

REGULATORY DOCKET FILE COPY

UNITED STATES ATOMIC ENERGY COMMISSION

IN THE MATTER OF:

THE TOLEDO EDISON COMPANY
and THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

(Davis-Besse Nuclear Power Station)



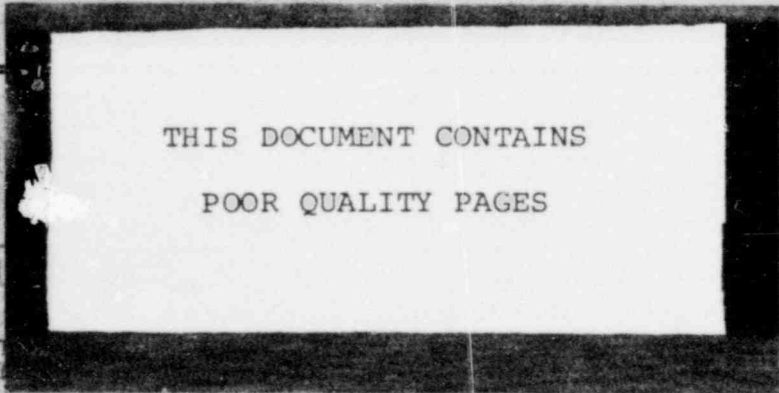
Docket No. 50-346

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ROOM 016

Place - Cleveland, Ohio

Date - 6 August 1973

Pages 756- 1036



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ATOMIC ENERGY COMMISSION

In the Matter of:

THE TOLEDO EDISON COMPANY
and the CLEVELAND ELECTRIC
ILLUMINATING COMPANY

(Davis-Besse Nuclear Power
Station)

Docket No. 50-346

Anthony Celebrezzi Building
1248 East Ninth Street
Cleveland, Ohio

Monday, 6 August 1973

Hearing in the above-entitled matter was
reconvened, pursuant to adjournment, at 11:00 a.m.,

BEFORE:

JOHN B. PARMAKIDES, Esq., Chairman,
Atomic Safety & Licensing Board.

DR. CADET H. HAND, JR., Member.

FREDERICK J. SHON, Member.

APPEARANCES:

On behalf of Applicant:

GERALD CHARNOFF, Esq., and JAY E. SILBERG, Esq.,
Shaw, Pittman, Potts & Trowbridge, 910 17th
St., N. W., Washington, D. C. 20006

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On behalf of the Regulatory Staff:

FRANCIS X. DAVIS, Esq., and MYRON KARMAN, Esq.,
 Office of the General Counsel, U.S. Atomic
 Energy Commission, Washington, D. C.

On behalf of the Intervenor:

RUSSELL Z. BARON, Esq., Brannon, Tackett, Baron
 and Mancini, 930 Keith Building, Cleveland,
 Ohio, 44115

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10	Intervenor's 10-A, 10-B (Stenoglass' testimony re Issues 7, 8.)		827	827
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14	Applicant's Exhibit 8, (Maximum Beta Activity in Lake Erie Water, Summary of Maximum Suspended and Maximum Dissolved Fractions)		858	851
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Revised

<u>EXHIBITS:</u>	<u>FOR IDENTIFICATION</u>	<u>IN EVIDENCE</u>
Applicant's Exhibit 13, (Assessment of Environmental Radioactivity in the Vicinity of Shippingport of 7-30-73)	921	921
Applicant's Exhibit 14, (Summary Report on Assessment of Environmental Radioactivity in Vicinity of Shippingport)	921	921
Intervenor's Exhibit 11-3, (Chart, External Dose Rates Ambient Radiation Dose Rate, 1971)	989	989
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Intervenor's Exhibit 11-7, (Chart, Ambient Radiation Levels #1 with #11)	989	989
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Intervenor's Exhibit 13	1002	- stricken
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C O N T E N T S, Cont'd

EXHIBITS:

FOR IDENTIFICATION IN EVIDENCE

Intervenor's Exhibit 15,
(Radioactivity of Drinking
Water with Dist. Sta. from
Vinebrook Road

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1012

Applicant's Exhibits 15-A,
15-B, 15-C and 15-D

(Copies to be furnished.)

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P R O C E E D I N G S

1 CHAIRMAN FRANKEDHS: The hearing will now be
2 in order, please.
3

4 This is a continuation of the evidentiary hearing
5 on the issue of the Davis-Besse facility. We recessed from
6 July 26 until the present because the Board had determined
7 that there was need to address a new issue which was raised
8 by Intervenor in the course of submitting their testimony,
9 especially the testimony of Dr. Sternglass. As the Board
10 understood the testimony, we understood Dr. Sternglass was
11 saying that radiation levels and contamination levels
12 around two other reactors, one of which is similar in type
13 to Davis-Besse, and one of which is similarly located to
14 Davis-Besse; that these radiation levels and contamination
15 levels have been much higher than those predicted for
16 Davis-Besse, although the releases from these reactors have
17 been lower than those predicted for Davis-Besse.

18 In pointing out the discrepancy, Dr. Sternglass
19 analyzed data that was obtained by independent organizations
20 who used standard methods of detection. In view of these
21 results, Dr. Sternglass stated that the levels around
22 Davis-Besse may prove to be much greater than those predicted
23 in the Final Environmental Statement of the Atomic Energy
24 Commission Regulatory Staff.

25 Accordingly, the Intervenor contended that the

1 Final Environmental Statement is inadequate in that the method:
2 used to relate the proposed releases of radioactive materials
3 to contamination and radiation levels in the environment
4 may greatly underestimate those final levels. We concluded
5 that we would hear the issue. We would receive evidence and
6 resolve it.

7 Also, I think, on July -- either 25 or 26 -- the
8 Applicant moved that the Board reconsider its decision and
9 strike the issue. The Board deferred ruling on that motion
10 for reconsideration and, accordingly, we are now at the point
11 where we will hear evidence on that issue.

12 One other preliminary matter: We had a conference
13 call of the counsel and the Board on July 31, and during
14 that conference call we decided the proceeding would be
15 Intervenor going first with his direct testimony, the
16 Applicant, and the Staff.

17 I have this morning been handed by Mrs. Stebbins
18 a motion to delay closing of record on Issue 2. I have not
19 yet had a chance to review it, and certainly we will consider
20 this motion, and we will try to resolve it today if we
21 possibly can; if not today, tomorrow.

22 Oh, I'm sorry. There is also a motion to compel
23 discovery, and an affidavit submitted to both of these
24 motions. The Board does not receive these very enthusias-
25 tically. We thought the record was going to be closed,

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1 and very frankly, I would like to let the Coalition know at
2 this time unless we see some very good cause in here, we are
3 not about to grant the motion. If there is some good cause
4 to grant the motion, why, certainly, the Board is anxious
5 to develop the record completely; but we will rule on that
6 today or tomorrow.

7 Now we are ready to proceed.

8 Mr. Baron?

9 MR. BARON: Mr. Chairman, as you noted when
10 Dr. Sternglass arrived -- I had hoped he would be here earlier
11 -- I don't know what the reason is, but I have not had any
12 opportunity at all to talk to him. He just whispered to me
13 he would like to confer with me for a few minutes.

14 CHAIRMAN FARMAKIDES: So you want how much
15 time, sir?

16 MR. BARON: Five minutes.

17 CHAIRMAN FARMAKIDES: Five minutes? All right.

18 In the interim, Mr. Davis?

19 MR. DAVIS: Mr. Chairman, in the interim perhaps
20 we could put on Staff responses to the limited appearances
21 at this time.

22 CHAIRMAN FARMAKIDES: That would be great. The
23 only problem, of course, is that Mr. Baron --

24 MR. BARON: No, sir, Mrs. Stebbins can do so.

25 CHAIRMAN FARMAKIDES: Excuse me. There is

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1 something else. Look, let's take one at a time.

2 We will take your responses, Mr. Davis, so we
3 do have in reserve your suggestion submitted at a bench
4 conference this morning that you go back on with Mr. Thompson;
5 right?

6 MR. DAVIS: Yes, Mr. Chairman.

7 CHAIRMAN FARMAKIDES: You could do that first?

8 MR. DAVIS: Yes, sir.

9 CHAIRMAN FARMAKIDES: Off the record.

10 (Discussion off the record.)

11 CHAIRMAN FARMAKIDES: On the record.

12 Mr. Charnoff?

13 MR. CHARNOFF: I thought I understood from the
14 conference that Mr. Silberg participated in -- I was not in
15 the office that day -- that there was also to be the oppor-
16 tunity first this morning for Dr. Sternglass to submit some
17 written rebuttal to Dr. Frigerio's remarks of last week
18 concerning Contention 3.

19 CHAIRMAN FARMAKIDES: You are right.

20 I assume that will be coming and we can explore
21 that later, but that was part of the conference call, that
22 written rebuttal testimony of Dr. Sternglass to this Board
23 will be coming in this morning.

24 All right. Let us proceed, then. Mr. Davis, you
25 had something else?

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1 MR. DAVIS: Could we go off the record?

2 CHAIRMAN FARMANIDES: Off the record.

3 (Discussion off the record.)

4 CHAIRMAN FARMANIDES: On the record.

5 MR. DAVIS: At this we would like Mr. Hugh
6 Thompson of the Regulatory Staff to respond to the limited
7 appearances -- one of the limited appearances -- made on the
8 23rd of July at Port Clinton, Ohio.

9 CHAIRMAN FARMANIDES: All right, Mr. Thompson?
10 You have been previously sworn, sir?

11 MR. THOMPSON: Yes, sir.

12 Whereupon,

13 HUGH THOMPSON

14 resumed the stand as a witness on behalf of the Regulatory
15 Staff and, having been previously duly sworn, was examined
16 and testified as follows:

17 FURTHER DIRECT EXAMINATION

18 WITNESS THOMPSON: In response to Mrs. Cook's
19 limited appearance concerning the need for an emergency plan
20 for the Davis-Besse station, I would like to state the
21 following:

22 The Atomic Energy Commission requires that
23 emergency plans incorporate emergency organization structure,
24 assessment, corrective, and protective measures, means of
25 activating and carrying out emergency plans, provisions for

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1 aids to affected persons, and interfaces with agencies having
2 applicable emergency plan responsibilities.

3 We need to look at the scope and objective of an
4 emergency plan itself. An "emergency" is defined as an
5 out-of-control situation in which the health and safety of
6 one or more persons is in jeopardy. Emergency planning aims
7 to diminish the degree of jeopardy by timely action on the
8 part of individuals who constitute a coordinated emergency
9 organization.

10 An effective approach to emergency planning
11 distinguishes between structural and functional details, that
12 is, the plan itself and its implementing details.

13 For example, implementing details would be step-by-step
14 procedures, checklists, names and telephone numbers,
15 equipment and supply inventory lists.

16 Each applicant's emergency plan must include
17 provisions for handling emergencies both within the site
18 of his plant and the environs of the site. Responsibility
19 for planning and implementing all emergency measures for
20 persons within the site and exclusion area boundaries rest
21 with the licensee. Planning and implementation of emergency
22 measures in the environs of the site arising from on-site
23 emergencies must be coordinated with local, county, state,
24 and federal agencies having responsibilities, and must be
25 described in the applicant's emergency plans.

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1 Such planning must include the persons and area
2 within the low population zone, as defined in the Safety
3 Analysis Report. The emergency plans consider evacuation
4 as a protective measure in the wake of serious airborne
5 release from the facility, and require taking into account
6 of the following: resident and transient population, and
7 their distribution within each of the 16 sectors around the
8 facility; means for notification of those persons in the
9 low population zone; disabilities, institutional confinements
10 or other factors which may impair mobility; the means of
11 effecting relocation, which may include walking as well as
12 use of vehicles or other modes of transportation; location of
13 potential routes of egress and their traffic capacities;
14 and potential impediments to use of egress routes, such as
15 rush-hour traffic, inclement weather, or flooding.

16 The analysis should result in estimates of time
17 required to carry out evacuation procedures which can be used
18 in turn to estimate upper limits on potential exposure.

19 In preparing emergency plans the applicant must
20 distinguish emergency preparedness plans from emergency or
21 abnormal operating plans. The latter incorporate explicit
22 operating or radiological control procedures to govern the
23 controlled return of the facility to a normal or a desired
24 status.

25 The emergency plan in its implementing procedures

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1 should, however, interface compatibly with these. The
2 emergency plan will incorporate sufficient detail so that
3 it may be distributed to other participating organizations
4 and agencies with related plans enabling the latter to determine
5 its own plans are most effectively coordinated with those
6 of the applicant.

7 In addition, the document will be prepared with
8 a view toward its continuing use as an aid in training
9 emergency personnel. It will not be designed as a primary
10 working document to be used during an actual emergency.
11 Implementing procedures documents will be available for this
12 purpose.

13 As the Staff stated in the Final Environmental
14 Statement on page 12-24, the emergency plans that I have just
15 discussed are prepared and receive the final Atomic Energy
16 Commission approval during review of the Final Safety
17 Analysis Report; and it is not part of an environmental
18 ~~hearing~~ *review*

19 This review of the applicant's emergency plans is
20 presently underway.

21 BY MR. DAVIS:

22 Q Mr. Thompson at the July 25th session of this
23 hearing you indicated that the Ohio Water Quality Criteria
24 referred to in Appendix A of the Reg Staff's Final Environmental
25 Statement have been superseded. In order to elaborate on

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1 this point I have a few more questions.

2 Mr. Thompson, will the effluents which are
3 anticipated to be discharged to Lake Erie from the Davis-Besse
4 facility, as described in the Final Environmental Statement,
5 be in compliance with the criteria adopted by the Ohio
6 Department of Health, Water Pollution Control Board, in
7 April 1967, and subsequently approved, with the exception of
8 the temperature and dissolved oxygen criteria there, by the
9 United States Department of Interior?

10 These are the same criteria referenced on page
11 5-3 of the Final Environmental Statement.

12 A Yes.

13 Q Have these same discharges been compared to the
14 specific water quality objectives set forth in Annex 1 to
15 the Great Lakes Agreement which was entered into force in
16 April 1972 between the Governments of the United States and
17 Canada?

18 These specific water quality objectives are set
19 forth on page 12-19 and 12-20 of the Final Environmental
20 Statement.

21 A Yes.

22 Q What were the results of that comparison?

23 A As we stated in Section 12 on pages 12-19 through
24 12-21, the Regulatory Staff has concluded that the discharges
25 from the Davis-Besse facility will be in compliance with the

1 specific objectives of the Great Lakes Agreement.

jrbl0 2 Q Has the Staff also done a study pursuant to its
3 responsibilities under the National Environmental Policy
4 Act of 1969, or NEPA, on the expected impacts on Lake Erie
5 from the discharges from this facility?

6 A Yes.

7 And the results of those studies and analyses are
8 included in Section 5 of the Final Environmental Statement.

9 MR. DAVIS: Thank you.

10 (Witness Thompson excused.)

11 MR. DAVIS: I would now like to call
12 Dr. Frigerio for the response to limited appearance of
13 Dr. Davies.

14 CHAIRMAN FARMAKIDES: Let me ask, with respect
15 to the answer on the limited appearances, the Board has no
16 further questions, but with respect to the additional testi-
17 mony, have you anything further, Mr. Charnoff, in
18 examination on your part?

19 MR. CHARNOFF: No, sir.

20 CHAIRMAN FARMAKIDES: Mr. Baxon is not in the
21 room.

22 Mrs. Stebbins, did you have any further questions,
23 ma'am, with respect to that -- the exchange between counsel
24 for the Staff and the witness for the Staff on the Final
25 Environmental Statement?

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1 MRS. STEBBINS: With respect to the answers to
2 the limited appearances?

3 CHAIRMAN FARMACIDES: That really went to the
4 Federal Water Pollution Control Act Amendments, and that was
5 the issue the Board raised, more than you all did.

6 MRS. STEBBINS: Yes.

7 No, I have nothing to add.

8 CHAIRMAN FARMACIDES: All right.

9 (The Board conferring.)

10 MR. DAVIS: I would now ask Dr. Frigerio to
11 *respond* ~~respond~~ to the limited appearance of Dr. Davies at the
12 July 23rd session at Port Clinton.

13 Whereupon,

14 N. FRIGERIO

15 resumed the stand as a witness on behalf of the Staff and,
16 having been previously duly sworn, was examined and testified
17 as follows:

18 FURTHER DIRECT EXAMINATION

19 WITNESS FRIGERIO: With respect to one of the
20 questions Dr. Davies raised, namely, was the and is the
21 survey of the flora and fauna in the vicinity of the Davis-
22 Besse Station adequate?

23 The list cited by Dr. Davies is by no means the
24 only survey being used. A more particular and more recent
25 survey has been in progress for some years, and is referred to

XXXXXX

Statement.

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1 on page 2-44 of the Final Environmental ~~Statement is the~~
2 *The reference is*
3 ~~References, & Believe, No. 37.~~ This study will continue as
4 part of the Bowling Green State University Environmental
5 Studies Center monitoring of the Davis-Besse site, and should
6 provide an adequate background, considering the expertise
7 and experience of the people involved, in addition to the data
8 already at hand.

9 So that, therefore, the list of *fields*
10 was not
11 intended to be all-inclusive, and is, in fact, not.

12 With respect to meteorology, the value of the
13 meteorological set used depends on the manner and purpose
14 of its use. For dispersion calculations of radiation dose,
15 the limited meteorological data given in the Final Environ-
16 mental Statement was not all that was used.

17 We examined the meteorological data to date, the
18 date being approximately the end of 1972, from the values
19 given by the United States Weather Bureau for Toledo, for
20 all reporting points on the Lake Erie Western Basin. And
21 from these we deduced what meteorological set would be most
22 likely to characterize the Davis-Besse site.

23 We ended up using a meteorological set somewhat
24 more conservative than that because of the lack of specific
25 data, and because of the fact that those points close to
Davis-Besse, such as Sandusky, do not report 24-hours; so
that we took a point in effect somewhat closer inland.

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1 This gives higher stabilities, and, therefore,
2 higher doses than will probably be experienced in practice,
3 so that the meteorological data that was used for dispersion
4 ^{was} ~~is~~ examined and employed in such a way as to yield a more
5 conservative value than the probable dosimetry of the site
6 itself.

7 CHAIRMAN FARMANIDES: Thank you.

8 Mr. Davis, anything further?

9 MR. DAVIS: That is the extent of the Staff's
10 response to the limited appearances.

11 (Witness Frigerio excused.)

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1 CHAIRMAN FARMAKIDES: I might also take this
2 opportunity to note, and, Mrs. Stebbins, you can perhaps
3 advise Mr. Baron of this, I would like to have responses from
4 the Applicant and the Staff to the motion filed by Mrs.
5 Stebbins sometime, hopefully, today.

6 Is this possible? Mr. Charnoff?

7 MR. CHARNOFF: Yes.

8 CHAIRMAN FARMAKIDES: Mr. Davis?

9 MR. DAVIS: Certainly.

10 CHAIRMAN FARMAKIDES: Can we do it on the record
11 orally rather than in writing?

12 MR. DAVIS: Of course. Hopefully implied in that
13 request is that we will have some time to study this first.

14 CHAIRMAN FARMAKIDES: Yes, the Board is also going
15 to take time to study it; but I would like to have responses
16 today; and we'll put them on the record so you won't have to
17 worry about submitting written briefs. All right, fine.

18 Off the record, please.

19 (Discussion off the record.)

20 CHAIRMAN FARMAKIDES: Back on the record.

21 We'll recess until 11:30.

22 (Recess.)

23 CHAIRMAN FARMAKIDES: Can we proceed, please?

24 Mr. Baron, proceed, sir.

25 MR. BARON: Yes, Mr. Chairman, with respect to the

1n2 1 rebuttal of Dr. Sternglass to the testimony of Dr. Frigerio,
2 Dr. Sternglass indicated to me that he just did not have the
3 time to prepare anything; and, therefore, we will waive any
4 rebuttal testimony on that issue. He was involved in some
5 other hearings and had no time, and so he is prepared now to
6 give direct testimony with respect to Intervenor's Issue No. 9.

7 CHAIRMAN FARMAKIDES: All right.

8 Are these written, sir?

9 MR. BARON: No, these are oral.

10 I might indicate, he'll be making reference to
11 some charts that were attached to the Issues 6 and 7 as part
12 of testimony of No. 9 but only with respect to these charts
13 as they might assist him in explaining his findings.

14 CHAIRMAN FARMAKIDES: Off the record.

15 (Discussion off the record.)

16 CHAIRMAN FARMAKIDES: Back on the record.

17 MR. BARON: Mr. Chairman, for the record, I don't
18 suppose it would be necessary to have the witness sworn again?

19 CHAIRMAN FARMAKIDES: No, sir.

20 Yes, it's perfectly all right.

21 MR. BARON: He was put under oath the last time.
22 His qualifications were read into the record, too; and they
23 begin on page 554 of the transcript.

24 Are you ready, Dr. Sternglass?

25 DR. STERNGLASS: Yes, I'm sorry. My plane was

lnJ 1 very late.

2 CHAIRMAN FARMAKIDES: Off the record.

3 (Discussion off the record.)

4 CHAIRMAN FARMAKIDES: Let's go back on the record.

5 Whereupon,

6 ERNEST J. STERNGLASS

7 was recalled as a witness on behalf of Intervenor and,
8 having been previously duly sworn, was examined and testified
9 further as follows:

XXXX 10 DIRECT EXAMINATION

11 BY MR. SARON:

12 Q Dr. Sternglass, the issue before the panel is
13 with respect to an allegation to the effect that independent
14 data has been found which would indicate that the emissions
15 and contamination levels -- I might paraphrase this -- for two
16 plants, one, a pressurized water reactor and the other phy-
17 sically located in a similar site to the Davis-Besse plant,
18 have been emitting higher levels than those predicted for those
19 plants originally and higher than those being predicted for
20 Davis-Besse.

21 Now, sir, have you made any study with respect
22 to such findings; and, if so, sir, please inform the panel
23 of the nature of the data upon which you base these conclusions
24 and also what tests and studies of your own that you might
25 have made in this regard.

1 A Right.

2 The initial evidence that the emission levels from
3 certain nuclear reactors have been in excess of what had been
4 expected on the basis of calculated values, specifically in
5 the case of the Shippingport plant and the Plumbrook reactor
6 located near Sandusky came to me as a result of the examination
7 of operating reports from these plants.

8 In the one case, NASA reports, annual reports, of
9 the operation of the Plumbrook reactor. No. 2, reports
10 supplied to me by the Governor's Committee appointed to
11 examine the Shippingport situation which took place last week;
12 and those documents are annual and semiannual reports of the
13 operation and radioactive measurements and releases of the
14 Shippingport facility prepared by the Atomic Energy Commission's
15 Division of Reactor -- Naval Reactors.

16 Q Dr. Sternglass, let me ask you this: Where, if
17 anyplace, are these reports on record or file? Do you happen
18 to know?

19 A Right. The reports I referred to are public
20 documents. The one on the Shippingport Station is typically
21 entitled "Environmental Radioactivity at the Shippingport
22 Atomic Power Station For The Second Half of 1964 Report to the
23 Pennsylvania Department of Health by the U. S. Atomic Energy
24 Commission, Pittsburgh Naval Reactors Office." These are
25 available. The document number is PNRO-DOV-133 for the

ln5 1 particular year of 1964. These documents have now, I believe,
2 go from about 1960 to about 1970 covering a ten-year period.
3 These are also -- in more recent years -- have been submitted
4 by the Duquesne Light Company to the State of Pennsylvania
5 so there is some confusion.

6 In one case they are reports by the Naval Reactor
7 Office; in other cases they are reports by the Duquesne Light
8 Company; but they all refer to emissions and radioactive
9 reports on what happened at Shippingport. The document with
10 regard to the Plumbrook reactor is the following: It's a
11 series of reports entitled "Report of Reactor Operations for
12 the NASA Plumbrook Reactor, License No. TR-3, Docket 50-30,
13 NASA, Lewis Research Center, Plumbrook Station," and these
14 have been issued annually, and the one I happen to have in
15 my hand is dated May 31, 1972.

16 There are a series of these publicly available
17 from NASA and from the Atomic Energy Commission. The other
18 source of information relating to the high degree of emission
19 comes from a series of reports published by the Ohio State
20 Department of Health, later the Environmental Protection
21 Agency of the State of Ohio; and they were sent to me in part
22 originally by Mr. William C. Schilling, Administrative
23 Assistant to the Mayor of the City of Cincinnati.

24 These Ohio EPA reports are, for instance -- well,
25 they're entitled as follows: "Environmental Protection Agency,

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1 Radiological Health Report, Surface and Ground Waters of Ohio."

2 The one I happen to have in my hand is for the
3 years 1969, 1970, 1971. "Ohio Surface Water Monitoring
4 Program 1973" is also included, and there's a series of such
5 reports, monthly reports and yearly summaries, published by the
6 Ohio Health Department, copies of which I have in front of me;
7 and they can be obtained from the Ohio Department of Health
8 relating to both total radioactivity and special alpha
9 activity and beta activity. These are one important source of
10 my information.

11 Q Do these reports, Dr. Sternglass, make any
12 specific reference to either Shippingport or Plumbrook?

13 A Yes, they do.

14 Q All right.

15 A For instance, Station No. 26 is purposely placed
16 on the Ohio River five miles below Shippingport with the intent
17 of measuring radioactive releases from this facility into the
18 Ohio River.

19 The station located at Sandusky is a station which
20 is designed to measure radioactive effluents and concentration
21 in Sandusky Bay as coming from Plumbrook by empties into
22 Sandusky Bay, and so these stations then summarize actual
23 radioactivity measurements on the basis of which I have formed
24 my conclusions.

25 Now, in addition, I have used measurements carried

ln7 1 out by the Pennsylvania Department of Health. The Pennsylvania
2 Department of Health has a Water Surface -- Surface Water
3 Quality Network that makes quarterly measurements of radio-
4 activity in all the rivers of Pennsylvania, including upstream
5 and below Pittsburgh, below Midland and East Liverpool.

6 These measurements are part of the testimony sub-
7 mitted just now by the Bureau of Health and the Bureau of
8 Environmental Resources of the State of Pennsylvania in the
9 Shippingport hearings, and I have with me a complete set, I
10 believe, of the Pennsylvania Department of Health Water
11 Quality Network readings and this is the material.

