling effort will change, the magnitude of the sampling effort will change with respect to the area near the intake.

Q. What will you be doing differently now than what you had originally agreed on with the AEC?

A. We will be reducing the number of sampling locations from three to one. That is, we have been sampling at three transects of the river, at approximately river mile 394, river mile 392, and river mile 391. In discussions with our biologists, and in discussions with Dr. Stolzenbach, the conclusion that we have reached is that in order to trule characterize the possible impact of the intake we should concentrate our efforts

in the transect at Tennessee river mile 392, which is the transect at the proposed intake.

Q Do you have an opinion as to how much time it will take for you to obtain sufficient sampling and any other needed information to arrive at a conclusion as to the percentage of larval fish that will be entrained by the intake structure?

A My opinion is that it will be necessary to continue sampling this year for the remainder of the season of the availability of larval fish, and that it will be necessary to sample an additional year.

Q Do you have an opinion based on your expertise as to what percent of entrainment is environmentally significant?

A By that do you mean at what point it represents a significant adverse impact?

Q Yes.

A The state of knowledge to date in the ecology of larval fish is such that no particular figure can be defended from a biological standpoint. The body of knowledge regarding the effects of additional mortality on the larval fish population in a large body of water, or a large aquatic system, just are not amenable to this sort of process, that is to the process of setting a number and attaching immediate significance or non significance to that number.

Q Based on the answer that you have just given, would I be correct in saying that the state of the art is such that no

one could conclude that even a one hundred percent entrainment would produce a significant adverse environmental impact?

A. I would not agree with that. However, in most of the discussions that I have had with AEC Regulatory Staff, and with other professional biologists both inside TVA and others that I have consulted with from time to time, the ordinary range of percentages that we are talking about usually ranges from zero to twenty-five or thirty percent, and in that range I believe my statement holds, that there is no way to defend any particular figure.

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Q If a qualified aquatic biologist stated that a 25 percent entrainment was a significant adverse environmental impact, would he, in your opinion, be wrong?

A I don't know that he would be wrong. I do believe that he could not cite any data or at this time, any body of theory that would support his number.

The problem is, as I have already stated, that this is a new biological problem. The biological community in general has only become aware of it in the last few years. The theory has not been developed and in speaking of any given percentage, one must consider the species that are likely to be involved. One must also consider the location where this entrainment will occur.

Twenty-five percent entrainment by a facility in one reservoir could have significantly different effects than 25 percent at another facility at another reservoir or for that matter, another facility in the same reservoir.

It depends really, I would say, on location and the species involved, if you are going to talk about significance.

Q You do expect that you would be able to obtain that type of information by the end of the next spawning season, however, to arrive at a conclusion for the Bellefonte site?

A With respect to true ecological significance, no, not unless somewhere a significant breakthrough occurs in the theory of population dynamics which would allow us to apply that

theory and supporting data.

Q Well, however, by the end of the next spawning season, you will be able to make a better assessment of the environmental impact?

A We will be able to make a better assessment of the estimated percentage of entrainment of larval fish by the proposed Bellefonte intake and the species' composition of that part of the larval fish population which is entrained.

Q Will you obtain your sampling information concerning various species of fish?

A Yes.

Q Larval fish?

A Yes.

Q Your information concerning that right now is quite limited?

A It is limited to the weekly samples taken from March 26 through June 4, the present time. That is with respect to the Bellefonte site.

Q Yes. Those samples do not show -- strike that. Do those samples give you any indication of the percentage of shad?

A I would like you to rephrase that question. I don't understand.

Q Do you know from those samples what percentage of the larval fish are shad?

A The most complete data we have at the present time represents the samples out in the channel and the data indicate that the family, Clupeidae, C-l-u-p-e-i-d-a-e, which in our reservoirs includes two species of shad and one species of river herring, comprise approximately 90 percent or slightly more, of the total population.

Q Was that, sir, for one day sampling or more than one?

A This represents generally the total picture from late March through approximately the end of May.

Q You limited, if I am correct, a statement you made concerning the environmental impact to up to 30 percent of entrainment. Can you conclude that entrainment in excess of 30 percent would have a significant adverse environmental impact?

A No. The limitation I placed on my earlier response was merely to get away from citing 100 percent which will represent an almost impossible situation,both from the engineering standpoint as well as the biological standpoint.

The whole point is that there is just no way of knowing. The obvious strategy, I think, that must be considered, is that entrainment of larval fish should be kept as low as possible coincident with good engineering techniques and including all economic considerations. We, I think, have a responsibility to be conservative. But it is very difficult, in fact at this

point it is impossible, to set numerical limits, really, which represent threshhold of significant adverse impact.

Q When you consider environmental impact, as, for example, in this case, do you consider the impact on ~~Gunnsville~~ Guntersville Lake or an area smaller than that?

A We consider the impact on the reservoir. In most of the environmental statements and reports, we have considered both the limited area around a given facility and the entire reservoir. With respect to environmental protection and protection of fisheries' resources in the Tennessee Valley, the unit of concern is the reservoir.

MR. PATON: Let's go off the record.

(Discussion off the record.

MR. PATON: On the record.

I have no further questions. Mr. Powell, do you have any questions?

MR. POWELL: I have no questions of Dr. Voigtlander.

MR. PATON: Let's go off the record.

(Discussion off the record.)

MR. POWELL: On the record. Due to the unavailability of TVA witnesses to sign the depositions that have been taken yesterday and today, TVA will waive the signature requirement on the depositions, provided that to the extent that any of the depositions are used in the evidentiary hearing, the witness will have an opportunity to make a correction onthe

record at that time.

MR. PATON: The Staff agrees.

(Whereupon, at 10:23, the deposition was concluded.)

Clyde W. Voigtlander

STATE OF TENNESSEE)
)
COUNTY OF KNOX)

Sworn to and subscribed to by me this 14th day of June, 1974.

Patricia McEvers
Notary Public At Large
My Commission expires 1-23-78.