12 I'll give you the exact title. It's called
13 "Pennsylvania Department of Environmental Resources Water
14 Quality Network Radioactivity Results, August 1964 through
15 August 1972, Southwestern Pennsylvania Counties, Rivers or
16 Major Tributaries Thereto." Some of my original figures on
17 radioactivity in the Pennsylvania Rivers came to me before
18 this data from a thesis written at the University of
19 Pittsburgh Graduate School of Public Health by Mr. C. E. Moss
20 in fulfillment of a degree of a Master's of Science and
21 Hygiene.

22 The thesis was designed to determine possible high
23 levels of radioactivity in the Ohio River resulting from
24 radioactive pharmaceuticals being discharged from Allegheny
25 County hospitals. There is a table in that figure -- in that

1n8 1 thesis which contains a summary of all radioactivity measure-
2 ments in Western Pennsylvania, and this is derived from the
3 Pennsylvania Water Department data.

4 Q Dr. Starnglass, does the Pennsylvania -- do the
5 Pennsylvania reports have any specific references to either
6 of these two plants, Shippingport or Plum Brook?

7 A The Pennsylvania reports were, I believe, generally
8 designed to determine unusual -- well, just to monitor the
9 levels of radioactivity from all sources into the Monongehela,
10 both from the Betis Laboratories, from the ~~area~~ ^{Realty Mills} and other
11 facilities throughout the state; and measurements were made
12 specifically in East Liverpool, Ohio by the State of Penn-
13 sylvania because that is located five miles downstream from
14 Shippingport as a possible way of making measurements that
15 relate to the Shippingport plant.

16 Now, in addition to these documents, I have relied
17 upon a publication called "Radiation Health Data and Reports"
18 published by the Environmental Protection Agency, formerly
19 the Bureau of Radiological Health of the Public Health Service
20 in Rockville, Maryland.

21 This agency issues monthly reports on levels of
22 radioactivity in the milk, the air, and the rainfall and the
23 surface deposition throughout the United States and specifically
24 in, of course, many areas also related in the neighborhood
25 of nuclear plants.

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1 In fact, the EPA of the United States Government
2 requires reports to be issued by the various government
3 facilities after their radioactive levels, and so another
4 source of my data has been this particular material.

5 Now, I have in front of me a copy of this, a copy
6 of the report on which I relied called "Radiation Data and
7 Reports." This is U. S. Environmental Protection Agency Office
8 of Radiation Programs, and it comes out in monthly publications
9 since about 1957.

10 Q Does that particular one have a date on it?

11 A This happens to have September 1972, Volume 13,
12 No. 9. This happens to be of interest because it measures
13 radioactivity in the milk in the general area of Ohio and
14 Pennsylvania for comparison with milk levels around the
15 Plumbrook and Shippingport reactors.

16 In addition, I have relied upon following other
17 government publications, a publication entitled "Radioactive
18 Waste Discharges from the Environment from Nuclear Power
19 Facilities," published by the U. S. Department of Health,
20 Education and Welfare, Public Health Service, Joe E. Logsdon
21 and Robert I. Chissler, Division of Environmental Radiation,
22 March 1970. The number is BRE-DEP70-2, and it has an Addendum
23 No. 1 with the same title, "Radioactive Waste Discharges to
24 the Environmental from Nuclear Power Facilities," called
25 ORP-SID71-1.

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1 Now, in addition, I have made use of documents
2 published by the Toledo Edison Company called the "Preopera-
3 tional Environmental Radiological Monitoring for the Davis-
4 Besse Nuclear Power Station, Toledo Edison Company, First
5 Quarterly Report, January, February, March, 1973," with the
6 number 643-01997, and the "Preoperational Environmental
7 Radiological Monitoring Program, First Environmental Report,
8 July through December 1972, Davis-Besse Nuclear Power Station,
9 Toledo Edison Company, Toledo, Ohio," dated March 8, 1973.

10 In addition, I have made use of the following
11 publication by the Atomic Energy Commission called HASL-214,
12 "Health and Safety Laboratory, Fallout Program Quarterly Summary
13 Report," appendix to this volume dated October 1, 1969. It
14 deals with measures of strontium-90 deposited by rainfall
15 throughout the world and including Ohio and Pennsylvania.

16 In addition, I have made use of the United Nations
17 Scientific Committee reports on ionizing radiation levels and
18 effects, Volume 1 and Volume 2, which I have Volume 2 in my
19 hand, published in 1972.

20 This contains data on radioactivity in the milk
21 throughout the world, radioactivity deposited on the ground
22 measured throughout the world, including the United States,
23 Ohio and Pennsylvania.

24 By means of these publications, I have arrived
25 at the following principal conclusions.

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1 Q Dr. Sternglass, let me ask you over what period of
2 time did your studies with respect to this particular issue
3 take in?

4 A With regard to possible emissions from nuclear
5 reactors, I began to become concerned with that subject in the
6 spring of 1970. Subsequently, I began investigations of
7 possible changes in radioactive levels, radioactivity levels
8 and health parameters around various nuclear facilities and in
9 connection with the Davis-Besse plant, I believe I testified
10 on possible high releases from the Dresden plant and associated,
11 what I believe to be associated, changes in infant mortality
12 and prematurity in the early part of 1971 in connection with
13 the Davis-Besse hearings here, so I have been concerned with
14 this question essentially for the last three years.

15 Q And with special emphasis now on the Shippingport
16 and Plumbrook plants, when did you first begin to examine the
17 data from those two plants?

18 A My examination of these two plants began in
19 November and December of last year, of 1972, I guess. And
20 they were brought about as follows: I think it's important
21 to understand the background. Until that time, I had been
22 under the impression that our principal concern with regard to
23 radioactivity in the environment was from nuclear testing in
24 the atmosphere.

25 My early work including my book, a copy of which

ln12 1 I have here entitled "Low Level Radiation" dealt primarily
2 with the effects of nuclear fallout, strontium-90, strontium-89
3 and all those various materials injected into the atmosphere
4 from nuclear testing.

5 But as a result of an examination of the environ-
6 mental report for the prepared new Beaver Valley plant to be
7 located on the same site as the Shippingport plant in Pittsburgh,
8 did I become aware that a plant that in this book I charac-
9 terized as being an example of great cleanliness, of the kind
10 of plant that one would expect to be able to build if one
11 had no limits on the amount of money that would be expended,
12 at that time I became aware of high levels of radioactivity
13 apparently indicated by a series of environmental measurements
14 carried out by the NUS Corporation of Rockville, Maryland.

15 Q With respect to which plant?

16 A This was with respect to the Shippingport plant.
17 I believe the same contractor has the obligation for the
18 environmental studies around the Davis-Besse plant.

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1 These measurements were part of the Environmental
2 Impact Statement for the Beaver Valley Unit 2 report, which
3 came to my attention as a result of an offer by an official
4 of the Duquesne Light Company to supply me with a statement
5 so that I could examine it and satisfy myself that all
6 precautions were taken to limit the radioactive releases to
7 the lowest possible values.

8 I have with me a copy of the four quarterly reports
9 by the NUS Corporation, which were a part of this environmen-
10 tal statement of the Beaver Valley Station. They are
11 entitled, "Preoperational Environmental Radioactivity Monitor-
12 ing Program at the Beaver Valley Power Station," prepared for
13 the Duquesne Light Company by Lawrence K. Cohan, Environmental
14 Safeguards Division, NUS Corporation, 4 Research Place,
15 Fockville, Maryland, 20850. It's signed by Albert W.
16 DeAgazio, Nuclear Power Programs, and Morton I. Goldman,
17 SCD, Vice President and General Manager, ESD.

18 There were four of these reports. The first one
19 is entitled, or has the identifying number, NUS-834, January
20 1972, covering the period January to June 1971.

21 The second of these reports is covering July-Sep-
22 tember, 1971. It's identifying number is NUS-916.

23 Then there is a third report covering the period
24 October to December 1971, entitled NUS-915.

25 And a final, a fourth quarterly report, entitled

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1 NUS-950, quarterly report January to March 1972.

2 So this period, almost slightly in excess of one
3 year, describes in great detail measurements carried out on
4 water samples, fish, bottom, sediment, soil, wildlife, milk,
5 airborne particulates and ambient radiation around the
6 Shippingport facility, since the Beaver Valley plant is
7 located within a few hundred feet of the existing Shippingport
8 plant.

9 So it was really a coincidence that an environment-
10 al statement was prepared for a region in which an existing
11 reactor was operating. No such detailed study of the
12 Shippingport facility had ever been carried out, either by
13 the Atomic Energy Commission, the EPA, or the Pennsylvania
14 Department of Health.

15 Upon inquiry with the Department of Health after
16 I found these things, I was told that they were discouraged
17 from making monitoring measurements in the milk and soil
18 around that plant.

19 Q Would you say that that particular report is the
20 one which deals with the subject most specifically?

21 A That is correct.

22 Q And that the other reports to which you made
23 reference were really background material for you --

24 A Not quite. Actually, the others are also highly
25 specific with respect to their own plants, but this was a key

1 document that began to get me concerned about the possibility
2 that the environmental radiation levels were indeed much
3 higher than had been anticipated on the basis of the official
4 releases as reported in the EPA documents which I just cited.
5 Specifically, they were much higher than for instance related
6 in the document called, "Radioactive Waste Discharges to the
7 Environment from Nuclear Power Facilities."

8 I would like, in fact, to make this important
9 point: That on Table 8, page 15, of DRX-DEB-70-2 there is
10 a table of total annual gaseous waste discharges which lists
11 for the Shippingport plant in 1966, for instance, 0.03 curies.
12 1968, only .001 curies. And these are very small amounts
13 compared to, say the Dresden plant, which I've been concerned
14 about, where in 1966 the levels were 736,000 curies, and in
15 1968, 240,000 curies. In other words, hundreds of millions
16 times larger than the announced releases from Shippingport.
17 And in fact, it was on the basis of this early material that
18 I was very concerned about the boiling water reactors of the
19 Dresden variety, or the Big Rock and Humboldt Bay variety,
20 and not nearly so much concerned about releases from the
21 pressurized water reactors, such as Shippingport.

22 And it is for this reason that I refer to it in
23 my book as being a relatively clean reactor, the Shippingport
24 reactor.

25 But it was this document, NUS Corporation's

wel 4 1 finding, that aroused my great concern. And let me briefly
2 summarize the nature of these findings for the Board.

3 The very first and most important thing that came
4 to my attention are the tables dealing with radioactivity
5 in the milk. In these tables, typically, -- for instance,
6 here radioactivity in the milk is on which table of this....
7 right, Table 7 of NUS-884, which was one of the first I
8 examined. And there are six dairies listed, all located
9 within a radius of ten miles from this plant.

10 And when I examined the listing of strontium-90
11 I was immediately struck by the fact that the very first
12 entry was 26.7 picocuries per liter of strontium-90. Now,
13 to the average person that doesn't mean very much. But I
14 had been studying fallout levels for years, and I realized
15 that only at the time of the height of nuclear testing in
16 1963 and 1964 did strontium-90 in the Pittsburgh or Pennsyl-
17 vania area ever approach a level as high as 26.7 picocuries
18 per liter. And this is, of course, for the year 1971, seven
19 or eight years after the end of testing. And so I was
20 immediately very concerned that something has been happening
21 in this environment that had not been recognized until this
22 environmental study had been made; that I, as well as
23 presumably the Duquesne Light Company, and almost everyone
24 else connected with the facility, had no idea that the levels
25 of radioactivity may be as high as this.

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2 And this was the beginning of my concern about
3 these nuclear plants.

4 Q Did that NUS report contain any conclusion as to
5 the reasons?

6 A No. But it does contain a statement that draws
7 attention to the unusually high levels. I could read you
8 that report -- that particular phrase.

9 I believe -- if I can find it -- if you'll bear
10 with me for a minute.

11 Right.

12 CHAIRMAN FARMAKIDES: How are you going to treat
13 this? Are you going to introduce it later in evidence?

14 MR. BARON: I'm showing the background for the
15 Doctor's reasoning as to why he then went on to make his own
16 independent studies, what led him to get into this.

17 CHAIRMAN FARMAKIDES: So that's the reason for
18 your questions?

19 MR. BARON: Yes. As far as the problem being
20 raised, it's again a practical problem of how to reproduce
21 copies of these.

22 CHAIRMAN FARMAKIDES: Well, without the Board
23 having access to something like this how can we accept the
24 proposed findings in this area?

25 All right. That's up to you, sir. I'm sorry.
Proceed.

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BY MR. BARON:

2 Q Did you find --

3 A These are public documents which are now available
4 at the Atomic Energy Commission.5 CHAIRMAN FARMAKIDES: It's not the duty of this
6 Board, however, to go about researching for evidence. It's
7 up to you, all three of you, to supply evidence to the Board.
8 That's my point. Mr. Baron understood it.

9 Excuse me. Go ahead.

10 BY MR. BARON:

11 Q Did you find the page that you were looking for?

12 A Well, what I had in mind was specifically a
13 statement that drew special attention to high levels of
14 iodine-131, which were found a few months later. And later
15 on it was pointed out by everyone that these levels were
16 anomalous and that something needed to be done to investigate
17 this.18 Q Were there any determinations made as to any
19 other possible causes?20 A That's right. At the time, no. After I discovered
21 these high levels of strontium-90 in the milk, both the
22 Environmental Protection Agency and the Atomic Energy Com-
23 mission and the NUS Corporation undertook efforts to see
24 whether they could relate this to any other source. And a
25 report to that effect has in fact been published by the

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wel 7 1 Atomic Energy Commission, jointly, and includes a copy of a
2 report by the Environmental Protection Agency which I will
3 so refer to.

4 This document is called a "Summary Report on the
5 Assessment of Environmental Radioactivity in the Vicinity
6 of the Shippingport Power Station," by the U. S. Atomic
7 Energy Commission, Division of Operational Safety, dated
8 May, 1973, and part of it is an EPA report -- and again it's
9 an important document -- entitled, "Assessment of Environment-
10 al Radioactivity in the Vicinity of the Shippingport Atomic
11 Power Station," interim report, April 27, 1973, by the
12 Eastern Environmental Radiation Facility, Montgomery, Alabama.
13 No individual authors are listed.

14 Now, this particular report examined the question
15 as to whether or not this release, this radioactivity, might
16 be due to such a thing as fallout from weapons testing. And
17 it was concluded by both the EPA and the Atomic Energy
18 Commission that that was not a likely explanation.

19 Now, the reason why this is not likely -- the
20 reasons are manifold -- but let me just summarize the main
21 findings of the NUS report that we had at the time, and then
22 you'll see why it is not likely that they are related to
23 fallout.

24 Number one, the levels in the soil as reported
25 dropped off roughly inversely with distance away from the

wel 8

1 stack, north, east, south and west, in every direction, by
2 a factor of about 50-fold. In other words, the concentration
3 as measured at the time near the stack was 50 times higher
4 than in the environment in general.

5 Secondly, the strontium-90 in the milk, after
6 being fairly high for a period of about five or six months
7 in the beginning of 1971, then towards the end of 1971
8 declined very sharply back to the levels of strontium-90
9 for the rest of Pennsylvania, including Harrisburg. And
10 then we found that in August-September, shortly before this
11 descent of strontium-90 levels began, the plant was shut down
12 for repairs.

13 Now, that suggests that after the shutdown for
14 repairs, the rains removed, and of course, the fodder was
15 eaten, the grass was eaten, the rains washed the strontium-90
16 from the leaves, and the strontium-90 levels returned
17 back to those typical for western Pennsylvania and eastern
18 Ohio.

19 Then another observation, which we noted in the
20 report to the Governor dated January 21, 1973, that led to
21 the Shippingport hearings, in that report, copies of which
22 were a part of my original 6 and 7 contentions, and they
23 are in the possession of the Board, the Shippingport report
24 entitled "Significance of Radiation Monitoring Results of the
25 Shippingport Nuclear Reactor," January 21, 1973, was made

wel 9: part of the original testimony as submitted here. And in
2 that report Figure 5 shows that when we look at the excess
3 strontium-90 levels in the milk for ten miles around the
4 Shippingport reactor, we found that the levels went up and
5 down together with the power generated at the Shippingport
6 plant, which tends to give one the impression that there
7 is a causal relationship between the levels of strontium-90
8 in the milk and the power generated during a period when
9 there was no atmospheric nuclear testing between January and
10 May of 1971. Neither France nor China nor the United States
11 carried out any nuclear tests in the atmosphere.

12 Now, that was part of the evidence.

13 A further piece of evidence consisted of measure-
14 ments taken by dosimeters, thermal luminescent dosimeters,
15 placed by NUS Corporation six feet above the ground at
16 various locations as far as two miles away and around the
17 perimeter of the plant. Now, a thermal luminescent dosimeter,
18 if I may just explain what they are--it turns out to be a
19 highly crucial point; in fact, it is probably one of the
20 most vital pieces of direct evidence of high doses and which
21 is now in dispute, by the way, and this is due to the fact
22 that these tiny crystals are a quarter of a millimeter or
23 so in diameter, square little pieces of a material which
24 gives off light after it has been irradiated to X-rays, given
25 X-rays, and the amount of light given off is a measure of

wal 10³ how much radiation it absorbs. And the way this is done
2 is, you take this piece of crystal -- it can be any one of
3 two or three, lithium fluoride, calcium fluoride -- these
4 crystals are first annealed in an oven and then they are
5 placed on the site and they absorb radiation. At the end
6 of it they are taken off the tree or the telegraph pole,
7 telephone pole, and they're placed in a little oven, in a
8 light-tight oven, and heated. And the amount of light given
9 off is multiplied. This light, then, represents a measure
10 of the dose.

11 And the first indication of high doses in support
12 of the strontium-90 levels comes from these dosimeters. For
13 instance, Figure 6 of my January 21 report, gives the direct
14 reading, uncorrected for anything else, directly out of the
15 NUS report for the period 1971 to early 1972, ambient
16 radiation levels at the town of Shippingport about a mile
17 and a half downwind, for the preferred direction of wind,
18 from the west. In other words, downwind to the east.

19 Q Dr. Sternglass, I hate to interrupt you, but just
20 for clarification, these diagrams, Figures 5 and 6, contained
21 in your Appendix ~~6-2~~ ⁶⁻² dated January 21, 1973, were diagrams
22 that you drew? Excuse me -- that was '60.

23 A I drew them based on the NUS measurements.

24 Q Of which date? The NUS measurements.

25 A Oh. These are the NUS measurements from February

wel 11,

1971 to April of 1972.

2 Q All right.

3 A All right. For that period the data was available;
4 not earlier, not later. That was the only period for which
5 it was available. And at that time the levels apparently
6 reached the dose rate of as high as 370 millirads per year,
7 uncorrected for any other effects.

8 Now, the reason this is so high is that the
9 typical background values as recently confirmed by the
10 Atomic Energy Commission's program where they flew an air-
11 plane overhead and measured the radioactive level -- you
12 know, a few years later, now normal levels turn out to be
13 of the order of 60 -- typically 80, even 90 millirads per
14 year. So that a level of 370 millirads, if sustained
15 throughout the whole year, would indeed be a very high level,
16 which is a cause of concern because the official report as
17 issued to the Environmental Protection Agency and sent to
18 me by Joe Logsdon in an appendix to this report dated Decem-
19 ber 22, 1972, Table I, indicates that the gaseous waste
20 released to the environment -- and of course, these would
21 give rise to these dosimeter readings, because they would
22 have to be on the ground and in the air -- reads zero.

23 In other words, the gaseous wastes released to
24 the environment, reported by Duquesne Light Company and the
25 Naval Reactor Branch of the AEC to the EPA, said zero, and

wal 12³

with a footnote saying, "No gases were released due to adequate holdup capacity."

And so there was on the face of it a very clear and difficult contradiction between levels of strontium-90 in the milk, high dosimeter readings, high level in the soil, and a claim of zero release. In other words, these were manifestly in clear contradiction because the actual claimed environmental doses given to the Environmental Protection Agency of the percent of permissible limit -- for instance, Table 4 of the document ORP-SID-71-1 list for the Shippingport Reactor -- no, that's the liquid limit. I've got the wrong table here.

The table I really mean is Table 10, called, "Annual Gaseous Radioactive Waste Discharges Expressed as a Percent of Limit for the Shippingport Reactor." For 1970 the limit listed is less than .001 percent of the limit, which is 170 millirads to the average individual, or 500 millirads maximum at the boundary.

Now, those dosimeter readings here, and these low levels, differ by something of the order of 10,000 to 50,000 times. We're not talking about a small difference between two officially-reported releases or measured doses by the same organization. And this is, of course, the origin of the great problem that we now confront.

In other words, we have what amounts to a clear

1 and direct and difficult to understand contradiction or
2 disagreement between officially reported releases and doses
3 to the public, and releases as measured by their own
4 environmental consultant. This, then, is really the nub of
5 the whole thing, because what we have done since is to
6 discover similar contradictions at these other facilities.
7 And I'll be glad to go into these problems in some more
8 detail.

9 Q Dr. Sternglass, the comparison you've made, the
10 contradiction you've pointed out, has this been noted by
11 anybody else in this world of science in which you --

12 A Oh, yes. It is now well recognized that a problem
13 exists. In fact, the Atomic Energy Commission and the
14 EPA reports are quite specific about pointing out that there
15 is a difficulty that needs to be resolved. And there are
16 only a couple of possibilities.

17 Number one, this is fallout, as we've just
18 discussed, or --

19 CHAIRMAN FARMAKIDES: Dr. Sternglass, are you
20 quoting from the May '73 report that you cited earlier?

21 THE WITNESS: This is the May '73 Atomic Energy
22 report, right. And I will read to you what the EPA said at
23 that time. They have since come up with a final report,
24 which is slightly modified, but basically it has the same
25 conclusions. And the EPA concludes, about the strontium-90

wel 15³ levels, which I believe are the most serious, there is some --
2 we don't understand the iodine, but the strontium-90 is a
3 very serious problem, and it says so on page 8 of the EPA
4 report attached to the May '73 document.

5 It says here:

6 "These levels of strontium-90 for 1972 are in
7 the same range as the levels in milk samples collected
8 by the ERF in February 1973. A suitable explanation
9 cannot be made of the higher-than-average strontium-90
10 levels recorded in 1971."

11 About the only thing that appears to be possible
12 is some strange error in the measurements, which suddenly
13 went away after the plant was shut down. This is very hard
14 to understand, because why should, with the technique
15 unchanged, the levels of strontium-90 come down to where
16 they are as measured by the Public Health Service for the
17 rest of Pennsylvania, if it is purely an instrumental error?
18 This is hard to understand why, in perfect coincidence with
19 the shutdown of the reactor, should the analytical technique
20 at NUS change in perfect synchronism so as to come down by
21 300 percent in their levels of strontium-90 in the milk?
22 That is hard to understand.

23 But the other alternative is that it is fallout.
24 But that is pretty much rejected on the basis that it just
25 doesn't behave properly. In fact, the Division of Biology

we1 16¹ and Medicine has an appendix here of its report, and they
2 say the following:

3 "The OBER evaluation of the origin of environ-
4 mental radioactivity at Shippingport..." --

5 CHAIRMAN FARWAKEDDS: Who is that?

6 THE WITNESS: The Division of Biology and Environ-
7 mental Research of the AEC says the following in their
8 opening page:

9 "However, a study of the limited data available
10 on precipitation and fallout patterns leads to the
11 conclusion that it is highly unlikely that the radio-
12 activity was of Chinese origin."

13 In other words, that it was a fallout.

14 And so we are confronted with a growing and
15 increasing puzzle; namely, it does not seem to be likely
16 that it is an instrumental error because the same company
17 carried out similar measurements at at least 18 other nuclear
18 sites, and no one else has found a major discrepancy, you
19 understand. And the same company is staffed with highly
20 competent people who have been associated with the Atomic
21 Energy Commission for many years, with the Environmental
22 Protection Agency -- in fact, it includes even some of our
23 own students. And so it is -- I mean I cannot say that
24 these people aren't competent, you understand.

25 And so the point is that it was done by competent

1 people. They examined the possibilities of fallout, and the
wel 17 2 only thing is that -- that now remains -- is that either
3 some very strange instrumental error, which applied to milk
123 4 measurements for cesium, to milk measurements for strontium,
5 to iodine -- it's using different techniques and soil
6 measurements, and air measurements and measurements in other
7 various environments. And now we have the additional data
8 that has just been supporting this strange finding of high
9 releases coming from two other independent sources, which
10 again is very important.

11 I'm referring to testimony that was just delivered
12 at Shippingport by two individuals, copies of which I have
13 with me. One is Mr. Irving Michaelson, who is an independent
14 consultant on radiation, health and --

15 MR. CHARNOFF: Mr. Chairman, I think we're going
16 to have objections. I think we're going to have a great
17 deal of difficulty dealing with testimony where somebody
18 said this and somebody said that, and there are reports --
19 and we're just not getting any documents. I was hoping that
20 at some point we'd begin to get something into the record
21 that we can deal with.

22 THE WITNESS: You are getting documents.

23 MR. CHARNOFF: Excuse me. I think we can deal
24 with the documents that are here in some respect. I have a
25 great deal more objection to statements about what somebody

wel 18^f else said somewhere else that we cannot deal with. And it
2 seems to me that -- I would move that it be eliminated from
3 this testimony, statements about what other people said,
4 unless there is at least a document in the room here to
5 support that and that we can deal with. Short of that I
6 think --

7 THE WITNESS: I have a document, which is a
8 document entitled, "Some Observations on the Reports of
9 Excessive Radionuclides in the Shippingport Area for Presenta-
10 tion to the Fact-Finding Committee of the Pennsylvania
11 Department of Health at the July 31-August 2, 1973 hearings,
12 for Irving Michaelson, Director, Environmental Health and
13 Safety Research Associates on behalf of Consumers Union,
14 Mount Vernon, New York, 10550." And in this document -- I'd
15 be glad to supply copies --

16 CHAIRMAN FARMAKIDES: Excuse me, Dr. Sternglass.
17 Mr. Charnoff isn't the only one who is concerned about this.
18 I've been very concerned about it. It's going to be the
19 responsibility of this Board to reach a decision based on
20 the evidence, and at this point in time I don't see any
21 evidence coming before this Board except your testimony, sir.
22 And that is fine, so far as it goes. But you're quoting
23 from documents, and you're quoting from tables, and you're
24 quoting statistics that are not before us.

25 Now -- look, I think perhaps the counsel ought

wei 19 3 to talk with the Board to see how we're going to resolve
2 this.

3 You have some more testimony, Dr. Sternglass?

4 THE WITNESS: Yes. I --

5 CHAIRMAN FARMANIDES: What we can do is recess
6 now, or hear the rest of your testimony, and --

7 THE WITNESS: I won't be able to conclude it --

8 MR. BARON: There's quite a bit more, Mr.
9 Chairman.

10 CHAIRMAN FARMANIDES: Fine. Why don't we recess
11 now, the Board meet with counsel, and we'll reconvene at
12 one-thirty.

13 (Whereupon, at 12:20 p.m., the hearing was
14 recessed, to reconvene at 1:30 p.m., this same day.)

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AFTERNOON SESSION

PAGE 4
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(1:30 p.m.)

CHAIRMAN FARMANIDES: We are ready to proceed, gentlemen.

Mr. Baron, proceed, sir.

Whereupon,

ERNEST J. STERNGLASS

resumed the stand as a witness on behalf of the Intervenor and, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BARON:

Q Dr. Sternglass, this morning you were indicating background information you had gathered from various sources to base a conclusion upon, and most of that information seemed to relate to the Shippingport plant.

Do you have any references which -- and again, Mr. Chairman, I will be tying this to his conclusions, so you will see the basis for it -- with respect to the Plumbrook reactor?

A Yes, sir, I have.

I have examined the annual report of the Plumbrook Reactor, and in the case of the typical report, the one that I have had a chance to examine in some detail for the period April 9, 1971 to May 1972, a fairly recent report, I had

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1 occasion to examine, for instance, their own measurements that
2 are reported on strontium-90 around the Plumbrook reactor.

3 And on page 21 of this document, it says, "Milk
4 samples within a nine-mile radius" -- quite analogous to the
5 situation around the Shippingport reactor -- "and the average
6 strontium-90 was 10 picocuries per gram calculated with
7 maximum strontium-90 as high as 50 picocuries per gram."

8 Now, since this is roughly equal to 10 to 50
9 picocuries per liter of milk, this again can be compared with
10 what is normal for the Cleveland area; and I have examined
11 the rad-health data and reports, measurements of the May
12 1972 Public Health Service measurements on Cleveland. And
13 it was seven picocuries per liter for Cleveland, six picocuries
14 per liter for Cincinnati, six picocuries per liter for
15 Buffalo, and seven picocuries per liter for Detroit.

16 So that a range of 10 to 50 picocuries per liter
17 is again abnormally high; and in fact, it is not the only
18 place where this occurs.

19 Q Well, --

20 A But again it typifies the situation being
21 encountered around Shippingport.

22 Q Were there any other documents that you made
23 reference to with regard to Plumbrook?

24 A With regard to Plumbrook, yes. I obtained a
25 set of data on the New York State measurement which, as you

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1 know, New York State also borders on Lake Erie; and they have
2 some reactors on Lake Erie similarly situated -- on
3 Lake Ontario -- similarly situated to Plumbrook and the
4 proposed Davis-Besse plant.

5 Q All right.

6 What dates, and would you give us some specific
7 references?

8 A Right.

9 I have this document -- excuse me. This is a
10 document entitled "The Environmental Radiation Bulletin No. 4
11 1972, Radioactivity in Air, Milk, and Water, for October -
12 December 1972," the New York State Department of Environ-
13 mental Conservation.

14 And in this report, again, there are a number of
15 reactors similar to Shippingport, similar to Davis-Besse,
16 similar to Plumbrook, for which strontium-90 levels were
17 measured; and I will just cite one or two examples to give
18 you an idea:

19 In Oswego County, there is a site that's in this
20 table "Results of Picocuries Per Liter" and again, strontium-90
21 is between nine and nineteen picocuries per liter; whereas
22 for other areas in New York State, it is down as low as
23 three picocuries per liter.

24 MR. CHARNOFF: Mr. Chairman --

25 MR. BARON: I'm going to stop it right at this

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1 point.

2 MR. CHARNOFF: I'd like to have another bench
3 conference, if I may, with counsel, to discuss where we are
4 going. I thought we had some understanding at the end of
5 the --

6 CHAIRMAN FARMERIDES: Let's let this go on for a
7 little while, and we will see.

8 MR. BARON: I was going to draw it to a conclusion
9 right now.

10 CHAIRMAN FARMERIDES: Fine, fine.

11 BY MR. BARON:

12 Q Dr. Stenzglass, now, you have indicated that the
13 background studies which you have reviewed yourself -- do you
14 have a conclusion, Dr. Stenzglass, an opinion, as to what
15 all of these studies and this information mentioned relates
16 to the Davis-Besse plant?

17 A Yes, I do.

18 Q And the Environmental Impact Statement which was
19 filed in connection with that plant?

20 A Yes, I do.

21 From the examination of all these different
22 reactors of similar, general background, using the similar
23 analyses to estimate the amount of radioactivity in the
24 environment, such as was used for Shippingport and other
25 reactors of a pressurized water type, it is my judgment at

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1 this moment that what has been missed are essentially
2 sizeable releases of particulate matter, so-called, which
3 includes strontium-90 and cesium-137, which have escaped in
4 gaseous form and were therefore not measured in the liquid
5 effluent.

6 And that these gaseous emissions have settled on
7 the lands surrounding these plants, increasing the
8 radioactivity in the milk and the vegetation, and that has
9 subsequently washed off into the rivers and increased
10 thereby the radioactive concentration in the rivers, or in
11 Plum Brook, or in the Ohio, and in Lake Erie, well beyond the
12 levels calculated and estimated based on the liquid releases
13 alone.

14 And it is this that allows me to understand for
15 the first time --

16 Q When you say "this", what do you mean?

17 A This -- this conclusion: that it is the gaseous
18 emissions of particulates, like strontium-90, cesium-137,
19 materials that had not been expected to be released in any
20 significant quantities at all, but apparently did escape.
21 That accounts for, Number One, the large strontium-90 level
22 around many of these plants, and the fact that, for instance,
23 in the case of Shippingport in 1966, we were able to observe
24 a rise in strontium-90 total activity, and strontium-90 per
25 square kilometer that could be traced in the one direction

1 all the way to Chicago, and beyond, in one direction; and in
2 the other direction all the way to New Jersey, New York,
3 and Bermuda, in the other direction.

4 And this is based on these ^{WASH} ~~114~~ 114 Measurements
5 of Radioactivity, and I have a graph illustrating this which
6 I would like to submit.

7 Q Dr. Sternglass, what does this mean in your
8 opinion with respect to the projected emission levels as
9 outlined for the Davis-Besse plant?

10 A Well, --

11 Q How does all this background information you have
12 been referring to relate to this, and what conclusions or
13 opinions do you have with respect to the Davis-Besse
14 Environmental Report?

15 A Well, as originally outlined in Contention 6,
16 where the numbers that you are asking for are detailed --

17 Q Do you have a page number?

18 A I have the page numbers, yes.

19 MR. CHARNOFF: Excuse me.

20 Is counsel for the Interveners introducing
21 Dr. Sternglass' testimony on Contention 6 and 7 as part of
22 the testimony in this record? I'm not sure I understand
23 what is going on.

24 MR. BARON: Well, just forget about Statement 6.

25 WITNESS STERNGLASS: It is material I had

1 calculated, applied directly to that question; and I wanted
2 to refresh my memory.

3 CHAIRMAN FARMAKIDES: I think, however,
4 Dr. Sternglass, just so we will proceed in an orderly way,
5 please answer Mr. Baron's questions only. You don't have to
6 extrapolate beyond that, sir.

7 I think Mr. Baron will lead you through the
8 testimony he wants to adduce.

9 WITNESS STERNGLASS: What I am trying to get to is
10 that in the Plumbrook reactor, it is much smaller; and the
11 Shippingport reactor is much smaller than the proposed
12 Davis-Besse plant. And the projected total power, thermal
13 power, generated, and the projected releases are much larger
14 than the projected releases and the reported releases from
15 the Shippingport plant and the Plumbrook plant by factors of
16 50 to a few hundred times, as I have indicated here.

17 CHAIRMAN FARMAKIDES: May I understand you, sir?
18 I am not sure that the Board is clear.

19 The Contention, as I understand it is that that
20 the Final Environmental Statement is inadequate.

21 WITNESS STERNGLASS: Right.

22 CHAIRMAN FARMAKIDES: In its relating of proposed
23 releases and contamination levels, it is underestimated?

24 WITNESS STERNGLASS: Right.

25 CHAIRMAN FARMAKIDES: Can you relate your answer,

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1 sir, to that Contention?

2 WITNESS STERNGLASS: All right, I'll try.

3 I have tried to establish so far that at levels
4 calculated for reactors similar to Davis-Besse the observed
5 doses, the observed amounts of radioactivity in the soil and
6 the mil and et cetera ---

7 CHAIRMAN FARMAKIDES: You are talking about
8 Shippingport and Plumbrook?

9 WITNESS STERNGLASS: Yes. -- were thousands to
10 tens of thousands times greater than had been calculated.

11 CHAIRMAN FARMAKIDES: Yes.

12 WITNESS STERNGLASS: -- using the same kind of
13 model that had been used in the Environmental Statement for
14 Davis-Besse.

15 CHAIRMAN FARMAKIDES: Okay.

16 BY MR. BARCH:

17 Q Now, Dr. Sternglass, to your knowledge has anyone
18 else in the scientific world dealing with this subject made
19 an analysis similar to yours?

20 A With regard to emissions?

21 Q Yes, and the conclusions that you are drawing now
22 with respect to Davis-Besse?

23 A Well, all I can say is that again, Dr. Harold
24 Rosenthal has just reported measurements that lead him to
25 believe that more strontium-90 got into the environment

1 around the Shippingport plant than had been expected. In
2 fact, it was as high as it was at any time since the
3 hydrogen bomb testing.

4 So he would agree and, I believe, testify to the
5 effect that there were abnormally high levels of strontium-90
6 within a radius of ten miles of Shippingport.

7 MR. CHARNOFF: Excuse me, Mr. Chairman.

8 I am going to move to strike that for a variety
9 of reasons.

10 CHAIRMAN FARMANIDES: I would like to hear a
11 response, Mr. Baron.

12 MR. BARON: I don't have any. I agree.

13 CHAIRMAN FARMANIDES: All right. That will be
14 stricken. The Board certainly agrees to that.

15 Proceed, sir.

16 BY MR. BARON:

17 Q But, Dr. Stetnglass, in the past you have been
18 as I understand it, working in this area and tried to estab-
19 lish evidence of these emissions, these higher emissions?

20 A Right.

21 Q And you've done certain studies?

22 A Right.

23 Q With respect to those?

24 A Yes.

25 Q How do the conclusions which you have now reached

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1 in light of these documents to which you have made reference,
2 how does that fit in with your earlier studies?

3 A Well, let me say it this way: Until these
4 documentary pieces of evidence came to light about high levels
5 of strontium-90 in the milk, and cesium-137 in the milk,
6 around Shippingport, and this other reactor -- Plumbrook --
7 there was not nearly as direct evidence of high radioactive
8 releases that would have explained my earlier findings on
9 changes in infant mortality, in fetal deaths, around these,
10 until this documentary material came out, suggesting that
11 tens of thousands of times as much radioactivity had
12 escaped. Until this time it was difficult to believe and
13 understand that rises of detectible kinds of cancer,
14 leukemia, infant mortality, and heart disease could have
15 occurred around nuclear plants. And that had been my
16 conclusion until only recently. I would have agreed that in
17 the past, until now, I did not have anything like such
18 detailed documentary evidence of high releases of highly
19 biologically toxic material such as strontium 90 from these
20 reactors.

21 Q Now, to tie this all together in conclusion,
22 Mr. Chairman, let me ask the Doctor some specific questions:

23 To your knowledge, has there been any publicized
24 explanation of these high releases from the Shippingport
25 plant?

1 A No, sir.

jrb 11 2 Q Just answer my questions yes or no.

3 A The answer is No.

4 Q You are indicating, then, that the releases as
5 reported in various documents have been much higher than
6 originally estimated by the various organizations?

7 A Yes, that is my belief.

8 Q In your examination of the Davis-Besse Environ-
9 mental Impact Statement you reviewed, I presume, the projected
10 emissions for this plant?

11 A (Nodding affirmatively.)

12 Q Is that correct?

13 A Yes, I have.

14 Q All right.

15 What are you saying, then, with respect to the
16 projected emissions as outlined in the Davis-Besse
17 Environmental Impact Statement?

18 A I believe that the estimated dosage to the
19 population based on the models used neglect totally the
20 doses from strontium-90 in the milk, and neglect the doses
21 to the early embryo and fetus, and neglect various pathways;
22 as a result of which I believe that this statement is
23 invalid as a projection.

24 Q And you are basing that statement on this other
25 information which you have been studying with respect to the

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1 Shippingport plant?

2 A That is correct.

3 CHAIRMAN FARMAKIDES: What information, sir?

4 MR. SARON: The EPA - AEC Summary.

5 WITNESS STERNGLASS: The NUS Study showing high
6 amounts of strontium in the milk and other isotoped in the
7 soil and water; I base it on the EPA analysis indicating that
8 at this moment they do not have any other explanation,
9 clear explanation, for the strontium-90 levels in the soil
10 and milk around that plant. And I base it on the NASA report
11 around the Plum Brook reactor showing high releases, both
12 that showed up in environmental samples of the milk, of the
13 vegetation, or the fauna or the water, all of which have
14 higher levels than projected.

15 MR. CHARNOFF: Objection, Mr. Chairman.

16 We are dealing in ranges of hearsay here, but I
17 think I can state my objection this way: I am not sure
18 whether or not I understood Dr. Sternglass to state he is
19 basing it upon an EPA document which states that it has
20 no other explanation?

21 Now, I don't know that there is any testimony in
22 the record saying that EPA says that the only explanation
23 available to them is that it is from Shippingport. And when
24 we get hearsay compounded by statements of this sort, it
25 becomes very difficult to deal with.

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1 CHAIRMAN FARMAKIDES: There is no doubt about it
2 that what we are talking about is hearsay. There is no doubt
3 about the fact that this Board will accept hearsay in those
4 cases where we feel it is reliable and relevant.

5 I would -- there is no reason, either, Mr. Charnoff
6 why you could not bring this out in your cross. It would
7 appear to me that that would be a better way for you to
8 proceed, because we have no offer of evidence as yet.

9 MR. CHARNOFF: I don't know what we have.

10 CHAIRMAN FARMAKIDES: Well, I know one thing: We
11 have no offer of evidence as yet. I don't see how we're
12 going to be getting it at this point in time.

13 MR. CHARNOFF: Very well.

14 CHAIRMAN FARMAKIDES: Now, unless Mr. Baron has
15 some other way of proceeding that I am not aware of at this
16 moment -- but let me not rule on your -- let me overrule
17 your objection at this point in time; and we will proceed.

18 MR. BARON: That's all the questions I have of
19 Dr. Sternglass, Mr. Chairman. And at this point I would like
20 to offer as exhibits for the Intervenor the charts which were
21 attached to the original testimony submitted by Dr.
22 Sternglass as part of Issue 6.

23 WITNESS STERNGLASS: The tables.

24 MR. BARON: The tables, I am talking about.

25 CHAIRMAN FARMAKIDES: How many of them are there,

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1 Mr. Baron?

2 MR. BARON: Well, he made specific reference to
3 Figure 5 and Figure 6; and I may have neglected to
4 note another one, -- Figure 1.

5 MR. CHARNOFF: Figure 6.1?

6 MR. BARON: That is correct.

7 CHAIRMAN FARMAKIDES: Excuse me, sir. There is a
8 statement of testimony on Contention 6 which is accompanied
9 by Figure 6.1 by Dr. Sternglass.

10 There is also attached to his offer of testimony
11 on Contention 6, Appendix 6-2, which is January 21, 1973,
12 Contribution to the Governor of Pennsylvania, which also
13 has these figures, I believe, 5 and 6.

14 So I think it would be helpful for ^{for purpose} delineating
15 ^{of delineating} this if you would identify which ^{ones you are} ~~ones we are~~ talking about.

16 MR. BARON: I see what you mean.

17 WITNESS STERNGLASS: I have in mind introducing
18 the Figures 6.1 and the entire document of January 21,
19 with all its figures.

20 CHAIRMAN FARMAKIDES: Well, let's be more clear
21 now.

22 Mr. Baron, proceed again. You are offering
23 what?

24 MR. BARON: Appendix 6-2 is the way this one is
25 marked.

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1 MR. CHARNOFF: Mr. Chairman, may I approach the
2 bench with Mr. Baron.

3 CHAIRMAN FARMANIDES: Off the record.

4 (Discussion off the record.)

5 CHAIRMAN FARMANIDES: Back on the record.

6 Mr. Baron, proceed, sir.

7 MR. BARON: Yes.

8 We would like to offer as an exhibit at this time
9 what was originally offered as the Testimony of Dr. Sternglass
10 to Issue 6, with the understanding that the Applicant might
11 wish to strike some written portions of it dealing with
12 specific subjects.

13 CHAIRMAN FARMANIDES: All right.

14 Any objections?

15 MR. CHARNOFF: Well, I would like to identify
16 the portions that should be stricken, sir.

17 CHAIRMAN FARMANIDES: All right.

18 This would be Intervenor's Exhibit -- what number?

19 MR. SILBERG: 10.

20 MRS. STEBBINS: No.

21 CHAIRMAN FARMANIDES: Off the record.

22 (Discussion off the record.)

23 CHAIRMAN FARMANIDES: Back on the record.

24 Mr. Baron?

25 MR. BARON: This will be Exhibit No. 10 and 10-A --

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1 CHAIRMAN FARMAKIDES: You mean 10-A and 10-B?

2 MR. BARON: Yes, sir.

3 CHAIRMAN FARMAKIDES: All right, fine.

4 It gets a little --

5 MR. BARON: It certainly does.

6 10-A would be Dr. Sternglass' testimony which
7 was originally submitted to Issue No. 6; and 10-B would be
8 Dr. Sternglass' testimony as originally submitted to Issue
9 No. 7, with whatever deletions Mr. Charnoff wishes to make.

10 CHAIRMAN FARMAKIDES: Mr. Charnoff?

11 MR. CHARNOFF: Yes, sir.

12 If you recall, the Board's issue was related this
13 morning to the question of the environmental radiation levels
14 away from the site, or the environs of the site; and Contention
15 9 does not include the biological effects of such
16 radiation levels.

17 I propose to strike on those sections of
18 Intervenor's Exhibits 10-A and 10-B which relate to environ-
19 mental effects; and I would agree to the biological effects
20 of the radiation -- I'm sorry.

21 Thus, we would propose to strike from Appendix 6-2
22 of Exhibit 10-A, which is the January 21, 1973 Sternglass'
23 paper with respect to Shippingport, we would strike everything
24 following "principal finding 9" which appears on page 4
25 of that paper, beginning with the paragraph starting

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"The seriousness of these findings..." to the end of the paper.

Now, we also strike the related figures which are Figures 9, 10, 11, 12 and 13, and Table 1, which is attached to the January 21, 1973 paper.

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1 MR. CHARNOFF: Sir, as he read that, I had
2 corrected myself to say that I was moving to strike those
3 matters dealing with biological effects.

4 CHAIRMAN FARMANIDES: Yes, he has that in there.

5 All right, Mr. Baron.

6 MR. BARON: Mr. Chairman, it occurs to me, and I'm
7 trying to follow the exact rationale that Mr. Charnoff has
8 proposed here, it occurs to me that this hearing is not to
9 determine the effectiveness of mechanical testing devices but
10 what, if any, possible consequences to human beings and, if
11 you will, biological testing devices will this plant have; and
12 if this testimony that is being offered here deals with
13 biological factors as further indicators of what has happened
14 as a result of the Shippingport plant's operation, I think you
15 have to consider it. I don't think it can be stricken.

16 The doctor has indicated that he has done
17 studies on fetuses, et cetera, et cetera to indicate that
18 these things have been happening; and now something has come
19 out through other sources, other agencies, to show that
20 something had been going on which gives some justification,
21 shall we say, to his earlier observations.

22 His only tools of measurement were human beings
23 or some form of human life; and, from his examination of
24 findings that he had been making with respect to the reactions
25 of those measuring devices, those human measuring devices, he

1n2

1 is now, I think, trying to tie this in with these other
2 things that have since developed through mechanical testing
3 devices.

4 And when you say strike out the biological
5 consequences, why do we do any of this? That is what this is
6 all about; what are the biological consequences going to be
7 to people? I don't care if their dosimeters, or however you
8 describe these things, were defective. There still is something
9 going on. It's been tied in to a degree in the thrust of
10 his testimony, and now they're asking us to strike all that
11 out and disregard these biological measuring effects or devices
12 or factors.

13 It cannot be done.

14 CHAIRMAN FARMER: Staff, Mr. Davis?

15 MR. DAVIS: Mr. Chairman, the Atomic Energy
16 Commission's hearings last summer dealt largely with this
17 matter. The hearings at the construction permit stage
18 regarding the Davis-Besse facility, I believe, held in 1970
19 dealt largely with these matters by the same witness.

20 This type of testimony if allowed in at this stage
21 would be a restatement of the same testimony that we heard
22 of him to the same point that we have heard before.

23 We cannot continually be reopening the hearings
24 that we have held before to consider the same matters that
25 have been considered before.

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1 We, therefore, support the Applicant's motion to
2 strike those portions of the Intervenor's proposed testimony
3 that deal with effects, that deal with matters other than
4 those issues that have been let in at this hearing.

5 (Board conference.)

6 CHAIRMAN FARMARIDES: The Board is very cognizant
7 of the point raised by Mr. Baron.

8 On the other hand, this, in fact, as Mr. Davis
9 pointed out, this, in fact, is a question of res judicata.
10 It was raised in the Applicant's initial motion. The type
11 of testimony that Dr. Sternglass gave in 6 is the testimony
12 that has been considered in the past.

13 It is not an issue before us. We were very clear
14 in the formulation of our issue which we thought related to
15 something new, a new claim raised by Dr. Sternglass, which
16 we wanted to hear. We're going to grant the motion to
17 strike.

18 Let's proceed. Mr. Charnoff?

19 MR. CHARNOFF: Thank you, Mr. Chairman.

20 I would also on the same grounds, with respect
21 to Intervenor's Exhibit 10B which is the testimony to offer it
22 in connection with Contention 7, propose that of the direct
23 statement, that pages 1, 2, 3 and the top seven lines on page
24 4 be admitted, striking the remainder of the pages from page
25 4 through page 11 of that document.

In4

1 We would also propose that Figure 7-1 be admitted,
2 but Figures 7-2, 7-3, 7-4 dealing with biological effects of
3 radiation be struck.

4 Attached to that basic testimony on 7, there is
5 an Appendix 7-1 which is a May 8, 1973 document authored by
6 Dr. Sternglass, again relating to Shippingport; and page 1, 2
7 and the top 12 lines on page 3 would appear to be relevant
8 to Contention 9 with the exception of certain material on
9 page 3 which begins on the second line of page 2 and reads
10 as follows: "and may, therefore, explain the recent sharp
11 rises in leukemia, cancer and infant mortality in the area
12 surrounding the plant amount to as much as 100 percent for
13 cancer mortality in the decade after discharges began in the
14 Town of Midland that uses the Ohio water one mile downstream
15 from Shippingport."

16 With that exception, pages 1, 2 and the top
17 portion of page 3 are relevant. From Line 13, Line 13 on
18 page 3, to the conclusion of that paper, the rest of the
19 material relates to the biological effects and that should be
20 struck.

21 Attached to 7-1, the May 1973 Shippingport paper,
22 there are certain appendices and figures; Appendix 1, Tables
23 A and B, would appear to be relevant to Contention 9 and
24 Figure 1 which is really the first figure attached to the
25 paper, Figure No. 1 didn't seem to Xerox very well on mine; but

ln5 1 it's a figure showing the relationship between class beta
2 radioactivity and water at various places near Shippingport
3 relative to certain years from 1964 to 1971 would appear to
4 be relevant.

5 Tables 1, 2 and 3 and Figures 2 through 8 would
6 appear to be irrelevant as relating only to biological effects,
7 and, therefore, should be struck.

8 I believe that effectively defines the difference
9 between the biological effects question and the question of
10 environmental radiation levels related to discharges from
11 power plants.

12 CHAIRMAN FARMARIDES: Mr. Baron?

13 MR. BARON: Well, Mr. Chairman, I'll make the
14 same observation that I made with respect to the motion that
15 was proposed to 10A, Exhibit 10A. I recognize the significance
16 and the meaning of the concept of res judicata, but I would
17 also submit to the Chairman that in the light of new evidence
18 that has since developed since 1970 as alluded to by
19 Dr. Sternglass, I think that this is a separate hearing.

20 This is on a different issue. This is the issue
21 of the environmental impact of this proposed facility. Now,
22 how does one draw a line of demarkation between environmental
23 impact and safety, I don't know. Safety was adjudicated in
24 1970.

25 I personally cannot determine the demarkation

In 6

1 line between the environmental impact because that's what
2 we're talking about, the safety of the environment of this
3 plant and that's what this hearing is all about.

4 CHAIRMAN PARRAKIDES: Well, Mr. Baron, look, yes,
5 you're right, it is that. However, we have attempted to
6 define an issue in which you parties can join because we felt
7 it was a serious charge raised by Dr. Sternglass.

8 This Board felt that. You people didn't raise
9 that. All right, fine. If you do, in fact, prove the charge
10 that you have made that the Final Environmental Statement is
11 inadequate, that will automatically trigger a process that may
12 very well go to the point that you raised; but you've got to
13 prove your charge, sir, and we can't sit here and have things
14 reprov'd time and time again.

15 We'll never end the hearing. I want you to prove
16 the charge that you make. Once that charge is proven, you
17 better believe it, this Board will function; but, if you don't
18 focus on the issue, we'll never finish. We can go off in ten
19 different tangents, and we will never address the issue before
20 us.

21 That's really one of the problems voiced by this
22 motion, and that's why this ~~Board wants to be very clear~~ *Board wanted to clear on*
what ~~what's~~
23 ~~the issue.~~ Let's focus on the issue. Let's settle it.
issue was admitted

24 If you can prove what you've said, the results
25 will flow from there. So I want to be ~~very clear~~ *very sure that* that the

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1 Board has made itself clear.

2 MR. BARON: Well, of course, the testimony that's
3 being offered is intended to be further evidence to prove that
4 contention. And they're asking -- I mean again I'm relying
5 upon Dr. Sternglass's comments to me with respect to this.

6 MR. CHARNOFF: Mr. Chairman, I --

7 CHAIRMAN FARMAKIDES: The Board does not agree,
8 sir.

9 MR. BARON: Fine, that's the judgment that the
10 Board must make.

11 CHAIRMAN FARMAKIDES: We look at the contention,
12 and we see no relationship between the information that has
13 been moved to be ~~struck from that~~ *struck with that* contention.

14 MR. DAVIS: Pardon me, I did not quite understand
15 which figures were to be stricken.

16 CHAIRMAN FARMAKIDES: Well, the Board has all
17 that information.

18 Now, if you wish, during our next recess, we can
19 get together on a bench conference; and we'll give you that.

20 MR. DAVIS: I wish to make one observation,
21 however. I think I understood the Applicant to move to strike
22 Figure No. 5 amongst all these other figures. That would
23 appear to be relevant.

24 MR. CHARNOFF: I had no objection to Figure 5.

25 CHAIRMAN FARMAKIDES: That's essentially a map;

1 In8 1 isn't it?

2 MR. CHARNOFF: Figure 5 can remain, sir.

3 CHAIRMAN FARMAKIDES: I guess there's no
4 problem on that. There's nothing significant. All right,
5 fine.

6 You withdraw your motion to strike?

7 MR. CHARNOFF: With respect to Figure 5.

8 I think the record should be clear on this point
9 on another matter, Mr. Chairman, with respect to the colloquy
10 you had with Mr. Baron is that last week when the Board
11 defined that issue, I specifically raised with the Board the
12 question of whether biological effects were included.

13 Mr. Baron was present. Immediately following
14 that, during a bench conference, the Chairman indicated that
15 we were not looking at the biological effects. There is
16 nothing new offered by Dr. Stezniglass since last week.

17 CHAIRMAN FARMAKIDES: I think we've settled the
18 matter.

19 Let's proceed. Mr. Baron?

20 MR. BARON: With respect to the data and documents,
21 the publications that the doctor has mentioned --

22 CHAIRMAN FARMAKIDES: Excuse me, anything further
23 on that motion?

24 It's granted.

25

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(The document referred to
 were marked Intervenor's
 Exhibit Nos. 10A and 10B
 for identification and were

with portions striping as stated
 received in ~~evidence~~ ^{evidence}

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MR. BARON: With respect to those publications

and those documents and so on, I recognize the problem that
 we would have with them representing hearsay testimony.

We don't have the authors here and so forth.

With the Board's permission, however, I inquired of
 Dr. Sternglass at the noon hour how quickly sufficient copies
 could be obtained of each one of these; and, of course, if
 there would be no objection to their being introduced, and
 I'm not enumerating which ones. I'm talking about the ones
 that have been published, of course, all of the ones --

CHAIRMAN FARMAKIDES: Introduced for what, sir?

MR. BARON: As exhibits.

CHAIRMAN FARMAKIDES: To support Dr. Sternglass's
 testimony?

MR. BARON: That's right. I know it's stretching.

CHAIRMAN FARMAKIDES: Mr. Charnoff and Mr. Davis?

MR. CHARNOFF: I would have no objection to the
 introduction and receipt into evidence of the EPA report of
 April 27, 1973 which was the draft statement by EPA of the
 final report by EPA which was July 20, 1973, with respect to

1 into 1 the Shippingport plant.

2 I would have no difficulty with the introduction
3 into evidence of the May 1973 Atomic Energy Commission
4 operational assessment of Dr. Sternglass's charges. I don't
5 recall what other documents there were.

6 CHAIRMAN FARMANIDES: There's an NUS document
7 and a NASA document.

8 MR. CHARNOFF: The NUS reports, I have no diffi-
9 culty with the introduction of ^{into} ~~the relevant~~ evidence of the
10 fourth quarterly NUS report.

11 I think we might add to that the annual report,
12 but that's not necessary.

13 THE WITNESS: The environmental reports for the --

14 CHAIRMAN FARMANIDES: Hold on, please, Dr. Sternglass.
15 Proceed, Mr. Charnoff.

16 MR. CHARNOFF: I'm asking, I guess, for a little
17 bit of help as to the documents.

18 CHAIRMAN FARMANIDES: The other one that was
19 relevant was the NASA report.

20 MR. CHARNOFF: The NASA report of discharges from
21 Plumbrook, I have no objection to receiving into evidence the
22 Plumbrook release data.

23 MR. BARON: What about the Governor's Committee
24 report?

25 MR. CHARNOFF: That's Dr. Sternglass's paper which

Inll 1 we have admitted part of?

2 THE WITNESS: The main documents, a series of
3 environmental studies of the Shippingport and Scriba sites
4 by the U. S. Atomic Energy Commission -- would they be all
5 right?

6 CHAIRMAN FARMAKIDES: Did you have reference to
7 this one, this AEC document?

8 MR. CHARNOFF: The AEC documents reporting the
9 releases from Shippingport, we have no objection to.

10 CHAIRMAN FARMAKIDES: In other words, as I
11 understand the Applicant, Mr. Charnoff, he has no objections
12 to any government reports submitted or to the NUS report?

13 MR. CHARNOFF: Well, I want the record to be
14 clear as to which documents we're talking about. I've listed
15 them specifically; and, if there are others, I want to address
16 myself to --

17 THE WITNESS: There are the Ohio Health Department
18 reports on radioactivity in the water.

19 CHAIRMAN FARMAKIDES: Here's what we're going to
20 do, gentlemen. I'm going to expect from Mr. Baron and
21 Mr. Charnoff a list of these submitted tomorrow morning to
22 me so that we're clear on what it is that we're talking about
23 here.

24 Now, I think we generally understand that I want
25 that list coming from the two of you and Mr. Davis.

1nl2 1 MR. DAVIS: I have the same difficulty as the
2 Applicant. We do not know exactly which documents they're
3 referring to.

4 CHAIRMAN FARMAKIDES: All right. Fine, I'll
5 let you three gentlemen work this out this afternoon and
6 tonight and let me have a list of the documents tomorrow.

7 I take it then you have no objection to the
8 admission of these documents?

9 MR. DAVIS: None.

10 CHAIRMAN FARMAKIDES: Mr. Charnoff?

11 MR. CHARNOFF: Subject to our identification of
12 the documents, that's right, sir.

13 CHAIRMAN FARMAKIDES: We'll delay then until
14 tomorrow morning.

15 We'll proceed with respect to identifying those
16 documents. We will admit those documents into evidence that
17 will be identified by the parties and brought to me tomorrow
18 morning.

19 We'll proceed on the basis that those documents
20 are admitted into evidence, all right? Let's go.

21 MR. BARON: Mr. Chairman, that's all the questions
22 we have of Dr. Sternglass.

23 CHAIRMAN FARMAKIDES: Cross, Mr. Charnoff?

24 MR. CHARNOFF: I have no questions of
25 Dr. Sternglass.

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CHAIRMAN FARMAKIDES: Mr. Davis, Staff?

2

MR. DAVIS: None, Mr. Chairman.

3

CHAIRMAN FARMAKIDES: All right.

4

The Board has a couple questions, Dr. Sternglass.

5

MR. SHON: I have one or two short questions.

6

You mentioned at one point in your testimony,

7

Dr. Sternglass, that there were records of 18 other sites

8

where this discrepancy did not show up; is that right?

9

THE WITNESS: I'm sorry. I mentioned it in a

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different connection. I mentioned that approximately 18

11

other sites have been monitored by the NUS Corporation. We

12

have with us a Vice President of the Corporation who can

13

give you the sites where they have measured environmental --

14

CHAIRMAN FARMAKIDES: But, sir, what's your

15

answer to the question posed?

16

THE WITNESS: The answer is it was incorrectly

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understood by you. I simply meant to say there were 18 other

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sites apparently where the same techniques have been used

19

where there apparently was no problem with the dosimeters

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showing up such high levels.

21

MR. SHON: Have you analyzed personally any of

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the data from those other sites?

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THE WITNESS: The only other site is this area

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here; namely, the NUS Corporation has also done measurements

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of the dosimeters around here.

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CHAIRMAN FARMANIDES: What do you mean by "here,"
sir?

THE WITNESS: Davis-Esse area up to the Sandusky
area.

MR. CHARNOFF: Could we have an identification of
those areas?

CHAIRMAN FARMANIDES: Wait a minute, Mr. Charnoff.
Dr. Sternglass, the Board is questioning.
Let's proceed.

THE WITNESS: Let me clarify this, the NUS
Corporation apparently is a parent corporation of the organiza-
tion that made environmental measurements right around the
Davis-Esse plant, and there are other sites. I have not had
a chance to look at the other sites measured by the NUS
Corporation; but, presumably, they must be all right; but
you can determine this by asking the NUS Corporation itself.

MR. SHON: In other words, you don't know whether
the data is discrepant in these other sites?

THE WITNESS: Apparently.

MR. SHON: You also mentioned very briefly large
strontium-90 levels around many of these plants.

THE WITNESS: Yes.

MR. SHON: The only ones we've heard about are
two so far.

THE WITNESS: Right, I mentioned that in New

1n154 York State, the New York State Environmental Report lists
2 various counties and sites and I will read them to you.

3 We can also introduce -- this is a government
4 report and, if you wish, we can discuss whether it will be
5 regarded as evidence.

6 CHAIRMAN PERAKIDES: Your testimony, as I
7 understand you, referenced a study involving Plumbrook and
8 studies involving Shippingport?

9 THE WITNESS: Directly, and I also sited other
10 areas for which strontium-90 has been measured in the milk;
11 and it turns out for the Oswego County site there is a high
12 strontium-90 level in the milk, much higher than other areas
13 far from the plant.

14 This is not my study but a New York State study,
15 and the same thing happened to be at Brookhaven National
16 Laboratories. Again, at Suffolk County, it was 22, 25 and 18
17 picocuries per liter. Around the Brookhaven reactor, around
18 the Scriba site so far, and there's also evidence here in
19 Westchester County again that strontium-90 are 10 picocuries;
20 whereas, the normal is 3 in other sites.

21 So, in Westchester, that's the location of the
22 Indian Point reactor, so we have evidence now obtained by
23 other groups that strontium-90 levels are abnormally high
24 compared to other areas around Indian Point, Brookhaven, the
25 Scriba site, Shippingport and the Plumbrook site.

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(Board conference.)

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CHAIRMAN FARMAKIDES: Mr. Baron, what we would like to do, will Dr. Sternglass be available the rest of the day and perhaps tomorrow when the other people are testifying?

What we would like to do is perhaps ask Dr. Sternglass back on the witness stand after we have heard what the other people have said, too, so we can further explore this last point that Dr. Shon has begun.

Is this convenient?

MR. BARON: It's certainly convenient for me.

THE WITNESS: You mean today?

CHAIRMAN FARMAKIDES: No, we would like to hear the direct case of either two parties. Then we would like to come back to Dr. Sternglass with possibly one or two questions on this very last point.

Is this all right?

THE WITNESS: Yes, is it possible to do it today?

CHAIRMAN FARMAKIDES: Well, were you planning to leave?

THE WITNESS: I was planning to leave at 7:30, but it's only 2:30 now.

CHAIRMAN FARMAKIDES: We'll try to accommodate that, yes, sir.

THE WITNESS: I can take a later flight if necessary.

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CHAIRMAN FARMAKIDES: No, we'll try to accommodate that so we'll get back to Dr. Sternglass today.

2

MR. BARON: There is one other exhibit, Mr. Chairman, which we would like to offer.

3

CHAIRMAN FARMAKIDES: Why don't you work this thing out with Mr. Charnoff and Mr. Davis tonight; and, if you can't work it out, tomorrow bring it before the Board; and we'll rule on it.

4

Any further redirect?

5

MR. BARON: None.

6

CHAIRMAN FARMAKIDES: I will permit a further examination; I interrupted the man but I didn't mean to.

7

Mr. Charnoff, did you have anything further that you wanted to contribute to the hearing?

8

MR. CHARNOFF: I don't know whether you would call it a contribution, but I just wanted to clarify the observation made by Dr. Sternglass that the NUS Corporation has been doing radiological monitoring around the Davis-Besse site, and I'm curious as to what document he had reference to.

9

CHAIRMAN FARMAKIDES: Could you answer that, Dr. Sternglass, with relatively short research there?

10

THE WITNESS: Yes, there are these documents entitled "Preoperational Environmental Radiological Monitoring for the Davis-Besse Nuclear Power Station, Toledo Edison

11

1418 Company, First Quarterly Report."

1 CHAIRMAN FARMAKIDES: That's what you had in
3 mind, sir?

4 THE WITNESS: Yes.

5 MR. CHARNOFF: I would simply point out that's
8 prepared by whom?

7 THE WITNESS: The Biotest Laboratories.

8 MR. CHARNOFF: Is that a subsidiary of NUS?

9 THE WITNESS: It's not.

10 MR. CHARNOFF: I see. It is not a subsidiary.
11 Fine.

12 CHAIRMAN FARMAKIDES: Okay, in other words, as I
13 understand the drift of your question then, Mr. Charnoff,
14 the NUS Corporation is not involved?

15 THE WITNESS: At all.

16 MR. CHARNOFF: The NUS Corporation has not
17 conducted radiological monitoring programs at Davis-Besse.

18 These were conducted by the Industrial Biotest
19 Corporation and reflected in those two documents in the
20 second half of 1972 and the first quarter of 1973.

21 CHAIRMAN FARMAKIDES: Let's proceed then.

22 No further redirect. No further examination.

23 We'll go to the Applicant's direct case.

24 Dr. Sternglass, thank you very much.

25 MR. CHARNOFF: May I ask Mr. Crouse and

1919 : Dr. Goldman to please take the stand.

2 CHAIRMAN FARMERIDES: Off the record.

3 (Discussion off the record.)

4 CHAIRMAN FARMERIDES: Let's take a ten-minute
5 recess.

6 (Recess.)

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CHAIRMAN FARMAKIDES: All right. We're ready to proceed.

3

Mr. Charnoff?

4

MR. CHARNOFF: Mr. Chairman, this is going to be testimony by Dr. Goldman, who has been previously sworn, and Mr. Crouse, who is the Chief Chemical Engineer at Toledo Edison.

7

8

Mr. Crouse has not yet been sworn. Mr. Crouse, would you please stand. Mr. Farmakides, would you administer the oath, please?

10

11

Whereupon,

12

RICHARD P. CROUSE

13

was called as a witness on behalf of the Applicant, and,

14

having been first duly sworn, was examined and testified

15

as follows:

16

and,

17

MORTON I. GOLDMAN

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was called as a witness on behalf of the Applicant, and,

19

having been previously duly sworn, was examined and testified

20

further as follows:

21

DIRECT EXAMINATION

22

BY MR. CHARNOFF:

23

Q Mr. Crouse, have you prepared a statement of your educational and professional qualifications?

24

25

A (Mr. Crouse) Yes, I have.

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MR. CHARNOFF: Off the record for a moment?

2

CHAIRMAN FARMANIDES: No, we're -- what is it?

3

MR. CHARNOFF: I just wanted to get a stipulation that this can go in.

5

CHAIRMAN FARMANIDES: Okay, off the record.

6

(Discussion off the record.)

7

CHAIRMAN FARMANIDES: Back on the record.

9

Mr. Charnoff?

9

MR. CHARNOFF: Mr. Chairman, I have given copies of Mr. Crouse's educational and professional qualifications to counsel for the Regulatory Staff and the intervenors and to the members of the Board, as well as extra copies to the Reporter.

14

I would move that Mr. Crouse's qualifications be admitted into the record as if read.

15

16

CHAIRMAN FARMANIDES: Any objections?

17

MR. DAVIS: No objection.

18

MR. BARON: No objection.

19

CHAIRMAN FARMANIDES: They will be so received.

20

Proceed.

21

(The statement of professional qualifications of Richard P. Crouse follows:)

22

INSERT

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25

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS
RICHARD P. CROUSE
CHIEF CHEMICAL ENGINEER
THE TOLEDO EDISON COMPANY

1. My name is Richard P. Crouse. My residence is 3322 Cromwell Drive, Oregon, Ohio. I am employed by the Toledo Edison Company, Toledo, Ohio as Chief Chemical Engineer.
2. I graduated from the University of Toledo in 1961 with a Bachelor of Science in Chemical Engineering degree. While attending the University, I worked with Toledo Edison as a Student Engineer and, upon graduation, commenced employment in the laboratory as an Assistant Engineer.
3. I advanced through various engineering positions and, in August of 1967, was appointed Chief Chemist. This title was later changed to Chief Chemical Engineer.
4. As Chief Chemical Engineer of Toledo Edison, I have been involved in the design, testing and control of various water treating systems, analysis of water, fuel and lubricating oils, for its power plants, and engaged in the company's various pollution control activities.
5. In 1967 I commenced training for the Davis-Besse Nuclear Power Station project. I have attended various courses at the University of Michigan, United States Environmental Protection Agency Eastern and Western Environmental Radiation Laboratories, United States Public Health Service Northwest Environmental Health Laboratory and the Babcock and Wilcox Lynchburg Training Center.

6. I have had on the job training at the Hadam Neck Plant of Connecticut Yankee Atomic Power Company, Robert E. Ginna Plant of Rochester Gas and Electric and the Savannah River Plant of the United States Atomic Energy Commission.
7. During the course of the Davis-Besse Project, I have worked on design of the various plant water treating systems, design of the Radiochemistry and Health Physics Laboratories and major responsibility for selection and training of the Chemistry and Health Physics Group Personnel. I am responsible for operation of the potable water plant at the Davis-Besse site.
8. I am a member of the American Institute of Chemical Engineers and am a registered Class II Water Treatment Plant Operator.

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BY MR. CHARNOFF:

Q Addressing myself to Dr. Goldman, in framing Contention 9, Dr. Goldman, the adequacy of the methods used to relate proposed releases of radioactive materials to contamination and radiation levels in the environment based on data presented in Dr. Sternglass' testimony, which was offered in connection with the issues 5 and 7, and which is now Interveners' 10-A and 10-B, recognizing that you and Mr. Crouse will deal later with specific portions of the Interveners' Exhibits 10-A and 10-B, would you first describe briefly to the Board the basis for present methods for analysis of environmental transport of radioactive materials following their release from a source?

A (Dr. Goldman) Yes.

The methods of analysis presently used to predict environmental levels of radioactivity from quantities released and the rates of release are essentially identical to those in use for the last 40 to 50 years to predict the fate of other discharges to environmental media. They are founded on the basic principles of continuity; that is, conservation of material released from a source in the environment and in a relatively unconfined medium such as a large water or air body on the macroscale diffusion analysis to the molecular processes of heat and momentum transfer.

These principles apply both to atmospheric

41 discharges and to releases to the water environment.

2 Advances in the state of the art of the last fifty
3 years have largely applied to the improvement in our ability
4 to predict the rate constants applying to the diffusion
5 processes in differing environments and to the improved
6 ability to deal with complex situations as the result of the
7 availability of high-speed computers.

8 In the area of atmospheric transport, for example,
9 the first diffusing experiments using smoke plumes and puffs
10 took place in England starting in 1921, and established in
11 that test series the basic Gaussian character of the crosswind
12 concentration distribution, which has been used ever since.

13 Experimental determination of diffusion processes
14 have been carried out since that time; that is, since the
15 early 1920's. Although it substantially increased in sophis-
16 tication and the number of tests in the last 25 years or so,
17 much of the stimulus for the large increase in the number of
18 studies arose from the need to identify potential effects
19 of earlier wartime nuclear ^{installations} ~~tests~~ in Hanford, Oak Ridge,
20 et cetera.

21 More recently, the importance of urban areas as
22 widespread sources of air pollution has led to studies of
23 these regions as a whole, as opposed to the transport from
24 isolated sources which had been extensively studied earlier.
25 Many, if not most, of the studies are documented and

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well 5 7 referenced in TID-24190, edited by David Slade and published
2 in July of 1968 by the U. S. Atomic Energy Commission.

This document also goes beyond the transport and
diffusion behavior of material released from the source, to
present methods of analysis and document studies on the
special characteristics of radioactive materials that need
to be considered in these analyses. These include the
potential for loss of material by decay during transport, for
the growth of radioactive daughters during transport, for
depletion of particulate materials from a plume by deposition
or precipitation, scavenging and irradiation of a point on
the ground surface from an elevated plume or cloud.

The latter factor, the ability of a radioactive
cloud to cause an effect at a distance from the cloud, is
perhaps the most significant difference between radioactive
plumes and other atmospheric contaminants. Certainly other
contaminants decay by chemical or other reactions, and
deposit or are washed out by rainfall.

Additional evidence of the ~~predictability~~ ^{predictability} with
respect to radioactive material transport is provided by
releases from AEC facilities which in prior years were large
enough to be unequivocally identified by field measurements.
When ~~appropriate parameters~~ ^{appropriate dispersion} were employed estimates of dose
or of ground contamination were generally well within a factor
of two over those values that were measured. However, one of

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1 the studies most pertinent to power plants is that by Kahn
2 et al of EPA entitled "Radiological Surveillance at a Boiling
3 Water Nuclear Power Reactor," published as BRH/DER-70-1 in
4 March of 1970. This extensive study of the Dresden Unit
5 number 1 included, among other aspects, simultaneous sampling
6 of stack and vent releases and ^{in ambient air} ~~in air~~ concentrations.

7 With the site meteorological data before these
8 periods available a comparison between measured and predicted
9 concentrations and doses showed agreement within a factor of
10 two, although the predictive model used was not extremely
11 sophisticated.

12 On the basis, then, of this fairly extensive
13 body of theory, experimental and field test data, the claim
14 by Dr. Sternglass that dose predictions could be in error
15 by factors of as much as 10,000 to 100,000 is highly unreason-
16 able. If this were the case we would have predicted the
17 extinction of life on earth from industrial and transportation
18 sources, of non-radioactive pollutants, many years ago, since
19 the same methods and models are employed to predict the
20 atmospheric transport and ambient concentrations of these
21 materials.

22 Turning now to the water environment, much the
23 same history exists in respect to transport and diffusion
24 as in the case of the atmosphere.

25 The subject of water transport has been of extreme

1 interest for decades to many agencies and individuals con-
2 cerned about the discharge of domestic sewage and industrial
3 waste effluents to water bodies.

4 In recent years more emphasis has been placed on
5 this subject because of the interest in the dissipation of
6 heat effluents and of radioactivity. Again, the basic
7 principles of conservation of material and of diffusion rate
8 processes govern the ambient concentrations of discharged
9 materials, and as in the case of atmospheric discharges,
10 the major advances have been in the more refined ability to
11 define the diffusion coefficients in various environments
12 and the ability to analyze more complex systems than possible
13 previously by the use of high-speed computers.

14 Unfortunately, since liquid discharges from
15 nuclear facilities have not been of as much concern as gaseous
16 releases, no compendium of comparable forms of meteorology
17 in the Atomic Energy report and the report I referenced
18 earlier is in existence. In contrast to the atmospheric
19 situation, the local water environment may be classifiable
20 into one of several distinct categories, each of which is
21 governed by different primary processes.

22 In the case of rivers or confined waters flowing
23 in one direction, the governing analytical process is the
24 continuity equation, which demands that all material entering
25 one section of a river either leave a downstream section or

1 be accounted for by decay, sedimentation, or other removal
2 processes. Except with extremely large rivers or those with
3 unusual characteristics as impoundments, essentially uniform
4 mixing usually occurs within five to ten river widths down-
5 stream of a ~~projection~~ *an injection* point, the distance being determined
6 primarily by the water velocity and turbulence.

7 Upon entry of a smaller stream into a larger
8 river the same process will obtain, assuming no major differ-
9 ences in water ~~temperature~~ *or chemistry* or temperature exist that would
10 inhibit mixing. Major studies of these processes have been
11 made on the Columbia River in connection with the Hanford
12 operations of AEC, and by the Tennessee Valley Authority
13 Public Health Service, and the Oak Ridge National Laboratory
14 on the Clynch and Tennessee River systems, as summarized in
15 IAEA -- that's International Atomic Energy Agency -- Safety
16 Series number 36, entitled "Disposal of Radioactive Wastes
17 into Rivers, Lakes and Estuaries," published in 1971.

18 The Dresden study by Kahn et al that I referred
19 to earlier also provides substantial further documentation
20 of the easily identifiable relationship between liquid
21 discharges and ambient water concentrations.

22 The analysis of transport and dispersion in lakes
23 is more analogous to the atmospheric situation in which both
24 transport, or current velocity, and turbulence play a
25 role in determining the rate of expansion of a discharge

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1 plume.

2 Additionally, the presence in a deep lake of a
3 thermocline or ~~temperature~~ *density interface*-induced temperature interface
4 closely parallels the ~~inversion~~ *the subsidence inversion* of the atmosphere in providing
5 an effective limit to mixing in the vertical direction.

6 The lake situation, however, is somewhat simpler
7 since the time variation of the thermocline behavior is very
8 much slower than is the case with the atmosphere.

9 Studies have been made on a number of lakes,
10 including Lakes Michigan, Erie and Ontario, using large-scale
11 hydraulic models, as well as field studies employing dye and
12 ~~drogues~~ *drogues* as tracers to determine transport and dispersion
13 properties of these water bodies in connection with the
14 discharges of municipal and industrial effluents.

15 The range of parameters so determined in these
16 field and analytical studies do not permit errors of 10^4 ,
17 10^5 to go unidentified, as appear to be claimed by Dr.
18 Sternglass. Again, such differences would have been
19 immediately apparent in their results from more conventional
20 pollutants discharged into these lakes.

21 Similar, but more complex, considerations are
22 applied in the treatment of estuarial and ocean discharges.
23 In these instances, further complicating may be introduced
24 by tidal effects and salinity gradients, particularly in
25 estuaries. In these cases, especially where complex salinity

10⁴ or tidal current problems exist, both hydraulic models and
2 field studies have been used to determine transport and
3 dispersion parameters, with such studies going back at le
4 30 years, to my knowledge.

5 In addition to the transport and dispersion
6 analyses, special considerations are required in radiological
7 dose analyses which recognize the properties of individual
8 radionuclides and radio elements with respect to external
9 irradiation of swimmers and boaters, the bioaccumulation
10 or biological concentration and to depletion by absorption
11 by sediment or by decay or by water treatment processes.

12 However, these factors have also been investigated
13 in many environments for many years, and there would not
14 appear to be any unknown mechanism which would permit errors
15 in dose prediction, even remotely approaching the factors
16 of 10,000 to 100,000 claimed by Dr. Sternglass.

17 Q Thank you, Dr. Goldman.

18 Mr. Crouse, if I may call your attention to Figure
19 6.1 in Intervenor's Exhibit 10-A, have you examined that
20 figure, Mr. Crouse?

21 A (Mr. Crouse) Yes, I have.

22 Q And does that figure state the source of the
23 information plotted there by Dr. Sternglass?

24 MR. BARON: Mr. Chairman, may I pose an objection?
25 I presume -- I thought this was to be direct testimony of

11² the Applicant with regard to issue number 9. It seems to
2 me to be rebuttal testimony to what Dr. Sternglass testified
3 to, and I was going to make the same reference to Dr.
4 Goldman's testimony. It seems to me to be rebutting, as
5 distinguished from direct testimony.

6 CHAIRMAN FARMAKIDES: Mr. Charnoff?

7 MR. CHARNOFF: The issue presented to the Board,
8 on the basis of which the issue was determined by the Board,
9 was the material set forth in the testimony offered in
10 connection with Contentions six and seven, now labeled as
11 Exhibits 10-A and 10-B.

12 What we intend to demonstrate are the fundamental
13 errors in that presentation, and we think it's directly
14 relevant to the issue and it is clearly responsive directly
15 to the material which supported the definition of the
16 contention by the Board.

17 We think it's entirely appropriate for us to
18 proceed here.

19 CHAIRMAN FARMAKIDES: I agree, Mr. Baron.

20 Objection overruled.

21 BY MR. CHARNOFF:

22 Q I believe I asked you, Mr. Crouse, whether Figure
23 6.1 identifies the source of the data plotted by Dr.
24 Sternglass.

25 A (Mr. Crouse) Yes.

wal 12 1 Q Could you tell me what the source is as stated
2 on Figure 6.1?

3 A The source is titled "Ohio EPA Rad Health Report
4 for 1969-1971, Table 3."

5 Q Have you examined, Mr. Crouse, the Ohio EPA
6 Radiological Health Report, and particularly Table 3 therein,
7 which is listed as the source of that data in that figure?

8 A Yes.

9 CHAIRMAN PARMAKIDES: Mr. Charnoff, we're having
10 difficulty. Which one are you talking about now?

11 MR. CHARNOFF: 6.1.

12 MR. SHON: It's a table 6.1?

13 MR. BARON: Figure 6.1.

14 MR. CHARNOFF: It's not in the appendix. It's
15 in the direct testimony.

16 CHAIRMAN PARMAKIDES: The direct testimony of --

17 MR. BARON: Exhibit 10-A, which was originally
18 offered as testimony on issue 6.

19 CHAIRMAN PARMAKIDES: Fine.

20 MR. SHON: We've got it. Thank you.

21 MR. CHARNOFF: Mr. Chairman, I would like to have
22 marked as Applicant's Exhibit 7 a document entitled
23 "Radiological Health Report, Surface and Groundwaters of
24 Ohio, 1969-1970-1971-1972," prepared by the Ohio EPA.

25 I'm giving three copies to the Reporter.

wel 13

1 CHAIRMAN FARMAKIDES: Off the record.

2 (Discussion off the record.)

3 CHAIRMAN FARMAKIDES: Back on the record.

4 (The document referred to,
5 entitled "Radiological Health
6 Report, Surface and Groundwat-
7 ers of Ohio, 1969-1970-1971-
8 1972," was marked for identifi-
9 cation as Applicant's Exhibit
10 7.)

11 BY MR. CHARNOFF:

12 Q Mr. Crouse, I show you Applicant's Exhibit 7.
13 Is this the document containing the Ohio EPA data that you
14 have examined?

15 A (Mr. Crouse) Yes.

16 Q Mr. Crouse, at lunch -- I'm sorry, strike that.
17 Mr. Crouse, Applicant's Exhibit 7 bears a stamp
18 on it, "rough draft." Could you tell me if that is the
19 stamp of Toledo Edison Company, or the stamp of the Ohio EPA?

20 A It's the stamp of the Ohio EPA.

21 Q I see.

22 Could you tell me when you obtained a copy of
23 this document?

24 A Approximately two weeks ago.

25 Q Now, Mr. Crouse, I'm going to show you a document

wel 14 1 which is a document that Dr. Stornglass identified this
2 morning as containing Ohio EPA data for 1969, 1970, and 1971.

3 (Handing document to Witness Crouse.)

4 Did you examine that document during the luncheon
5 recess?

6 A Yes.

7 Q Would you tell me whether that document has been
8 identified as a final or a rough draft?

9 A That document has been identified as a rough draft
10 in the cover letter.

11 Q The cover letter from whom to whom, sir?

12 A It is the cover letter to Mr. Charles M. Bolton,
13 Superintendent, Water Works, Cincinnati, Ohio, from Dr. Ira
14 Whitman.

15 Q Who is Dr. Ira Whitman?

16 A Dr. Whitman is the Director of the Ohio Environment-
17 al Protection Agency.

18 Q I see.

19 And have you examined the document attached to
20 that cover letter which is the 1969, 1970 and 1971 data?

21 A Yes, I have.

22 Q And could you tell me the differences, if any,
23 between that document and Applicant's Exhibit Number 7?

24 A The document attached to the letter to Mr. Charles
25 Bolton has a Table 5 in it, which is titled "Graphic

wel 15⁹

Presentation, Average Total Radiation and Desirable Limit for Drinking Water."

Our Exhibit 7 does not have that table 5. The table 5 in our exhibit 7 has tabulated in it the 1972 data on radiological measurements.

Q Now, specifically with respect to table 3, which is cited as a source of material for Figure 6.1 in the Ohio EPA radiation health reports, is there any difference between the data reported in Applicant's Exhibit number 7 and the document that Dr. Sternglass furnished, which only covered the 1969 through 1971 period?

A No, there is no difference in the data.

Q So there is data in Table 3 for 1969, 1970, and 1971, is that correct?

A That's correct.

Q And the 1972 data appears in Table 5 and not in Table 3?

A Yes.

Q Thank you.

MR. CHARNOFF: Mr. Chairman, I would move at this point that Applicant's Exhibit 7 be received in evidence.

CHAIRMAN FARMANIDES: Any objections?

MR. DAVIS: None.

MR. BARON: If I understand this correctly, this is the same document except for a difference in table numbers

161 as one that will be offered by the Intervenor after we've
2 conferred and agreed upon -- I have no objection, but it
3 seems --

4 CHAIRMAN FARMAKIDES: All right.

5 Mr. Davis?

6 MR. DAVIS: None.

7 MR. CHARNOFF: Let me just clarify the observation
8 of Mr. Baron.

9 Insofar as the 1969, 1970 and 1971 data are
10 concerned it is precisely the same data, and we have repro-
11 duced this, and it seems to me that it takes care of both
12 what you were offering and what we would now propose to
13 offer. It has in addition to that, however. The 1972 data.

14 CHAIRMAN FARMAKIDES: All right. Hearing no
15 objections, we'll admit it as Applicant's Exhibit 7.

16 (The document entitled
17 "Radiological Health Report,
18 Surface and Groundwaters of
19 Ohio, 1969-1972," was received
20 in evidence as Applicant's
21 Exhibit 7.)

22 end #6
23
24
25

TAKE 7
...B:jrb

1 Q Now, Mr. Charnoff, referring to the top curve
2 on Figure 6.1, which is labeled "Total Beta Activity in
3 Drinking Water (Max) 1970," could you tell me what this top
4 curve purports to represent?

5 A (Mr. Crouse.) The curve appears to represent
6 total beta activity showing the maximum beta activity of
7 samples taken at six specific locations during 1970 in
8 drinking water.

9 Q Do the data points for that curve on Dr.
10 Sternglass' Figure 6.1 correctly reflect the data in Table 3
11 of the Ohio EPA Report, now termed Applicant's Exhibit No. 7?

12 A No, the data points and their description on
13 Figure 6.1 misrepresent and erroneously present the data in
14 Table 3 of the Ohio EPA report.

15 Q What do you mean, Mr. Crouse, by "misrepresent?"

16 A Dr. Sternglass called the top curve "Total Beta
17 Activity in Drinking Water (Max) 1970". In fact, these data
18 points taken from Table 3 of the Ohio EPA Radiological Health
19 Report, are the activity in surface water.

20 By "surface water" I mean untreated lake water.
21 There are no drinking water measurements reflected in the
22 cited Ohio EPA report.

23 Q Now, Mr. Crouse, you said the data points also
24 erroneously reflect the data in the Ohio EPA Report in
25 Table 3. Would you please explain that, sir?

jrb2

1 A Table 3 in the Ohio EPA report is titled
2 "Maximum Annual Values for Each Measured Radioactive
3 Parameter, Picocuries Per Liter." I emphasize each.

4 This table sets forth the highest reported fraction
5 of suspended and dissolved alpha and beta activity sample
6 measurements. As the Board undoubtedly knows, water samples
7 are customarily analyzed for radioactivity by separating
8 suspended or insoluble materials from the dissolved or
9 soluble fraction. Each fraction is measured separately.

10 This procedure is explained on page 2 of the Ohio
11 EPA Report.

12 Dr. Sternglass, apparently ignoring the standard
13 practice and the text of the Ohio EPA report, wrongly added
14 the results of the two reported fractions together, and
15 plotted their sums, even though they represent fractions of
16 different samples.

17 This is why, in Table 3 of the EPA Report, the
18 total beta --

19 Q Excuse me.

20 You are returning now to Table 3 of the EPA Report
21 for the Year 1970, Mr. Crouse?

22 A Yes.

23 Q Right.

24 A I will go on.

25 This is why in Table 3 of the EPA Report, the

jrb3

1 total beta activity value is generally less than the sum of
2 its suspended and dissolved fractions; in fact, the data
3 reported under the total beta activity column in Table 3,
4 is not the sum of the reported maximum suspended and
5 dissolved fractions, but is the report of the samples contain-
6 ing the maximum combined suspended and dissolved beta
7 measurements.

8 Only when both of the maximum fractions occur
9 on the same sample would their sums equal the total value
10 shown on Table 3. I have personally reviewed the Ohio
11 Department of Health monthly reports. These show, for
12 instance, that at Toledo the maximum suspended beta value
13 occurred on May 5, 1970; while the maximum dissolved beta
14 value occurred on October 1, 1970.

15 At Fort Clinton, the suspended maximum was on
16 November 16, and the dissolved maximum was on March 16.

17 This same pattern holds for all other data points
18 except Huron, Ohio. At Huron, Ohio, the maximum suspended
19 and dissolved beta activities both occurred on the same sample
20 which was taken on October 16, 1970.

21 Q Is the curve on Figure 6.1 labeled "Maximum
22 Alpha Activity in Water (Suspended)" -- that is, the lower
23 curve on 6.1 -- correct?

24 A This curve is correct. But, of course, as noted
25 on Figure 6.1, it is only the suspended fraction that is

jrbs

1 plotted. If the total activity would have been obtained
2 an plotted in a similar manner as Dr. Sternglass did with
3 respect to the top curve on the beta activity, the shape of
4 the curve would have been vastly different than shown.

5 Q What would the shape of the curve have been?

6 A The curve would show a maximum at Port Clinton,
7 Ohio, and would show a minimum at Toledo, and level line for
8 the four other locations.

9 But, again, I must point out, this would be
10 plotting selected data as Dr. Sternglass has done, by summing
11 two maximum values for each location, even though they do not
12 necessarily occur on the same sample

13 I would also point out that this curve, again,
14 represents alpha activity in raw, untreated lake water, and
15 not drinking water; and therefore, cannot be compared with
16 drinking water samples.

17 Q Now, Mr. Crouse, there is a point on that
18 Figure 5.1 entitled "Toledo 1973 Beta Activity Level." Is
19 that figure or point correct?

20 A Yes. This value is a correct representation of
21 the first quarter of 1973 average measurements in drinking
22 water at Toledo.

23 In our Davis-Besse Preoperational Environmental-
24 Radiological Monitoring Program, Applicant's Exhibits 5-A
25 and 5-B, this is the lowest average value for drinking water

jrb5

1 that we have recorded.

2 Values at Toledo for the third quarter and fourth
3 quarter of 1972 were higher. In addition, the values in
4 drinking water at Port Clinton and Sandusky industrial park
5 for the first quarter of 1973 were approximately 50 percent
6 higher than Toledo.

7 Q Mr. Crouse, does treated drinking water show lower
8 levels of beta activity than untreated water?

9 A Yes.

10 Most of the activity in lake water results from
11 beta activity. This beta activity is distributed between
12 suspended and dissolved materials in the water.

13 The water treatment process removes essentially
14 all of the suspended material, and some of the dissolved
15 material through the process of clarification and softening.
16 Thus, as a result of the treatment process removing a major
17 portion of any radioactive material involved in raw water,
18 the treated water contains much lower levels of beta activity.
19 In fact, drinking water normally contains only from one-third
20 to one-half the activity that would be present in untreated
21 lake water.

22 Q In addition to the mislabeling, then, of the beta
23 activity data plotted in the top curve on Figure 6.1 and
24 the erroneous adding together of maximum fractions of suspended
25 and dissolved beta activity in different samples, and the

4rb6

1 selected plotting of only suspended alpha activity in order
2 to arrive at a curve paralleling the beta activity, is there
3 any other comment you would like to make with respect to the
4 so-called "Beta Activity in Drinking Water" curve for 1970
5 in Figure 6.17

6 A Yes.

7 There are two additional comments I would like to
8 make: First, based upon my examination of the Ohio
9 Department of Health monthly reports, it is clear that the
10 maximum annual values listed in Table 3 are maxima reported
11 at each sampling station at various times during the year.
12 There is no chronological relationship among the reported
13 values on Table 3.

14 Thus, some of the data reflects samples taken in
15 January 1970 and some as late as early November 1970.

16 Second, even if there was any possibility to
17 summing the maximum fractions of different samples, and to
18 relating samples collected at different times, I have used
19 the Sternglass methodology and made similar plots of beta
20 activity for 1969 and 1971, and compared these curves with
21 these beta activity curves for 1970 plotted on Dr. Sternglass'
22 Figure 6.1.

23 The 1969 and 1971 curves show no peaking in
24 the Sandusky-Huron area.

25 Q Have you a copy of the plot for 1969 and 1971,

jrb7

1 the other two years mentioned in Dr. Storaqlass' testimony,
2 but not plotted on Figure 6.17

3 A Yes.

4 My chart compares all three years.

5 (Mr. Charnoff distributing documents.)

6 MR. CHARNOFF: Mr. Chairman, I would ask to be
7 marked a chart entitled "Figure 1," it shows relative to
8 air miles from Sandusky beta radioactivity in surface water.
9 It is captioned "Maximum Beta Activity in Lake Erie Water,
10 ^{sum}~~Summary~~ of Maximum Suspended and Maximum Dissolved Fractions."

11 I have had that marked as Applicant's Exhibit
12 No. 8.

13 (The document referred to,
14 "Maximum Beta Activity in Lake
15 Erie Water, Summary of Maximum
16 Suspended and Maximum Dissolved
17 Fractions," was marked Applicant's
18 Exhibit No. 8 for identification.)

XXXXXXXX

19 BY MR. CHARNOFF:

20 Q Mr. Crouse, is this the curve you were just
21 referring to?

22 A (Mr. Crouse.) Yes, it is.

23 MR. CHARNOFF: I would move that Applicant's
24 Exhibit No. 8 be received in evidence, Mr. Chairman.

25 CHAIRMAN FARMARIDES: Any objections?

JRB*2

1 MR. BARON: Well, subject to our cross-
2 examination, there is no objection at this time.

3 MR. DAVIS: No objection.

4 CHAIRMAN PARMARIDES: It will be received.

5 (The document referred to,
6 previously marked Applicant's
7 Exhibit 8 for identification,
8 was received in evidence.)

XXXXXXXX

9 BY MR. CHARNOFF:

10 Q In this connection, Mr. Crouse, I would like to
11 refer you to page 2 of Dr. Sternglass' testimony submitted
12 for Contention 7 and now identified as Intervenor's Exhibit
13 10-B.

14 On page 2, in the middle paragraph the final
15 sentence there states, 'Thus, year by year Toledo and
16 Cleveland radioactivity declined and rose together with the
17 Plumcreek activity as shown for the year 1970 in Figure 6.1.'

18 Now, does Applicant's Exhibit 8, which has just
19 been received in evidence, Mr. Crouse, confirm or dispute this
20 statement?

21 A (Mr. Crouse.) It is clear from Applicant's
22 ~~Exhibit 8~~ ^{Exhibit 8} that, indeed, in 1971 Toledo and Cleveland data
23 using the Sternglass method of adding maximum dissolved beta
24 activity and maximum suspended beta activity, increased,
25 while Sandusky and Huron declined. In fact, I have

jrbs

1 examined Ohio Department of Health data for 1961 through
2 1972, and that Department's monthly maximum total activity
3 show no pattern of increases or decreases in Toledo or
4 Cleveland radioactivity, with Sandusky and Huron increases
5 and decreases.

6 Q Mr. Crouse, in your review of the Ohio EPA data,
7 and other data concerning the Plumbrook reactor facility,
8 have you found any unusually high releases of radioactivity
9 reported from Plumbrook in 1970; and in this connection, I
10 note that Dr. Sternglass, on page 1 of Intervenor's Exhibit
11 10-A reported that a large release took place in 1970 from
12 the Sandusky reactor.

13 A No.

14 The report of reactor operations for the NASA
15 Plumbrook reactor does not indicate that a large release took
16 place in 1970, or 1969, or 1971, for that matter.

17 I assume that Dr. Sternglass came to a conclusion
18 that there was a large release because one single sample of
19 water taken from the Plumbrook stream by the Ohio Department
20 of Health in 1970 indicated a specific activity of 2,889
21 picocuries per liter of total beta activity from both suspended
22 solids and dissolved solids. There is no information on
23 stream flow at the time the sample was taken, and as a result
24 no conclusion on total activity discharged from the Plumbrook
25 reactor can be inferred.

1 It is interesting to note that 85 percent of this
2 total activity is from suspended solids. This fraction of
3 total activity of suspended solids is well above the
4 fraction of suspended solids found in any other 1970 samples.

5 It is also interesting that the samples taken
6 at the same location as shown on the monthly reports in the
7 months immediately preceding and following the large reported
8 figure were orders of magnitude lower.

9 Q Now, even though you have stated that a large
10 release -- the term used by Dr. Sternglass cannot be inferred
11 from this one sample, assuming, however, that it does indicate
12 that such a large release occurred, what is its significance
13 to the data plotted in Figure 6.1, Intervenor's Exhibit 10-A,
14 by Dr. Sternglass?

15 A None.

16 The large reading of 2,689 picocuries per liter
17 was obtained from a sample taken on November 19, 1970.
18 Table 3, as I have said previously, lists the maximum total
19 beta activity samples recorded in 1970, and maximum
20 suspended beta activity fractions recorded, and the maximum
21 dissolved beta activity fractions; all of the maximum total
22 beta activity samples recorded for the six locations plotted
23 in Figure 6.1 were taken prior to November 1970.

24 All of the maximum dissolved activity fractions
25 were also taken prior to November 19, 1970. The maximum

1 suspended solid beta activity that is recorded for the six
2 locations plotted in Figure 6.1, five were from samples prior
3 to November 19, 1970; the sixth was taken on that day in
4 the Sandusky intake water, and the value recorded was 10
5 picocuries per liter.

6 Thus, the data plotted in Figure 6.1 essentially
7 reflects data which preceded the so-called "large release"
8 of November 19, 1970.

9 Q On page 2 of Dr. Sternglass' testimony, he states,
10 and I quote -- this is page 2 of Exhibit 10-A -- "The
11 maximum levels near Sandusky and Huron of 30 picocuries per
12 liter beta activity sum" -- and I don't understand that word
13 there -- "are therefore 15 times as large as occur from
14 normal, natural activity, and fallout, for a level of 1,500
15 percent of normal after dilution by more than 1,000 times
16 as taken place."

17 Would you comment on this conclusion?

18 A On page 2 of Dr. Sternglass' testimony, Dr.
19 Sternglass has -- excuse me -- Dr. Sternglass has compared
20 a maximum value of 30 picocuries per liter of beta activity
21 in raw lake water, which occurred at Huron on October 16,
22 1970, with the average value of 2 picocuries per liter in
23 treated, Toledo drinking water for the first quarter of
24 1973.

25 Such a comparison is meaningless.

jrbl2

1 Q Now, in Dr. Sternglass' next sentence on page 2,
2 Exhibit 10-A, he states, "Similarly the peak of four picocuries
3 per liter in suspended alpha activity is some 20 times
4 or 2,000 percent the normal alpha activity in Lake Erie."

5 Would you comment on this observation?

6 A Dr. Sternglass' multiple of 20 is apparently
7 derived from his comparison of the four picocuries per liter
8 of suspended alpha activity maximum value with the Biotest
9 report of a quarterly average value of 0.2 picocuries per
10 liter, reported in Dr. Sternglass' immediately preceding
11 paragraph.

12 The Biotest report is of alpha activity in
13 drinking water, and cannot be compared with suspended
14 activity in untreated water.

15 Similarly, a comparison of a quarter average value
16 with a single maximum sample ~~value~~ ^{value}, is invalid. Nor is it
17 accurate of Dr. Sternglass to characterize the Toledo
18 drinking water concentration as equivalent to the normal
19 alpha activity in Lake Erie.

20 Q Now, Mr. Crouse, in Dr. Sternglass' testimony
21 on dose rates in Exhibit 10-A, he uses data on
22 thermal luminescent dosimetry from the Davis-Besse preopera-
23 tional environmental-radiological monitoring program.

24 Would you explain what thermal luminescent dosi-
25 metry is?

b 13

1 A Thermal luminescent dosimeters we commonly refer
2 to as "TLD's". These dosimeters are very small chips of
3 crystalline lithium fluoride activated with manganese. These
4 chips are about the size of a soap flake.

5 Lithium fluoride is a material that has the
6 ability to absorb and store energy from ionizing radiation,
7 and release this energy as light in the visible or near-
8 visible region of the spectrum when the material is heated.
9 When a TLD chip is struck by a gamma proton, electrons are
10 excited to higher energy levels in the crystal. When the
11 TLD is read, it is placed in a TLD "reader" or the chip is
12 heated, and on heating the excited electron returns to its
13 ground state and emits light.

14 The light given off is proportional to the amount
15 of gamma radiation that the chip had absorbed.

16 Q Is this a good method of measuring radiation
17 levels, ambient radiation levels?

18 A The state of the art for measuring ambient
19 radiation levels has shown that TLD's are more reliable
20 than the previously-used film badges. Consequently, TLD's
21 have become the accepted method for measuring ambient
22 radiation levels.

23 Q Are there any problems associated with TLD's?

24 A Radiation levels in the environment currently are
25 quite low and are approaching the limit of sensitivity of the

jrb 14 1 TLD's. The TLD chips are subject to fading or losing
2 electrons when they are in the field for long periods of
3 time. Also the chips, as with film dosimetry, are subject
4 to exposure in shipment or transportation between the site
5 and the contractor's location where they are read.

6 To offset this problem we use monthly, quarterly,
7 and annual TLD's; because the TLD chips tend to fade with
8 time, we feel that the monthly TLD is probably our best
9 indication of actual radiation levels in the environment.
10 While we would expect that the sum of the three individual
11 months should be nearly the same as what the quarterly
12 TLD chips read, due to fading we generally observe that
13 quarterly chips are slightly lower than the sum of the three
14 individual months.

15 This fading phenomena has been explained by
16 J. R. Cameron in his Book, *Thermoluminescence*
17 "Thermal Luminescent Dosimetry."

18 Q On page 5 of Dr. Sternglass' testimony in Exhibit
19 10-A, in Item 1, Dr. Sternglass states, and I quote, "Both
20 for the periods July to December 1972 and January to March
21 1973, the highest dose readings out of the 12 sites listed
22 occurred nearest the Plum Brook reactor, namely for location
23 T-24, just west of Sandusky."

24 Is that statement true, Mr. Crouse?

25 A If one looks at only the quarterly TLD values
this would be true. However, the quarterly TLD value is

jrb15 1 based on just that: a single value.

2 Dr. Sternglass has completely neglected all of
3 the individual month's data that were collected and were
4 available to him in the Biotest reports.

5 Q Excuse me -- Biotest Reports are Applicant's
6 Exhibit 5-A and 5-B?

7 A Yes, sir.

8 Q Go ahead, sir.

9 A If we look at Table 16 of the Biotest Report
10 for July to December 1972 period, we can see the total of
11 the monthly TLD values for Station T-24 gives a 182-day
12 calculated exposure of 33.4 millirems. Eleven of the 18
13 monitoring locations have exposure levels in excess of this
14 T-24 level.

15 In Table 16 of the January to March 1973 Biotest
16 Report, the Station T-24 total exposure for the three months
17 is recorded at 17.9 millirems. During this time period, six
18 other monitoring sites were above this value.

19 Thus, based on all the data in the Biotest Reports
20 it cannot be concluded that Station T-24 had the highest
21 exposure levels of all 18 sites.

22 Q Assuming, Mr. Crouse, that there was no error in
23 the quarterly TLD values, is there any relationship which
24 can be reasonably inferred between discharges from Plumbrook
25 and the fact that the quarterly TLD values obtained at the

jrb 16

1 Sandusky location, T-24, were higher than the average
2 of the exposures at the other TLD locations?

3 A No.

4 First, it should be noted that the T-24 quarterly
5 values were the last quarter of 1972, and the first quarter
6 of 1973, are within two standard deviations of the average
7 of the exposures at the other TLD locations.

8 More significant, however, is the total lack of
9 any pattern showing a declining level of exposure from the
10 T-24 location or from the Plumbrook reactor. In fact, there
11 about a half-dozen other locations with quarterly TLD values
12 similar to the value read at location T-24, and they are
13 randomly located near TLD locations showing average or
14 less than average exposure levels.

15 Indeed, some of the higher values are further
16 away from Sandusky than the lower values obtained at TLD
17 locations closer to the Plumbrook facility. The fact is,
18 that TLD values for the reasons which I have stated before,
19 are not precise instruments intended to show actual exposure
20 levels. They are useful to show trends of radiation levels
21 over time when enough data points are obtained. And that is
22 all.

23 (Mr. Charnoff distributing documents.)

24 BY MR. CHARNOFF:

25 Q Mr. Crouse, has Toledo Edison has prepared for it

jrb 17

1 chart or a figure showing the TLD dosimeter readings in
2 millirems per month for 1973 -- or August-December '72 and
3 for the first six months of 1973?

4 A Yes.

5 MR. CHARNOFF: I have provided the parties and
6 the Reporter with Applicant's Exhibit No. 9, Mr. Chairman.

7 BY MR. CHARNOFF:

8 Q Does the chart of these monthly readings appear
9 in Applicant's Exhibit No. 9, Mr. Crouse?

10 A (Mr. Crouse.) Yes.

11 MR. CHARNOFF: I would move that Applicant's
12 Exhibit No. 9 be received in evidence, Mr. Chairman.

13 CHAIRMAN FARMARIDES: Any objection, Mr. Baron?

14 MR. BARON: I am assuming -- that's the question.
15 What's the location? What plant? What geographic reference.

16 BY MR. CHARNOFF:

17 Q Mr. Crouse, does the chart show the locations
18 where TLD readings were obtained?

19 A (Mr. Crouse.) Yes. The locations are numbered
20 T-1 through T-27.

21 MR. BARON: Which plant --

22 MR. CHARNOFF: Which plant? I think we're only
23 talking about Davis-Besse, Mr. Baron.

24 BY MR. CHARNOFF:

25 Q Was the monthly TLD readings conducted by

jrbl8 1 Biostat for Toledo at the Davis-Besse location for the
2 preoperational monitoring program, Mr. Crouse?

3 A Yes, it is.

4 MR. CHARNOFF: I'm sorry, I think there is a
5 ruling pending.

6 CHAIRMAN FARMAKIDES: Any objections, Mr. Baron?

7 MR. BARON: No.

8 CHAIRMAN FARMAKIDES: Mr. Davis?

9 MR. DAVIS: No.

10 CHAIRMAN FARMAKIDES: Received.

11)The document referred to,
12 Thermoluminescent Dosimeter
13 Readings, was marked Applicant's
14 Exhibit No. 9 for identification,
15 and was received in evidence.

XXXXXX

16 BY MR. CHARNOFF:

17 Q On page 5 of Dr. Sternglass' testimony,
18 Intervenor's Exhibit 10-A, in paragraph number 3, Dr.
19 Sternglass refers to a sharp drop in absolute background
20 dose rates for 1972 to 1973.

21 What significance, if any, do you infer from
22 the alleged sharp drop in absolute background dose rates
23 from 1972 to 1973?

24 A (Mr. Crouse.) Well, it must be pointed out that
25 Dr. Sternglass' allegation of a sharp drop in background

1 exposure levels from 1972 to 1973 is again based on his
2 sole consideration at the single, quarterly readings in 1972
3 and 1973. The monthly TLD values do not show any such
4 sharp drop. Applicant's Exhibit 9 sets forth the TLD monthly
5 readings and shows there was no noticeable drop from 1972
6 to 1973.

7 The monthly TLD figures are set forth in Table
8 16 of the Biotest Report, and had Dr. Sternglass
9 considered such data he would not have made his allegation of
10 a sharp drop.

11 The fact is that the quarterly TLD values for the
12 last quarter of 1972 set forth in Table 17 of the Biotest
13 Report are suspect, partly because they did not appear to
14 fade when compared with the monthly TLD values. More
15 important, as reflected in Table 16 the September and
16 October 1972 monthly readings were found to be unreliable
17 because they and the accompanying in-transit control TLD's
18 were apparently exposed to a radioactive source in transit.
19 The last quarter of 1972 quarterly TLD's were shipped with
20 the October 1972 TLD's, and undoubtedly also were exposed
21 in transit.

22
23
24
25
END
Linda fls

#8
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1 Q Mr. Crouse, you compared the changes in the
2 TLD values at Station T-24 at Sandusky with those at Station
3 T-9 which Dr. Sternglass observed on page 5 of Intervenor's
4 Exhibit 10A, was upwind from Sandusky, and what have you
5 found?

6 A (Mr. Crouse.) To the extent that T-9 can be
7 viewed as a control TLD which would be independent of the
8 Plumbrook activity, it is interesting that measurements at
9 T-9 and T-24 tended to change together.

10 That is, low values at ~~T-9~~^{W-24} and ~~T-24~~ occurred
11 simultaneously and high values occurred simultaneously.
12 Indeed, in some instances changes at T-9 on a percentage
13 basis exceeded changes at T-24. Strongly suggesting that
14 the Plumbrook reactor releases had no noticeable change on
15 the environment.

16 Q Is it your view, then, Mr. Crouse, that
17 Dr. Sternglass's conclusions drawn only from the single
18 quarterly TLD values including the suspect last quarter of
19 1972 TLD have no foundation when all the data is considered?

20 A Yes, it demonstrates that selection of some
21 data and failure to consider other available data can lead
22 to faulty conclusions.

23 Q Thank you.

24 Dr. Goldman, Dr. Sternglass provided testimony
25 in support of Intervenor's Contentions 5 and 7 which led to

1n2 1 the formulation of Contention 9 by the Board concerning
2 the technical or technological ability to predict environmental
3 dose contributions from nuclear plant discharges. The basis
4 for this concern arose largely from allegations made by
5 Dr. Sternglass in connection with the Plum Brook reactor and
6 the Shippingport power station.

7 Have you examined Dr. Sternglass's testimony in
8 Intervenor's Exhibits 10A and 10B as it relates to discharges
9 from and environmental radiation measurements in the vicinity
10 of the Shippingport plant?

11 A (Dr. Goldman.) Yes, I have.

12 Dr. Sternglass's testimony basically consists of
13 Appendix 6-2 entitled "Significance of Radiation Monitoring
14 Results for the Shippingport Nuclear Reactor," dated January
15 21, 1973 and Appendix 7-1 entitled "Radioactive Waste
16 Discharges from Shippingport Nuclear Power Station and
17 Change in Cancer Mortality," dated May 8, 1973.

18 In those documents Dr. Sternglass references
19 NUS reports covering the period of 1971 and the first quarter
20 of 1972 derived from the Environmental Monitoring Program
21 conducted on behalf of Duquesne Light Company for the Beaver
22 Valley nuclear power plant.

23 Q Dr. Goldman, in Appendix 6-2 to Intervenor's
24 Exhibit 10A, I'm referring to the January 21, 1973 paper by
25 Dr. Sternglass entitled "The Significance of Radiation

ln3 1 Monitoring Results for the Shippingport Nuclear Reactor,"
2 Dr. Sternglass makes a number of findings based on the
3 reported environmental data which he relates to operations at
4 the Shippingport power station. Have you examined these?

5 A Yes.

6 Q I refer you to page 2 of Appendix 6-2 which is
7 entitled "Principal Findings."

8 I have marked and handed to the Reporter Applicant's
9 Exhibit No. 10, "Table 1 Strontium-90 in Soil 1971."

10 (The document referred to,
11 "Table 1 Strontium-90 in
12 Soil 1971" was marked
13 Applicant's Exhibit No. 10
14 BY MR. CERNOFF: for identification.)

15 Q Dr. Goldman, did you have this table prepared?

16 A (Dr. Goldman.) Yes, I did.

17 Q Could you tell me briefly what the table
18 presents?

19 A The table presents a summary of 16 soil samples
20 which were originally measured in 1971 from the vicinity of the
21 Shippingport site and which were reported in the references
22 noted in the footnote to the table, and it records reanalysis
23 of these samples within the last month or two by our laboratory
24 and by the Environmental Protection Agency, Eastern
25 Environmental Radiological Laboratory in Montgomery and by

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1 the Health and Safety Lab, at least in a preliminary fashion,
2 to date, of the AEC. And the results of all these analyses
3 are presented for the samples in this table.

4 MR. CHERNOFF: Mr. Chairman, I move that
5 Applicant's Exhibit No. 10 be received in evidence.

6 CHAIRMAN FARMANIDES: Any objection, Mr. Baron?

7 MR. BARON: No objection.

8 CHAIRMAN FARMANIDES: Mr. Davis?

9 MR. DAVIS: No objection.

10 CHAIRMAN FARMANIDES: It will be so received.

11 (The document referred to,
12 "Table 1 Strontium-90 in
13 Soil 1971, heretofore marked
14 Applicant's Exhibit No. 10
15 for identification, was
16 received in evidence.)

17 BY MR. CHERNOFF:

18 Q Well, I would refer you now, Dr. Goldman, if
19 you don't mind again, to page 2 of Appendix 6-2 of Intervenor's
20 Exhibit 10A. I specifically refer you to Dr. Sternglass's
21 Principal Finding No. 1 which reads, "The measured levels of
22 strontium-90 in the soil decreased with distance away from
23 the plant in all directions at their peak in the spring and
24 summer of 1971 when strontium-90 in the local milk also
25 attained its peak values."

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1 Have you any comments on this finding,

2 Dr. Goldman?

3 A (Dr. Goldman.) Yes, as Dr. Sternglass indicated
4 that with respect to strontium-90 in soil, the measured levels
5 decreased with distance in all directions, this conclusion
6 is reached by selecting data from the spring and summer
7 samples only and by ignoring the fall and winter samples in
8 the same reports.

9 These latter two sets of samples show, if anything,
10 a constant or inverse relationship with distances. That is,
11 the closer to the plant, the lower the strontium-90 level. If
12 the effect were genuine as claimed by Dr. Sternglass, I
13 would expect that later samples would show the same distribu-
14 tion shape; that is, higher near the plant, lower farther away
15 although perhaps lower sample activities might be measured
16 later.

17 This, however, was not the case; and, as indicated
18 in Table 1, the reanalysis of these early 1971 spring
19 samples and fall samples completed so far by our own laboratory,
20 by EPA and on a preliminary basis by the Health and Safety
21 Laboratory have indicated the initially reported results
22 to have been in error.

23 The correct values are shown in Table 1, and they
24 do not support in any way the Sternglass Principal Finding
25 No. 1.

ln6 1 Q Now, I notice in Applicant's Exhibit No. 10
2 where you record or list the EPA values, Dr. Goldman, your
3 Testimony No. 2 cites an EPA document published on July 20,
4 1973, is that the final report of the Environmental Protection
5 Agency with respect to the Shippingport atomic power station
6 allegations by Dr. Sternglass that was mentioned by
7 Dr. Sternglass this morning?

8 A Yes, this is the final report by the Environmental
9 Protection Agency.

10 Q I see. And the EPA analyses of the 1971 soil
11 samples that you list in Applicant's Exhibit No. 10 appear
12 in that July 20, 1973 final report; is that correct?

13 A Yes, they do as Appendix VIII in that report
14 entitled "Analysis of 1971 Soil Samples, Shippingport,
15 Pennsylvania."

16 Q Were the same data presented in the EPA draft
17 report which Dr. Sternglass paid a little bit more attention
18 to this morning dated April 20, 1973?

19 A No, they were not.

20 Q Why is that? Do you know?

21 A The samples were not yet -- the 1971 samples
22 were not yet in their hands; and the analyses, therefore,
23 could not have been included.

24 In fact, the Interim Report stated that in the
25 absence of these samples there was no way of concluding what

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1 the situation had been back in 1971.

2 Q Thank you.

3 Now, I refer you to Principal Finding No. 2 on
4 page 2 of Appendix 6-2 of Intervenor's Exhibit 10A.

5 CHAIRMAN PARMAKIDIS: Before you go to 2,
6 Mr. Charnoff, can I understand the witness, are you saying,
7 sir, that strontium levels decreased the closer you came
8 to the plant most of the year?

9 WITNESS GOLDMAN: No, sir, I was trying to indicate
10 that if Dr. Sternglass had looked at all of our original
11 data in the references to which he referred, the four quarterly
12 reports that we published back in 1971, if he had looked at
13 all of the data and not just the data presented in his analysis,
14 he would have necessarily had to identify at least for
15 several seasons of that year the relationship he claimed of
16 a decrease in concentration with distance from the plant
17 clearly did not exist.

18 If anything, a contrary indication was provided
19 that the strontium-90 increased with distance from the plant
20 thus negating the dropoff that he claimed to have found. In
21 any event, the data on which both of these earlier contentions
22 were based was faulty.

23 And the premise that strontium-90 either increased
24 or decreased with distance from the plant has no foundation
25 in the measurements that we now have which are the correct

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1 ones.

2 MR. SHON: The data present in your Exhibit 10
3 here show only the spring and fall data and show those
4 extremely high values.

5 Did the summer and winter data, the other seasons
6 all show such high values?

7 WITNESS GOLDMAN: The winter values showed
8 quite low values. The summer values were intermediate
9 roughly between spring and fall.

10 We have not been able to locate these samples
11 for reanalysis. Our presumption is that the same analytical
12 errors were made in those samples as in the spring and
13 fall samples.

14 CHAIRMAN FARMARIDES: Why did you present only
15 the spring and fall samples? Again, just to be sure that
16 we're in context.

17 WITNESS GOLDMAN: Because these are the only
18 samples we were able to relocate. These are samples that
19 are now two years old. We do not normally keep samples longer
20 than a year. The spring and fall samples were relocated.
21 We were unable to relocate the summer and winter samples.

22 CHAIRMAN FARMARIDES: I'm sorry, Mr. Charnoff.

23 BY MR. CHARNOFF:

24 Q I think we might pursue this a little farther.

25 Dr. Goldman, when you found the April and

In9 1 September soil samples, how did you go about determining
2 that your reanalysis would be confirmable?

3 A (Dr. Goldman.) The samples when they were dis-
4 covered, were split between the two agencies that I mentioned,
5 the Environmental Protection Agency and the Health and Safety
6 Laboratory of the Atomic Energy Commission as well as our own
7 facility.

8 The results of those analyses were requested to
9 be sent to Dr. Charles Pelletier who is consultant retained
10 by Duquesne Light Company to review the WUS Laboratory
11 operation.

12 The results then of the EPA analyses were for-
13 warded to Dr. Pelletier and the Health and safety Laboratory
14 results were forwarded to Dr. Pelletier, and he put the three
15 sets, including our analyses, of data together so that no
16 one laboratory knew what the other two had.

17 Q Have the results that have now been obtained from
18 EPA and the preliminary results that have been obtained from
19 Dr. Pelletier from the Health and Safety Laboratory, would you
20 tell us whether the results are all very similar to that which
21 you obtained on your reanalysis?

22 A I would say generally that the results obtained
23 on our reanalysis are quite consistent with those reported
24 by EPA and the limited results available by the Health and
25 Safety Laboratory.

1nl0 1 Q Thank you.

2 MR. SHON: Dr. Goldman, I notice that the
3 original values that you published for many of the samples
4 at least are like a factor of 10 to 20 higher than what you
5 got and HASL and EPA ultimately got. Had you in 1971 been
6 analyzing similar samples regularly?

7 WITNESS GOLDMAN: No.

8 MR. SHON: You had not.

9 Did no one think numbers that size strange
10 when they got them at that time?

11 WITNESS GOLDMAN: Not at that time. The results,
12 in fact, were compared when the reports were prepared with
13 results that had been reported in other parts of the country;
14 and these were not unusual.

15 There are portions of the United States that are
16 currently reporting levels of strontium-90 in this range.
17 They tend to be at the extreme, and two of the values,
18 particularly those above 5 picocuries per gram tend to be
19 outside the normal range of 1 to 2 which would be the normal
20 upper range of strontium-90 concentration in the soil.

21 There was at that time some question, but since
22 these were the first soil samples that had ever been analyzed
23 in this region, we had no basis for suspecting that they might
24 be unusual since there were other areas of the country in
25 which similar values existed.

1 In 1 MR. SHON: And have subsequent samplings of
2 this same region been made and what did they show?

3 WITNESS GOLDMAN: The samplings of this region
4 have been made continuously since that time. The values that
5 we have been getting since early 1972, in fact, since the
6 winter of 1971, are consistent with those which now appear in
7 this table for the values in early and the second and third
8 quarters of 1971.

9 There has not been any significant change between
10 then and now in those levels.

11 MR. CHARNOFF: That applies to soil --

12 CHAIRMAN FARMANIDES: But what you're suggesting
13 to me, sir, as I understand you, you are suggesting that
14 there is no relationship between strontium level and the
15 presence of a nuclear plant?

16 WITNESS GOLDMAN: That is most avowedly the case,
17 sir.

18 CHAIRMAN FARMANIDES: And what is your support
19 for that?

20 WITNESS GOLDMAN: The support for this comes from
21 the very large number of measurements that have been made of
22 strontium in soil, strontium in milk, strontium in water
23 that correlate very well with the transfer of strontium-90
24 from weapons tests, residuals from weapons tests which are
25 still in the stratosphere and are still being deposited,

1 although much more slowly on the earth's surface.

2 A reinforcement every now and then from a weapons
3 tests in China or by the French, and there is no correlation
4 that anybody has been able to make between strontium-90 in
5 milk or water or soil samples that can be validly related to
6 releases from power plants.

7 This has been specifically examined in the
8 reference I mentioned which Dr. Kahn at the Dresden 1 reactor
9 where examination was made of the vent releases and the stack
10 releases, particularly for the kinds of isotopes that are of
11 concern here and everywhere.

12 There have been no correlation between environ-
13 mental measurements of radiation from power plants of this
14 kind of material and the material that is released. Pri-
15 marily because the ambient levels that result are infinites-
16 mally small compared to what has already been laid down and
17 is still being laid down by fallout.

18 We're looking for an extremely small addition or
19 change from a power plant in an environment that already
20 contains what is an appreciable level of this material from
21 fallout, and we just cannot see any correlation between what
22 we find in the environment and what is released from the
23 plants because of this screening or shadowing effect of what's
24 there already.

25 CHAIRMAN FERMAKIDES: Sorry to interrupt,

ln13 1 Mr. Charnoff. Please proceed.

2 BY MR. CHARNOFF:

3 Q Dr. Goldman, in 1971 when these samples were
4 being analyzed, I think you indicated too that you were doing
5 other soil sample work at that time.

6 When did the NUS Laboratory start performing
7 these soil analyses?

8 A (Dr. Goldman.) In 1971.

9 Q So this was kind of the first time that NUS
10 was performing soil samples in its own laboratories?

11 A That's correct.

12 Q I'd like to refer you then to Principal Finding
13 No. 2 by Dr. Sternglass on page 2 of Exhibit 10A.

14 In that finding, Principal Finding, Dr. Sternglass
15 asserts "The absolute levels of strontium-90 in the soil
16 nearest the plant boundary reached levels some 50 to 100
17 times those measured in the same locations after repairs had
18 been carried out to the reactor" -- referring to the
19 Shippingport reactor -- "in September of 1971, and levels of
20 strontium in the soil and milk had declined to those typical
21 for the Eastern United States in January of 1972."

22 Would you comment on that Principal Finding, sir?

23 A Well, I think, as I indicated before, this finding
24 which relates to the decline in strontium-90 levels in soil
25 to repairs at the Shippingport reactor in September of 1971

1n141 has no merit for two reasons: First, any decline would be
2 much slower than that apparently measured since the strontium
3 would not disappear over a shorter period of time as a few
4 months.

5 Rainfall, precipitation, is not quite that
6 effective in cleaning out the material that is present in
7 our soils.

8 Secondly, the reanalyses of the samples that are
9 indicated in Table 1 do not indicate any significant difference
10 between samples collected before and after that period.

11 Q I have handed to the Reporter a document marked
12 as Applicant's Exhibit 11 that was entitled Table 2 Strontium-
13 90 in Milk 1971."

14 Was this table prepared by you, sir?

15 A Yes, it was.

16 Q And could you tell me briefly what this table
17 purports to present?

18 A As in the case of the soil samples, Dr. Sternglass's
19 questions about milk led us to search for and to discover
20 samples that we have used for analysis of strontium-90 in
21 milk dated back to 1971.

22 In this instance the samples of milk themselves
23 were not available, but the counting dishes or planchettes
24 that contained the strontium-90 precipitate were available,
25 and we recovered those for four months of 1971 from July,

1n15 1 August, September and November; and, in this instance, since
2 it was not technically feasible to physically split the
3 counting dishes, we distributed the dishes from the six dairies
4 in each month with two dairies being analyzed by ourselves;
5 that is, the planchettes from these milk samples from two
6 dairies being analyzed by ourselves, two by EPA and two either
7 by the Health and Safety Laboratory or by a commercial
8 laboratory.

9 We have not gotten any results back from the
10 commercial laboratory or the Health and Safety Laboratory
11 yet so that there are for each month only four dairies
12 represented, two by our own laboratory and two by EPA. This
13 table then sets forth the original values contained in our
14 reports for these samples, the results of our reanalysis and
15 the EPA values which were reported again to Dr. Pelletier
16 by the EPA laboratory.

17 I should point out that this table does need one
18 correction, and that is for the sample NUS No. 1576 under the
19 ~~volume~~ *column* headed NUS 7-31-73 values, there should be an equal to
20 or less than in front of the numerical value 5.9. So that
21 should read "equal to or less than 5.9."

22 MR. CHARNOFF: I would offer Applicant's Exhibit
23 11 into evidence, Mr. Chairman.

24 CHAIRMAN FARMARIDES: Any objections, Mr. Baron?

25 MR. BARON: No.

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1 CHAIRMAN FARMANIDES: Mr. Davis?

2 MR. DAVIS: None.

3 CHAIRMAN FARMANIDES: It will be received.

4 (The document referred to,
5 "Table 2 Strontium-90 in Milk
6 1971" was marked Applicant's
7 Exhibit No. 11 for identifica-
8 tion and was received in
9 evidence.)

10 BY MR. CHARNOFF:

11 Q Now, Dr. Goldman, I would refer you to
12 Dr. Sternglass's Principal Finding No. 3 on page 2 of
13 Intervenor's Exhibit 10A which relates strontium-90 levels in
14 the Shippingport area dairies sampled to those for the
15 Pittsburgh and Harrisburg areas.

16 Would you please comment on this Principal
17 Finding?

18 A Well, I think at the outset any comparison of
19 concentrations in milk from a single dairy with those
20 reported for composites of a number of dairies or for the
21 country as a whole is not valid since compositing of individual
22 samples will naturally eliminate extremes.

23 Nevertheless, it is of interest to note that for
24 a number of other stations in both state and federal milk
25 networks, including Erie, Pennsylvania and Harrisburg which

1 in17 1 are themselves composites and with one exception are not
2 in the vicinity of nuclear plants, values for strontium-90
3 in milk were highly variable in this same period; that is,
4 1971, early 1972 and greatly exceeded the national average
5 of the pasteurized milk network.

6 However, again, in this instance, the recovery
7 of the precipitated strontium-90 milk samples and their
8 reanalysis as indicated in Table 2 indicate that our results
9 were as originally published, were high. It is also of
10 interest to note that the samples taken prior to the supposed
11 repair of the Shippingport plant on average are lower than
12 those that were taken after the repair of the Shippingport
13 plant.

14 That is, the average of four samples in August
15 of 1971 was about 3.7 picocuries per liter. This was
16 supposedly prior to the repair of the Shippingport plant.
17 In September, the average was about the same, 3.7 picocuries
18 per liter on average; but, after the repair of the plant as
19 claimed by Dr. Sternglass in November of 1971, the average
20 of the four samples returned for reanalysis is 9.2 picocuries
21 per liter almost -- well, between two and three times what
22 it was before.

23 These would not provide any greater degree of
24 support than for Dr. Sternglass's Principal Finding No. 3
25 or for that matter No. 4 or No. 5.

1n18 1 Q And I refer you, Dr. Goldman, to Principal
2 Finding No. 3 appearing on page 3 of Intervenor's Exhibit 10A.
3 Now, in this finding, Dr. Sternglass discusses the
4 TLD results at Beaver Valley site. Would you please comment
5 on this finding, sir?

6 A Dr. Sternglass's finding provides an example of
7 the way in which data can be misused if it is not
8 completely understood.

9 The data reported by NUS for the TLD results at
10 Beaver Valley site include the contribution known as the
11 in transit dose as well as the field contribution.

12 In our annual report for 1971, the fact that the
13 TLD values reported included these in transit dose contribu-
14 tions was clearly identified in the text, and I quote "Experience
15 during the initial 11-month period of the program indicates
16 that for field use TLDs are a reasonably sensitive means for
17 measuring ambient radiation levels.

18 "However, the system has one serious problem which
19 tends to overstate the external radiation levels."

20 The dates listed in Table 13 -- the reference
21 report; that is, the exposure period of the TLDs at their
22 monitoring stations. "These measurements are intended to repre-
23 sent the ambient external radiation dose integrated at those
24 stations during that time period.

25 "In reality, however, the reported dose measurement

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1 includes an additional in transit dose accumulated by the TLDs
2 during the time period the dosimeters were in route from the
3 processing laboratory located in Santa Fe, New Mexico to
4 the monitoring station and from the monitoring stations to
5 the processing laboratory. The in transit periods can be
6 as long as two to three weeks and the associated dose rates
7 during these time intervals are ~~available~~ *variable*.

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assuming
"I assume equal dose rates in transit and in the

2 field, the dose received received during the in-transit time
3 period, can be a significant fraction of the total reported
4 monthly dose; hence a large error occurs when the dosimeters
5 are exposed for only one month.

6 Under the present system, consequently, the results
7 must be viewed as an overestimate of the actual radiation
8 levels in the area."

9 Measurements of in-transit dose contributions
10 which we made in 1971 that indicated the highly variable
11 transit times in doses to these units ranged from six to
12 forty-three days, an average dose per day ranging from 0.2
13 to 0.9 millirem. Using an average in-transit dose rate of
14 .5 millirem per day, the 1971 DLD data have been corrected
15 and indicate an annual average dose of 90 millirem, as
16 contrasted to the uncorrected value of 170 millirem, and Dr.
17 Sternglass' failure to recognize the limitations placed on
18 these data in the referenced reports was the primary basis
19 for his misuse and misunderstanding of the numbers presented.

20 Q In other words, Dr. Goldman, the comment made by
21 Dr. Sternglass this morning when he said that he was referring
22 to uncorrected figures could not validly be used to draw
23 any inferences until or unless a correction was made for the
24 in-transit dose; is that correct?

25 A That's correct.

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Q Now, I refer you to Dr. Sternglass' principal finding number 7 appearing on page 4 of Appendix 6-2 of Exhibit 13-A, and in that principal finding Dr. Sternglass makes reference to certain high iodine readings found in milk during the early 1972 period.

Would you comment on this proposed finding?

A Yes. EUS did report iodine-131 level in local milk increased to maximum in a single sample in January of 1972 of 121 picocuries per liter.

It should be noted that the 100 picocuries per liter limit referenced by Dr. Sternglass in his principal finding number 7, as established by the Federal Radiation Council, represent a permissible average daily intake over a period of an entire year, and the percentage that he establishes in that principal finding, then, has really no merit since it was only a single sample that indicated this value.

Also contrary to the statement by Dr. Sternglass that iodine levels in the eastern states did not exceed ten percent of the NUS values, EPA has reported levels in Fayetteville, Tennessee on January 17, 1972 of 37 picocuries per liter, and of 32 picocuries per liter on March 29, 1972. Clinton, Tennessee on that date was also reported to have a level of 30 picocuries per liter.

During the same period Colorado reported levels

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wel 31 up to 67 picocuries per liter, Wyoming up to 77 picocuries
2 per liter in January, and levels in the range of 10 to 40
3 picocuries per liter were reported for Kansas, Utah and
4 Kentucky.

5 While an investigation by NUS has not revealed
6 other stations in the northeastern part of the U.S. with
7 comparable radioiodine levels, Chinese weapons tests were
8 conducted in January and March of 1972. Based on previous
9 fallout behavior it would not be unusual to find highly
10 spotty deposition patterns across the U. S., as would appear
11 to be the case in this instance.

12 It is impossible at this stage to precisely
13 identify the source of radioiodine detected in milk. However,
14 independent analyses by AEC and EPA have confirmed that
15 radioiodine levels in reactor coolant at the Shippingport
16 plant were not sufficiently great to have given rise to
17 releases of the magnitude necessary to produce the levels
18 measured in the area's milk sample.

19 It should also be noted that the AEC and EPA
20 have tended to rule out fallout as a likely source. They tend
21 to suspect that there was an analytical error in our
22 laboratory. We are investigating this possibility.

23 Q Dr. Goldman, you referred to the independent
24 analyses by AEC and EPA which confirmed that the radioiodine
25 levels in the Shippingport reactor coolant were not

wei 4 1 sufficiently great to have given rise to the iodine level
2 reported by the NUS milk monitoring program.

3 Are you referring there to the EPA report again,
4 of April 27 in draft form, and July 20, 1973?

5 A That's correct.

6 Q And are you also referring there to the May 1973
7 *Division of Operational Safety*
~~portion of the operational safety~~ report?

8 A Yes.

9 Q So would it be fair to say that, unlike Dr.
10 Sternglass this morning, that the AEC and EPA reports did
11 not leave as the only possible explanation for the high
12 readings the possibility that this reading emanated from
13 Shippingport, but rather that they concluded that it could
14 not have been from Shippingport?

15 A I think both reports --

16 CHAIRMAN FARMANIDES: Excuse me, sir.

17 I'm sorry, gentlemen. Please go outside and talk,
18 if you like. We can't hear. (Referring to people in the
19 audience.)

20 Continue, sir.

21 WITNESS GOLDMAN: I think it would be fair to
22 characterize both reports as being quite definite, that
23 neither -- I'm sorry -- that the Shippingport plant could
24 not possibly have been the source of either the iodine or
25 the previously discussed strontium activity.

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BY MR. CHARNOFF:

2 Q Do you recall whether the EPA report calculated
3 how much of the reactor coolant would have had to have
4 escaped from Shippingport in order to give rise to the
5 reported iodine level in milk?

6 A Yes. They did make that calculation. I would
7 not say that I recall it correctly, but I do recall that
8 they made it, yes.

9 Q Was it more or less than a single or two volumes
10 of the reactor coolant, do you recall that?

11 A It would require several coolant volumes per day,
12 as I recall, to provide the magnitude of leakage necessary.

13 Q To your knowledge was there a loss-of-coolant
14 accident in Shippingport in 1971?

15 A To my knowledge there was no loss-of-coolant
16 accident in Shippingport in 1971, or any other time.

17 Q Now, incidentally, Dr. Goldman, in principal
18 finding number 7 Dr. Sternglass refers to the recent report
19 by the National Academy of Science, which urges a 100-fold
20 lowering of present permissible dose; are you familiar with
21 that report?

22 A Yes. That's what is referred to as the BEIR
23 report.

24 Q Could you spell that?

25 A B-E-I-R, all capitals.

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1 Q I see.

2 And do you have a copy of that report with you?

3 A Yes, I do.

4 Q Did that report make any comment with regard to
5 Dr. Sternglass' "methodology?"

6 A Yes, it does.

7 MR. BARON: Objection to any questions in this
8 area, Mr. Chairman. I think we're going into biological
9 effects.

10 MR. CHARNOFF: We don't want to discuss biology.
11 We simply want to discuss the statistical methodology or
12 use of data, Mr. Chairman, which was relevant to Contention
13 8 and directly relevant to Contention 9.

14 MR. BARON: Well, the very title of the publication
15 uses the word "Population."

16 MR. CHARNOFF: I'd be glad to have a bench
17 conference, to show both Mr. Baron and the Board the sentences
18 that we propose to introduce which do not relate to the
19 biological effects, but simply to Dr. Sternglass' use or
20 misuse of data.

21 CHAIRMAN PARMAKIDIS: All right, Mr. Charnoff.
22 I would appreciate a bench conference. On the face of it,
23 though, it does appear that Mr. Baron is correct.

24 But let's see it.

25 Let's take a ten-minute recess.

wel 7 1

(Recess.)

2

CHAIRMAN FARMERIDES: Back on the record.

3

We have had a bench conference, and we apparently have had nothing resolved, unless the parties were able to resolve the issue between them after the bench conference.

6

Was there any such luck?

7

MR. CHARNOFF: No.

8

CHAIRMAN FARMERIDES: Well, then, the Board is going to take the ball on its own, and the Board rules that that last sentence stated by Mr. Charnoff, the last sentence of Exhibit 10-B, principal findings of Dr. Sternglass, which begins, "And it should be noted..." that sentence will be stricken. It relates strictly to biological effects that we have already ruled are not relevant to the contentions before us. And we therefore grant the objection of Mr. Baron.

17

18

19

20

21

MR. CHARNOFF: Mr. Chairman, I would refer you to page 2 of Exhibit 10-B, on page 2, lines 5 through 9, and 10, there's another reference to the National Academy of Science document. What does the Board propose to do with that?

22

MR. BARON: What page are you on?

23

MR. KARMAN: Page 2.

24

CHAIRMAN FARMERIDES: That's not before us.

25

MR. CHARNOFF: Well, it is, because since we're

1 dealing with Contention 9 testimony, and I asked the question
2 in the context of the testimony --

3 CHAIRMAN FARMAKIDES: Well, I disagree, Mr.
4 Charnoff. I don't think you asked the question in the context
5 of the testimony, sir. This particular testimony does not
6 relate to the question you asked, Mr. Charnoff.

7 So let's be clear about it. So far as I'm
8 concerned, if you want to rephrase your question I will
9 entertain another objection and will rule on that again.

10 So you may proceed, sir.

11 MR. CHARNOFF: I would propose at this time to
12 strike, sir, the paragraph on page 2 of Exhibit 10-B, which
13 states, "It should be noted that the proposed new mpc under
14 Appendix I is only 20 picocuries per liter for --"

15 CHAIRMAN FARMAKIDES: We're still not with you.
16 We still haven't found your reference. Yes we do. I see it.

17 MR. CHARNOFF: Page 2.

18 CHAIRMAN FARMAKIDES: Mr. Baron?

19 MR. BARON: Well, Dr. Sternglass seems to feel
20 that this has nothing to do with biological effects, and I
21 can only offer that comment.

22 CHAIRMAN FARMAKIDES: Well, Mr. Charnoff is really
23 going to the report, sir. Unless you give me a reason, I'll
24 strike it.

25 MR. BARON: There's no other explanation that can

wel 9

1 be offered, Mr. Chairman, except that there's no reference
2 being made in this paragraph other than biological effects.

3 I assume what you're saying, though, that since
4 it does refer to this report, and that the report itself is
5 inadmissible, this paragraph should not be in. I can't
6 argue with that.

7 CHAIRMAN FARMARIDES: Motion to strike granted.
8 Anything else?

9 MR. CHARNOFF: No, I will withdraw the question,
10 then, to Dr. Goldman.

11 CHAIRMAN FARMARIDES: All right. Let's proceed.

12 BY MR. CHARNOFF:

13 Q Dr. Goldman, I refer you, then, to principal
14 finding number 8. In principal finding number 8, Dr. Goldman,
15 Dr. Sternglass compares the radioactivity in the Ohio River
16 bottom sediment in 1971 with a study, or with a figure which
17 he represents as being the lowest recorded in a 1959 study
18 carried out by Professor Maurice Shapiro, at the Graduate
19 School of Public Health of the University of Pittsburgh.

20 Would you please comment on this principal
21 finding?

22 A (Dr. Goldman) This can only be considered a
23 selective use of data in supporting his finding number 8
24 relating to bottom sediment activity in the Ohio River, by
25 failing to present the data also published on sediment

10³ wel 10³ radioactivity upstream from the Shippingport plant of the
2 five monthly samples reported in 1971 by NUS. The sediment
3 sampled upstream of the discharge were higher in activity
4 in two cases than those collected near the Shippingport
5 discharge.

6 The 1971 mean gross beta activity values of the
7 upstream and the discharge location samples were 18.2, plus
8 or minus 2.4, and 19.6, plus or minus 3.9 picocuries per
9 gram, respectively.

10 These do not statistically differ from each other--
11 each error value I gave is one standard deviation.

12 In addition, Dr. Sternglass ^{compares} ~~present~~ peak values
13 measured by the NUS with "the lowest recorded in the 1969
14 study," by Shapiro.

15 And examination of the data reported by Shapiro
16 for his station number 2, located at the Shippingport
17 discharge, which is where our samples are presently being
18 taken, indicates a range of activity which varied from 1.5
19 to 107 picocuries per gram, with an average of 19.9,
20 essentially the same as it was in 1971.

21 The upstream sample locations over the same
22 period by Shapiro provided an average value of 26.7 picocuries
23 per gram, slightly higher than those reported by us in 1971,
24 on average.

25 Since the upstream samples, however, varied

wel 11 1

2 from 0.02 to 127.6 picocuries per gram, the statistical
3 uncertainty in the average value would indicate that there
4 is no significant difference in the Shippingport between
5 upstream and discharge locations, or between the 1959-1960
6 period and the present time.

7 Q Dr. Goldman, I refer you now to Appendix 7-1,
8 which is in Intervenor's Exhibit 10-B.

9 I refer you there to the text that's been
10 admitted in evidence here, including the Table A and Table B
11 of Appendix 1, and the first figure, which is Figure 1 but
12 not marked on the copy that we received, of gross beta
13 radioactivity in water during the period 1964 through 1971,
14 at five different locations in and around Pittsburgh.

15 Now, in this Appendix 7-1, Dr. Sternglass has
16 presented data on Ohio River radioactivity concentrations
17 to support his theory of excessive discharges from Shipping-
18 port.

19 Dr. Sternglass here claims that the water quality
20 monitoring efforts of the Pennsylvania State Department of
21 Health indicated in 1964 and again in 1970 that gross beta
22 radioactivity in the Ohio River, measured at Midland, one
23 mile below the plant, exceeded by many times the activity
24 measured in the Allegheny and Monongehela Rivers, which form
25 the Ohio River some 25 miles upstream from the plant.

I'm referring specifically to the second paragraph

wel 12 1 at page 1 of Appendix 7-1.

2 Have you examined this claim by Dr. Sternglass on
3 the data set forth in the tables in Figure 1, and do you
4 have any comment on the claim and the data set forth in
5 support of the claim?

6 A Yes, I have examined this and found no merit
7 whatsoever in this claim.

8 At the outset, the Pennsylvania State Department
9 of Health did not sample water at Midland one mile below
10 the plant, as claimed by Dr. Sternglass, but on the Ohio
11 River on a bridge on Route 30, in East Liverpool, Ohio,
12 below Rochester in Beaver County, Pennsylvania, a location
13 about six miles below the Shippingport plant. And the data
14 used by Sternglass was from that location.

15 The Sternglass analysis ignores radioactivity
16 data taken at Sewickley, Pennsylvania.

17 Q Could you spell that?

18 A S-E-W-I-C-K-L-E-Y. -- below the confluence of
19 the Allegheny and Monongahela Rivers, and upstream of
20 Shippingport, in favor of data taken on the Allegheny over
21 24 miles upstream at Natrona, and 45 miles upstream at
22 Kitanning, K-I-T-A-N-N-I-N-G, above the confluence with the
23 Monongahela, and on the Monongahela at the third sampling
24 station at Greensboro, over 85 miles above its confluence
25 with the Allegheny.

vel 13 1

2 If one were to attempt an honest evaluation of
3 this type of selected sampling stations, it should be as
4 close as possible up and down stream of the plant in order
5 to minimize other potential sources, and to make a material
6 balance at least reasonably realistic.

7 In this instance these other sources would
8 include, in addition to major drainage areas for fallout and
9 natural radionuclide contributions, potential contributions
10 from hospitals, universities and industrial sources, and
11 various radionuclides in the greater Pittsburgh area.

12 At least one major tributary with one major
13 nuclear installation on it, a tributary to the Monongahela,
14 the Youghiogheny River, is excluded by the choice of sampling
15 stations.

16 The third major difficulty in this analysis arises
17 from the basic concept of using a measurement referred to
18 as gross beta activity as a consistent indicator of absolute
19 radioactivity content about which material balances can be
20 made.

21 The gross beta measurement is, itself, highly
22 indeterminate on an absolute basis. Its only purpose is to
23 serve as an indicator of the need for more specific and
24 precise isotopic measurements. For example, the type of
25 detector used will itself radically change the measurement.

As an example, a proportional counter may be used,

14 and one may be used with or without a window. However, the
2 windowless counter will be much more responsive to low-energy
3 beta particles than will the windowed version.

4 Since the energy spectrum of radioactive material
5 in a so-called gross beta sample is unknown, the true
6 counting efficiency cannot be known; and hence, the absolute
7 activity reported can only be an estimate, even for the same
8 laboratory and for the same instrument.

9 Comparison of gross beta measurements between
10 laboratories are even more meaningless.

11 A fourth major difficulty is created by the
12 absence of any attempt at all to use river flow and radio-
13 activity data to approximate a material balance. No
14 indication is made by Sternglass of the relative importance
15 of the contributions of the Allegheny and the Monongehela
16 to the combined flow in the Ohio.

17 Thus, a simple-minded use of a difference in
18 activity concentration in two river sections is meaningless,
19 since it does not reflect the total number of curies con-
20 tributed by each tributary stream.

21 The specific shortcomings in Sternglass' data
22 in Appendix 7-I are identified in the following sections,
23 and reference to this appendix and the tables, particularly
24 Table A and Table B may be helpful in following these
25 comments:

PAGE 10
EXHIBIT 1

1 In table A of Appendix I there is a value noted --
2 MR. CHARNOFF: Excuse me, is that Appendix I
3 or Appendix 1?

4 WITNESS GOLDMAN: I am sorry, Appendix I --
5 Roman I.

6 MR. CHARNOFF: Go ahead.

7 WITNESS GOLDMAN: In ^{label} paragraph A of this Appendix
8 there is a value listed for the Ohio and Midland, which as
9 I indicated would represent the Pennsylvania station at
10 East Liverpool, there is a value indicated for the third
11 quarter of 1964 of 17 picocuries per liter. There was no
12 third quarter sample taken in 1964 reported by the Pennsylvania
13 State Department of Health.

14 The value of 17 indicated in the table for the
15 Midland Station was in fact reported from November, 1964,
16 the fourth quarter of that year; and it was reported as 17
17 plus or minus 4 picocuries per liter.

18 BY MR. CHARNOFF:

19 Q And was that taken, sir, at Midland or East
20 Liverpool?

21 A No.

22 All of the Pennsylvania Department of Health data
23 that are reported by Dr. Sternglass from Midland are in fact
24 taken at East Liverpool, Ohio by the Pennsylvania Health
25 Department.

1 Second, although the text on page 2 of this
2 exhibit, and the first ~~table~~ ^{figure} if you recall Figure 1 in
3 Appendix 7-1, showed the radioactivity data for the Allegheny
4 at Natrona, Table A, sites, the Allegheny at Kitanny -- which
5 is about 18 miles farther upstream than Natrona -- and is
6 above the confluence of the Kiskiminetas River -- and I'll
7 spell that.

8 Q Dr. Goldman --

9 MR. BARON: Will you advise me when you switch
10 from table to table?

11 WITNESS GOLDMAN: I am still on Table A.

12 The Kiskiminetas River has a significant drainage
13 basin -- over 1,800 miles -- of its own, and undoubtedly
14 would contribute some radioactivity in addition to its
15 substantial flow. The value cited by Sternglass for the
16 third quarter of 1964 for this station was again not measured
17 in the third quarter, but was reported for November of 1964,
18 the fourth quarter by the State of Pennsylvania. And they
19 reported a value 3 plus or minus 3 picocuries per liter.
20 There was no third quarter data.

21 Third, in this Table A, no contribution at all
22 from the Monongehela River is considered, despite the fact
23 that in his methodology he indicates that he is averaging
24 the Allegheny and Monongehela River to arrive at an upstream
25 value.

1 Although in fact no 1964 data at all reported for
2 the Greensboro Station, which is the station he indicated he
3 was using, there was a downstream station in operation and
4 measurements available at a lower location on the Monongehela
5 just above its confluence with the Allegheny, and values
6 were available for use in the third and fourth quarters of
7 that year.

8 Thus, in the analysis of the 1964 - 65 data
9 Dr. Sternglass failed even to follow his own model of
10 considering the upstream data to be comprised of the
11 input from both tributaries to the Ohio.

12 Fourth, in looking at the fourth quarter, 1964
13 data reported by Dr. Sternglass at Midland, in Table A,
14 the 9 picocurie per liter value, there were in fact -- the
15 value reported by the State of that number -- 9 plus or minus
16 4 for January of 1965, which is not the fourth quarter of
17 1964.

18 A value for February also for the first quarter
19 of '65, was also reported by the State as 10 plus or minus
20 4 picocuries per liter. Thus, if any value were to be used
21 at all, the correct average of the first quarter values for
22 1965 would reflect both January and February, and should have
23 been 9.5 plus or minus 5.6 picocuries per liter.

24 Fifth, the Allegheny values for the first quarter
25 of 1965 were reported by the State as 5 plus or minus 3, and

jrb4

1 7 minus 3 for January and February, respectively, for a mean
2 of 6 plus or minus 4.2 picocuries per liter, rather than
3 the value of 7 indicated by Sternglass.

4 Thus, in this table not one of the
5 radioactivity values used by Sternglass is correct. He has
6 moved data from one calendar quarter to another, and ignored
7 limits associated with the values. He has conceded no
8 contribution at all from the Monongehela River, and no attempt
9 at all was made to produce an even approximate material
10 balance by considering the flow rates of the tributary
11 streams.

12 BY MR. CHARNOFF:

13 Q Pardon me, Doctor.

14 Have you performed or attempted to perform such
15 a material balance for the 1964 period in question?

16 A (Dr. Goldman.) Yes, I did. But only for one
17 month -- November of 1964 -- in which consistent flow and
18 radioactivity concentration data were available at the
19 stations to be used.

20 I used the Ohio River at *Sw Swickley* Zwickley(?), the Beaver
21 River, and Raccoon Creek and major flows immediately upriver
22 from Shippingport. I should stress, however, that the
23 material that I balanced this gross beta activity with is
24 not a valid or consistent substance, and that the single
25 sample for radioactivity in each of these streams is not an

1 appropriate representation of the ^{monthly} ~~month~~ and the mean values;
2 because these values can vary from one day to the next, and
3 from one week to the next.

4 Q What does that balance show as the difference in
5 concentrations between East Liverpool and the upriver region?

6 A Well, recognizing the warnings I gave in my
7 previous answer, the net difference I calculated was 3.5
8 plus or minus 5.4 picocuries per liter. Since the error of
9 the estimate is larger than the mean, I would regard it as
10 not significantly different than zero.

11 Q But you continued, then, with your analysis of
12 the data in Exhibit 10-B?

13 A Yes.

14 In Table B, now, dealing with the 1970 release
15 of this Appednix --

16 Q Table B of Appendix 1 to 7-1, is that right?

17 A Yes.

18 In this Table, Dr. Sternglass has added the
19 Monongehela River, although even with this he neglects the
20 relationship of the flows in these rivers, in attempting any
21 sort of valid material balance.

22 For example, in 1970, the ratios of quarterly
23 flow in the Allegheny, was added to the Monongehela near
24 their confluence -- were 1.36 in the first quarter -- I might
25 say that means that the flow in the Allegheny was

1 136 percent of that in the Monongehela. In the second quarter
2 it was 179 percent of that of the Monongehela, and in the
3 third quarter it was 607 percent of that in the
4 Monongehela. And in the fourth quarter, 272 percent of that
5 in the Monongehela.

6 Therefore, any attempt to average the activities
7 in these two rivers to arrive at a valid contribution
8 upstream of the Shippingport plant must recognize those
9 factors: The average values provided in Table B by
10 Dr. Sternglass do not recognize them at all, and invalidate
11 that analysis.

12 Further, in reviewing the radioactivity data in
13 Table B it is apparent that Sternglass has manipulated the
14 calender again. The State data on the Allegheny River at
15 Natrona show no sample for the third quarter of 1970. They
16 show two samples in the second quarter, April and June, of
17 6.7, plus or minus 4, and 6 plus or minus 4 picocuries per
18 liter respectively, averaging 6.4 plus or minus 5.7.

19 Thus, the third quarter so-called upstream
20 average is invalid on this basis alone.

21 And second, the State data on East Liverpool
22 sampling again called Midland by Dr. Sternglass -- show no
23 fourth quarter data. Two values are shown for the third
24 quarter, 9 plus or minus 4, and 18 plus or minus 5 pico-
25 curies per liter, for July and September samples

1 respectively.

2 Dr. Sternglass has conveniently removed the
3 third quarter sample into the fourth quarter of 1970 to make
4 his analysis.

5 If the correct value were to be used for the
6 third quarter, downstream end Ohio and Midland value would
7 be 13.5, plus or minus 6.4 picocuries per liter. The fourth
8 quarter value, as I mentioned, of 18, shown by Sternglass
9 in this table for Midland, does not exist.

10 Considering the choice and misapplication of the
11 sampling stations, the flexible application of state data
12 to calendar quarters in which it was needed, the basic
13 inadequacy of the approach by Dr. Sternglass to any form of
14 material balance, the use of a single grab sample to represent
15 the calendar quarter, and the dependence on such an
16 undefinable material as gross beta activity, it is my view
17 that this attempt to show an otherwise unknown contribution
18 of Shippingport to the Ohio River can only be characterized
19 as unscientific nonsense.

20 I should add that the same conclusion -- although
21 perhaps more kindly -- has been stated by William Rowe,
22 the Deputy Administrator of the Office of Radiation Program,
23 EPA, last week before the Governor's Fact-Finding Committee
24 in Altoona, Pennsylvania, and as well by the AEC.

25 Although I have complete copies of both statements

1 which I would be pleased to provide the Board and parties,
2 two of Mr. Rowe's --

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3 MR. BARON: I will object to that, Mr. Chairman.
4 He is now going into what somebody else has said.

5 MR. CHARNOFF: Mr. Chairman, I would like to mark
6 and distribute Applicant's Exhibit No. 12, which is the
7 Testimony by Mr. Rowe before the Governor's Fact-Finding
8 Committee at the hearings in Aliquippa, Pennsylvania.

9 BY MR. CHARNOFF:

10 Q I will ask whether this is the testimony you were
11 just referring to, Doctor?

12 A (Dr. Goldman.) Yes, it is.

13 MR. CHARNOFF: I would move that this
14 testimony be received in evidence, Mr. Chairman, and we need
15 not let Dr. Goldman read into the record at this point the
16 observations by Mr. Rowe on the analysis.

17 CHAIRMAN FARMAKIDES: Any objection?

18 MR. BARON: Of course, Mr. Chairman, it's pure
19 hearsay to me. This is a significant thing. Dr. Goldman is
20 here to testify. He has given his own analyses of these
21 works. I cannot see that we should permit him, regardless of
22 his own qualifications, to testify as to what somebody else
23 has said.

24 CHAIRMAN FARMAKIDES: Mr. Davis?

25 MR. DAVIS: Mr. Chairman, the Staff does not see

jrb9

1 the relevance of this testimony, and until we read it --

2 MR. BARON: Regardless of whether it's relevant,
3 it's hearsay.

4 CHAIRMAN FARMAKIDES: I know it's hearsay. And
5 as I said frequently this Board will admit hearsay, if it is
6 relevant, and if there is a purpose.

7 But, now, at this point in time, and until the
8 Board looks at it, too, and in view of the objection we are
9 going to defer ruling until the Board has had a chance to
10 look at it.

11 MR. CHARNOFF: May I state, Mr. Chairman, that
12 position is certainly agreeable to the Applicant, and that
13 this testimony was the introductory statement by Mr. Rowe
14 last week at the Governor's Fact-Finding Committee. It
15 served to introduce into the record of that hearing the EPA
16 report of July 20, and it commented specifically on the data
17 in Tables A and B of Appendix I to Dr. Sternglass' paper,
18 which is also being analyzed by Dr. Goldman.

19 And we thought, since it is an official statement
20 by a high executive of the Environmental Protection Agency,
21 testifying on behalf of that agency, that it would be
22 appropriate.

23 CHAIRMAN FARMAKIDES: Mr. Charnoff, in view of the
24 discussions that you will be having with Mr. Baron and
25 Mr. Davis on the list of the exhibits, there is no reason

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1 why you can't add this to the discussion. Perhaps we can
2 draw up a stipulation on the exhibits of the Intervenor as
3 well as this one.

4 MR. CHARNOFF: All right, thank you.

5 CHAIRMAN FARMAKIDES: Now, let's proceed.

6 BY MR. CHARNOFF:

7 Q Dr. Goldman, can you conceive of any explanation
8 which would produce elevated river levels from radioactive
9 releases other than liquid discharges?

10 A (Dr. Goldman.) Well, only in the event of
11 atmospheric discharges which contained large quantities of
12 short-lived radio gases which decay to particulate material,
13 susceptible to precipitation, scavenging, and ^{deposition} ~~positioning~~
14 or, of course, large quantities of particulate materials
15 themselves.

16 This is true, for example, of atmospheric weapons
17 testing which all fission gases as well as particulates
18 are released immediately to the atmosphere and do, of course,
19 find their way into surface waters including rivers.

20 Q And this would not be a reasonable explanation
21 for reactor discharges, is that right?

22 A No, it would not be a reasonable explanation for
23 reactor discharges.

24 Now, the decay period within the cooling circuit
25 and gas hold-up system within power plants, and particularly

jrb11

1 within pressurized water plants, is sufficiently long to
2 preclude any significant discharge of materials except the
3 longer-lived noble gases; and these do not produce radioactive
4 daughters.

5 The only other possible addition to this might be
6 very small quantities of radio-iodines.

7 Q Would it be unreasonable, therefore, Dr. Goldman,
8 to exclude water radioactivity data taken at Zwickley(?)
9 which is about 20 miles upstream from the Shippingport plant
10 on the theory that one is seeking to avoid fallout at that
11 location from gaseous releases from Shippingport?

12 A Yes.

13 The particulate, as I mentioned, because of the
14 PWR's -- and Shippingport is a PWR -- have an extremely
15 long hold-up time within the basic system; and usually will
16 provide extremely long hold-up in gas wastes systems.
17 Extremely small quantities of noble gases and only long-
18 lived noble gases are discharged from this plant; so that
19 "fallout" -- as you characterized it -- from these discharges
20 would not be conceivable, let alone significant.

21 Q Now, this morning -- perhaps it was after lunch --
22 Dr. Sternglass testified to a general kind of conclusion that
23 it was his observation that high readings that have been
24 detected must be attributable to some sizeable particulates
25 which would have escaped in gaseous releases, and then

1 deposited on the ground, and then flowed into the river.

jrbl2

2 Do you find that hypothesis a reasonable one,
3 sir, in light of all the data that we have discussed here
4 today?

5 A No.

6 I don't find that believable at all. In order to
7 obtain the quantities of particulates, the long-lived
8 strontium-90, cesium-137, for example, that would be necessary
9 to attribute all of the environmental levels of these
10 two radionuclides to power reactor operations -- or any
11 reactor operations -- would require releases or release
12 rates of their gaseous precursors of hundreds of thousands
13 of times as great; because of the difference in the half-
14 lives, the amount of activity in parent-daughter relationship
15 is inversely related to the relationship in their half-lives.

16 Thus, long half-lived daughters like strontium-90
17 or cesium-137, with very short-lived gaseous precursors,
18 would require the gaseous precursors to be present in quanti-
19 ties which almost stagger the imagination. They could not
20 sneak out of a plant unobserved.

21 Q Thank you.

22 MR. CHARNOFF: Mr. Chairman, I have and would like
23 to introduce at this time two documents that we were going
24 to introduce into evidence, and which Mr. Baron specifically
25 said he would like to. And I would like to hand them out

1 as Applicant's Exhibits 13 and 14.

jrbl3

2 They are the EPA Report of July 20, 1973, and the
3 AEC May 1973 Assessment of Environmental Radioactivity in
4 the Vicinity of the Shippingport Plant, which I would propose
5 be received in evidence at this time -- unless the Board
6 simply wants to defer this to tomorrow.

7 I think we did agree that the specific documents
8 would go in, and that this might provide the Board with
9 something to do tonight besides going to the Cleveland
10 Browns football game.

11 (Laughter.)

12 CHAIRMAN FARMAKIDES: I don't know what you're
13 going to be doing, Mr. Charnoff, tonight, but I'm going to
14 be reading the transcript.

15 (Laughter.)

16 MR. BARON: Mr. Chairman, I have some other plans,
17 I have a meeting tonight.

18 (Laughter.)

19 CHAIRMAN FARMAKIDES: Mr. Charnoff, while we are
20 doing that, can we clarify the record a little bit with a
21 question to Mr. Goldman at this time?

22 Number one, Mr. Charnoff asked you whether one
23 could use or not use data at Zwicky(?) as upstream data
24 for this kind of measurement; and I am sorry -- I thought
25 I understood you to say you would reject that data?

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1 WITNESS GOLDMAN: No.

2 DR. SHON: Later on it appeared you would accept
3 it.

4 WITNESS GOLDMAN: Yes.

5 The question was whether I would reject the data
6 at Zwicky(?) because it might be contaminated by gaseous
7 contamination from Shippingport.

8 DR. SHON: I see. And you would not reject it?

9 WITNESS GOLDMAN: I would not reject it.

10 DR. SHON: You did not say exactly what that data
11 showed, did you?

12 WITNESS GOLDMAN: Yes.

13 This was the data on which I based the material
14 balance for the one month that I did attempt.

15 CHAIRMAN FARMAKIDES: Let me understand you,
16 Mr. Charnoff: You are offering this but you -- for identifi-
17 cation only?

18 MR. CHARNOFF: I am offering it to be received in
19 evidence today. I think we might as well do it. It's here.
20 The parties had specifically asked that these documents be
21 received.

22 CHAIRMAN FARMAKIDES: Let the record be very
23 clear;

24 Applicant's Exhibit 12 was offered only for
25 identification.

jrb15 1

MR. CHARNOFF: That's correct.

CHAIRMAN FARMAKIDES: All right.

(The document referred to, "Testimony by W. D. Rowe, Before the Governor's Fact-Finding Committee at Hearings in Aliquippa, Pennsylvania, July 31, August 1 & 2, 1973," was marked Applicant's Exhibit No. 12 for identification.)

XXXXXXXXX 10

11 CHAIRMAN FARMAKIDES: Now we are talking about
12 Applicant's Exhibit 13, and Applicant's Exhibit 14, offered
13 for identification and into evidence?

14 MR. CHARNOFF: That's right.

15 Applicant's Exhibit 14 is the AEC May '73 Summary
16 Report on the Assessment of Environmental Radioactivity in
17 the Vicinity of the Shippingport Power Station.

18 CHAIRMAN FARMAKIDES: Mr. Baron, I assume you have
19 no objection, and that these are the documents you were
20 referring to?

21 MR. BARON: No objection.

22 CHAIRMAN FARMAKIDES: Mr. Davis?

23 MR. DAVIS: No objection.

24 CHAIRMAN FARMAKIDES: They will be marked and
25 received.

1 (The document referred to,
 2 "Assessment of Environmental
 3 Radioactivity in the Vicinity of
 4 Shippingport Atomic Power Station,
 5 July 20, 1973 (Eastern Environ-
 6 mental Radiation Facility, Montgo
 7 Montgomery, Alabama, was marked
 8 Applicant's Exhibit 13 for
 9 identification, and was received
 10 in evidence.)

11 The further document referred to,
 12 "Summary Report on the Assess-
 13 ment of Environmental Radioactivity
 14 in the Vicinity of the
 15 Shippingport Power Station,"
 16 (U.S. Atomic Energy Commission),
 17 was marked Applicant's Exhibit
 18 14 for identification, and was
 19 received in evidence.)

20 MR. CHARNOFF: Mr. Chairman, I have no further
 21 direct evidence by these witnesses. They are available
 22 for cross-examination.

23 CHAIRMAN FARMAKIDES: All right.

24 MR. Baron, cross?

25 M . BARON: Yes, Mr. Chairman.

jrbl7 1

CROSS-EXAMINATION

~~XXXXXXXXXX~~ 2

BY MR. BARON:

3 Q Dr. Goldman, throughout your testimony, your
4 review of all of the reports and tables of Dr. Sternglass,
5 it seems you have indicated and made it a point of indicating
6 this "selective" method; or, to put it another way, the
7 "Sternglass methodology".

8 Basically, what you are saying -- and I don't
9 think you intend to infer that it is deliberate or insidious
10 or anything of that nature -- is that he is mistaken? He
11 is in error? Is that correct?

12 A (Dr. Goldman.) I think that the impression that
13 I have had of the presentations made by Dr. Sternglass
14 is that where he can find data that suits his theories, he
15 will use it. If he finds data that does not suit his
16 theories, he will not use it. And where there is a conflict
17 in data available, he will select that which supports him
18 and reject that which does not.

19 Whether that is "insidious" or "mistaken," I
20 don't know.

END 10

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BY MR. BARON:

2 Q Let's not play semantics. Let's get down to
3 what I'm driving at. You have indicated here with respect
4 to your testimony, you talked about reanalysis on several
5 occasions by NUS, your company or the company of which you're
6 a high officer. You have indicated that soil samples cannot
7 be located for retesting purposes or reanalysis purposes,
8 and I wonder then as to the competency and the accuracy of
9 your staff that made the original analyses which were apparently
10 later on determined by your company to be apparently grossly
11 in error.

12 Can you go into that, please, because you have
13 indicated this has happened with respect to every one of the
14 points in Exhibit 10A that you talked about.

15 A (Er. Goldman.) That's correct.

16 The staff that worked on the analyses
17 reported originally in 1971 are no longer employed by us.

18 Q They were all fired en masse?

19 A I'd like to think it was somewhat more selective
20 than that.

21 Q How many people were involved in the original
22 analyses?

23 A At one time or another, five.

24 Q What were their degrees and what were their
25 capabilities?

ln2 1 A Their degrees were variable from a Ph.D. in
2 radiochemistry to a two-year college Associate level.

3 Q And who would have been the person responsible for
4 their initial hiring?

5 A The person responsible for their -- well, they
6 were hired by different people because they occupied different
7 positions.

8 They were, as I mentioned, people ranging from the
9 supervisor of the laboratory to technicians basically,
10 chemical technicians in the laboratory.

11 The supervisor was hired by one individual. The
12 technicians were hired by somebody else.

13 Q What prompted the reanalysis?

14 A The reanalysis was prompted by the Interim
15 Report of the EPA which came out in, as I recall, April or
16 May that indicated they found no basis for the -- for other
17 sources of this and raised the suspicion of analytical error.

18 Q Did any of Dr. Sternglass's published works or
19 testimony have anything to do with the reanalysis performed by
20 your company?

21 A I think Dr. Sternglass certainly provided my
22 company a useful service in stimulating the whole question to
23 begin with back in January.

24 Q And so then an entire new staff or new group of
25 people made the reanalysis?

ln3 1 A No, no, that's not exactly the case.

2 At least two of the original staff made the -- two
3 of the staff who were involved in the original analyses are
4 still employed and were involved in the reanalysis.

5 Q Now, with respect to, again forgive me and
6 indulge me because I'm not familiar with how this is done, --
7 the reanalysis obviously had to begin with a sample?

8 A That's correct.

9 Q And these samples had to be gathered. You didn't
10 have the original samples?

11 A Yes, we did have the original samples.

12 Q Some of which had been lost?

13 A No, if I can clarify: We had been unable to
14 locate the samples back in January when Dr. Sternglass first
15 brought these anomalies to our attention and everyone else's.

16 We did not really expect to find any samples because
17 we do not normally keep samples for longer than about a year
18 after they have been analyzed so that we would have samples
19 and would expect to find samples for 1972, for example, at
20 the beginning of 1973.

21 We would not have expected to find samples that
22 went back to early or mid 1971. The search that was made it
23 turned out afterward appeared to have been somewhat perfunctory.

24 We were informed -- I was informed that the
25 samples could not be located. This was in January of this

ln4 1 year. In June of this year the samples were located in a
2 storage room, a rather out of the way area, but some of the
3 original samples were located.

4 Q Where was the storage room located?

5 A It's in the basement of the NUS building in
6 Rockville.

7 Q Were these samples protected in any way or
8 were they just put into the storage building in an out of the
9 way place as you have indicated?

10 A They were in cardboard cartons. The one set of
11 samples, those from, if I recall, April of 1971, were in the
12 original collection bags, the plastic bags, in which the
13 collection had taken place with the original tags and labora-
14 tory log numbers on them.

15 The September samples, the fall sample anyway,
16 was in a counting dish which is a plastic petri dish of
17 approximately three inches in diameter, an inch and a half
18 deep; and it's sealed with tape and identified with the
19 sample number.

20 Q So then you're indicating that the total amount
21 of time that passed between the original sampling and the
22 reanalysis was how long?

23 A The original samples were collected at the indi-
24 cated times in 1971. They were originally analysed in 1971.

25 Q What month; could you be specific?

ln5 1 A I can't be specific. I would need the entire
2 laboratory log to identify that.

3 It would be obviously the second half of 1971 and
4 the beginning of 1972.

5 Q And they were reanalyzed --

6 A They had been reanalyzed beginning in approximately
7 the middle of June of this year.

8 Q So that's approximately two years since they had
9 last been examined and looked at?

10 A That's right.

11 Q Now, is there any effect upon the radioactivity
12 levels of those samples with the passage of two years' time
13 sitting in a storage room?

14 A I would expect that the strontium-90 would have
15 decayed by the equivalent of two years. With a half-life of
16 30 years, that's not particularly significant.

17 Q Was that taken into account in the reanalysis?

18 A Yes.

19 Q And that can be done accurately so that you can
20 put that sample back to what it was at the time it was first
21 analyzed?

22 A With respect to strontium-90, there is no doubt
23 that the correction for decay can be made more precisely
24 than the analysis itself.

25 Q Is that true for the other elements?

ln6 1 A I would think that is largely true. For these
2 extremely low concentrations of materials, the procedures
3 and methods of analysis are quite difficult and have a fair
4 degree of uncertainty associated with them as indicated by
5 error limits that are attached to them.

6 Q Does your company, NUS, do this kind of analyses
7 for other companies constructing reactors around this country?

8 A When we can't avoid it, yes.

9 Q At the time, say, June, to what extent of
10 involvement was your company in?

11 A We are conducting either full preoperational
12 surveys or preliminary site assessments for approximately --
13 I'd say in the range of eight to ten power plant sites at
14 the present time.

15 Q And at the same time when this information first
16 came to light about the high levels, would you say the same
17 number of plants involved -- would you have the same number
18 of plants involved?

19 A I don't understand.

20 MR. CHARNOFF: Objection, clarification.

21 BY MR. BARON:

22 Q When these high levels were first made public
23 coming from the Shippingport plant, was your company involved
24 with just as many other plants as eight to ten?

25 A Approximately.

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1 Q I would assume then that when this became
2 public knowledge, it was a source of embarrassment for your
3 company?

4 A To say the very least.

5 Q So that something had to be done to remove that
6 source of embarrassment?

7 A I don't know that I would indicate that it would
8 be a removal of source of embarrassment as much as identifying
9 what our problem was and rectifying it.

10 Q Now, you have indicated, I think this was in
11 response to a question from Dr. Shon, that no regular analysis
12 had been done by your company in 1971?

13 A No. What I indicated, I think, was that we
14 started a laboratory operation at NUS in '71; that was the
15 year in which we began this kind of operation.

16 Q And you indicated that no one thought the
17 original results were too high?

18 A That's correct.

19 Q Now, wouldn't that be due to lack of experience?

20 A No, as I indicated, I think in my response to
21 Dr. Shon's question, there are, there were then and there are
22 now areas of the country in which levels of strontium-90, both
23 in milk and in soil, are at levels which were not greatly
24 dissimilar from those that we were finding; since this was the
25 initiation of a study in that area, the first one that

ln8 1 had been done, we had no basis for comparison with normality,
2 shall we say, in that area.

3 We looked at other areas of the country and
4 found not too dissimilar results and had, therefore, no
5 great basis for concern.

6 With respect to the incidents or the situations
7 involving the high radioiodine measurements, we did at that
8 time call the Shippingport power plant or Duquesne Light
9 Company to inquire as to any unusual releases because that was
10 an unusual occurrence; one that was outside the range of our
11 normal expectation of measurements.

12 Q But even though you made these phone calls and
13 some inquiries and did note these higher levels, there was
14 no reaction from the people in your company to the effect
15 that some of our subordinates, some of our people here, have
16 made a gross mistake and are in error?

17 A At the time we reported these, we were
18 not aware of any errors. The errors have come ^{to light} ~~too late~~, only
19 within the last month or two.

20 These are values that were reported well over a
21 year or more ago.

22 Q You were studying at that time other plants, I
23 think, you have indicated?

24 A Yes.

25 Q Were there any similar high levels noted?

ln9

1 A No.

2 Q Now, the same team was working on those other
3 studies?

4 A Generally, yes.

5 Q But they didn't make any errors in any of those
6 particular plants?

7 A At the moment, we are in the process of finding
8 out. All our samples have been recovered from that location
9 and are also being reanalyzed at the moment.

10 Q Can you indicate the names of those plants?

11 A One of them is the Calvert Cliffs plant.

12 Q Any others?

13 A That, I think, is the one which we have the
14 greatest basis for concern about.

15 Q And what about the others -- I assume you'll be
16 beginning to make studies of those plants as well?

17 A No, because at that period in 1971 the Calvert
18 Cliffs plant was the only one in which we had an intensive
19 program underway.

20 Q I see.

21 You indicated something to the effect that
22 residuals from weapons testing and the fallout could have
23 contributed or caused the result which he's making reference
24 to, Dr. Sternglass is making reference, as stemming from a
25 reactor?

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1 A I think the only -- let me see if I understand
2 what you're saying. There are two instances, I think, in
3 which fallout has been referred to. One is the major source
4 of a long-life radioactive material which is presently found
5 in the environment regardless of the location, strontium-90
6 and cesium-137.

7 The other refers to the radioiodine measurement
8 about which there is a disagreement or at least no resolution.
9 It is our view, the view of NUS, that the likelihood of
10 fallout contributing to that activity is substantially
11 greater than it appears to either the AEC or EPA.

12 Now, if you care to differentiate between which
13 fallout situation you're talking about, I'd be happy to
14 explain that.

15 Q I want to go back to the reanalysis.

16 With respect to the retesting, was it done by an
17 independent laboratory or was it done just by NUS?

18 A No, as I indicated in my testimony, the samples
19 were where they could be split; that is, physically separated
20 into different portions.

21 We analyzed one portion and other portions were
22 analyzed by EPA and by the Health and Safety Laboratory of
23 AEC, neither of which we own or is a subsidiary of anyone
24 else.

25 Q In the distribution of the samples, shall we say,

1n11 1 dealing them out, was there a specific indication to the
2 various agencies to whom they were being sent as to where
3 they had come from?

4 A Yes.

5 Q And you gave them all the background information?

6 A They already had the background information in the
7 sense of having copies of the quarterly reports for Beaver
8 Valley.

9 Q So if I can summarize what you're saying, you
10 are appearing here and you're saying that we made a mistake?

11 A That is correct.

12 Q In the initial analyses; that we have determined
13 that we made a mistake; and this determination is based upon
14 our reanalysis of the same samples, those of which we could
15 find?

16 A That's correct.

17 Q And you have indicated that these samples were
18 sitting in a storage cabinet in an out of the way area for
19 two years. You have discharged the people who made -- some
20 of the people who made the original analyses which up
21 until this summer apparently you would have stood behind;
22 and you're now saying we were totally wrong?

23 A That's correct.

24 Q And our own reanalysis as supported by these
25 independent agencies with our own material have corroborated

1nl2 1 what we have redetermined to be the truth or the real fact?

2 A The facts --

3 Q Is that a fair statement?

4 A I think insofar as it relates to those samples,
5 yes.

6 Q Excuse me.

7 In the distribution to these agencies, did you
8 indicate why this was being requested or why you were
9 soliciting this test or was it as Dr. Sternglass uses the
10 word "blind," was it a blind study?

11 A No, I think it was quite obvious to both agencies
12 as to why these samples were being submitted for reanalysis.
13 They had a great deal of interest in these samples and
14 analyses, EPA, since their Interim Report, the April report,
15 indicated they could make no judgment about 1971 because the
16 samples were not available for reanalysis.

17 The Health and Safety Laboratory which contributed
18 significantly to the AEC Division of Operational Safety
19 summary report also had a great deal of interest in determining
20 the facts as they related to 1971 since there is no way of
21 otherwise reconstructing what may have happened.

22 They were quite pleased in this instance to
23 serve as a check for commercial organization, a function they
24 don't ordinarily perform.

25 Q Is that a typical way of soliciting independent

ln13 1 study of a sample or of an analysis that one makes?

2 A I don't know of a typical way. In this instance,
3 there was hardly any way we could disguise these samples.

4 What I'm saying is we had to identify what was
5 being provided and the basis for its provision.

6 Q If those errors had not been made at all,
7 what would your opinion be as to Dr. Sternglass's analyses
8 using those original analyses?

9 A Well, I think, Mr. Baron, I indicated that in
10 my testimony with respect to --

11 Q Well, let me ask a different question then.
12 Would he still be wrong?

13 A Yes.

14 Q All right. For various other reasons?

15 A Yes.

16 Q Okay.

17 With respect to the other plants you were testing,
18 you indicated Calvert Cliffs is probably the only one in which
19 you're now actively doing a reanalysis?

20 A That's correct.

21 Q All right, were you doing testing of strontium-90
22 levels at other plants?

23 A Yes.

24 Q And when?

25 A Except for Calvert Cliffs, these were all after

ln14 1 1971 -- that is, 1972.

2 Q But they were prior in time than 1973 reanalysis?

3 A Yes, but I should point out that in 1972 and
4 since, starting early in 1972 and since then, we have what
5 I will refer to as quality control or quality assurance
6 checks which were not in existence in 1971 when the laboratory
7 first got underway and these analyses and checks of a quality
8 control nature have indicated to us that data in 1972 and
9 subsequent have no problems associated with them.

10 Q So you couldn't possibly make the same mistake
11 is what you're saying?

12 A I wouldn't say "never" but the likelihood of
13 significant error, I think, has been substantially reduced.

14 Q Now, were the measurements at Shippingport which
15 led to the reanalysis, do you recall, the most recent
16 measurements?

17 A The most recent samples from the Beaver Valley
18 Surveillance Program probably were collected about five or
19 six days ago.

20 Q I'm referring to the ones prior to the necessity
21 to make the reanalysis. And I'm trying to tie that in with
22 when your Quality Control Department began?

23 A The samples have been collected continuously
24 at the Beaver Valley -- or in connection with the Beaver
25 Valley Surveillance Program since early ¹⁹⁷¹~~1970~~. This is a

ln15 1 program which is still underway and still continuing.

2 The results of these analyses have been reported
3 on a regular basis to Duquesne Light Company, and the need
4 for reanalysis was apparent when Dr. Sternglass stimulated
5 our organization and Duquesne Light and the Atomic Energy
6 Commission and everybody else in January of this year.

7 At that time we felt the need for these samples
8 for reanalysis. It would have solved a lot of problems and
9 answered a lot of questions much more rapidly than it has
10 done.

11 These samples, however, were not located until
12 about one or two months ago at which time they were submitted
13 for analysis by the laboratory, by EPA, by AEC and by our
14 own lab.

15 Q All right, now those are the samples that were
16 taken in June of 1971?

17 A That's correct, April --

18 Q Okay, but still 1971. And you have indicated that
19 there's been sampling constantly right up to five days ago.

20 A That's correct.

21 Q And in 1972 sometime your lab developed a quality
22 control feature to the analysis work?

23 A That's correct.

24 Q Did you reanalyze the samplings taken since the
25 early samplings upon which you had made the mistakes?

ln16 1 A Yes, samples have been checked in early 1970 to
2 February of 1972. In fact, they were reported in the Interim
3 EPA Report, the reanalysis of soil samples taken in February
4 of 1972 were reanalyzed both by EPA and our own laboratory;
5 and, in that Interim Report, they indicated that there was
6 quite good agreement between the original values that we
7 reported, the reanalysis that we reported, and their analysis.

8 Q Of course, that wouldn't necessarily indicate
9 that the earlier levels, the ones upon which the supposed
10 mistake occurred, that that original analysis was wrong.

11 It would merely indicate that at the time of
12 these more recent samplings radiation levels were low?

13 A That's correct. That is why we wanted to find
14 the 1971 samples.

15 Q So at this point the only justification that
16 you can offer to explain these high levels, these original
17 readings being so high, is a mistake on the part of your
18 staff of five people?

19 A On the part of some individuals on the staff.

20 Q Some of the individuals.

21 You also indicated when you were commenting upon
22 Point 3 of Dr. Sternglass's Exhibit 10A, page 2, again you
23 used the word "reanalysis" and you indicated, I'm just
24 quoting here, "Original results were high."

25 You made mention of in transit exposure, meaning

1n17 1 the actual shipment of the samples? Or the measuring
2 devices?

3 A The doses accumulated by the thermoluminescent
4 dosimeters of TLD during their transportation back to Santa
5 Fe.

6 Q But again that had to be reanalyzed?

7 A That's correct. They were reanalyzed mathematically
8 rather than in a laboratory sense.

9 Q May I submit, isn't that a bit of a selective
10 readjustment of some statistics?

11 MR. CHARNOFF: Objection, Mr. Chairman.

12 MR. BARON: All right, I'll withdraw.

13 Mr. Chairman, at this point, I would ask the
14 indulgence of the panel to permit Dr. Sternglass himself to
15 ask some questions of Dr. Goldman.

16 He could go far more in the scientific realm,
17 and I would not be able to do it.

18 CHAIRMAN FARMAKIDES: Mr. Baron, the Board as
19 we said last time, was interested in any way possible to
20 expedite the hearing and to develop an adequate record, and
21 that's why we permitted you to do so last time.

22 We have a couple of unfortunate delays, however,
23 occasioned by this procedure; and we then asked you to take
24 a more direct hand in coaching the questions of Dr. Sternglass.

25 Now, we'll permit you to proceed in the way we

ln18 1 settled on at the last evidentiary session; and we hope
2 that the question of Dr. Sternglass are not complex and they
3 can be answered with a very simple yes or no answer, and they
4 can be connected.

5 MR. BARON: Well, these were notes that he had
6 been making with respect to the testimony as it was being
7 given by Dr. Goldman and I would assume that he . . .

8 CHAIRMAN FARMAKIDES: All right, Dr. Sternglass,
9 proceed, sir.

10 BY DR. STERNGLASS:

11 Q Now, Dr. Goldman, is it then correct that you have
12 stated that you believe that these high levels of TLD
13 readings are essentially due to the transit going down to
14 New Mexico, that they were exposed in the airplane?

15 A Yes, as I testified, we have measurements of
16 *in transit duration* ~~in transit~~ and dose that are highly variable and substantial
17 and that this would appear to be responsible for the bulk
18 of the nominal uncorrected exposure value.

19 Q Now, I now show you a set of diagrams which we
20 want to mark as an exhibit.

21 MR. CHARNOFF: Excuse me, this is marked
22 Applicant's Exhibit 11.

23 MR. BARON: That shows you the hour. It's
24 Intervenor's, I'm sorry.

25 CHAIRMAN FARMAKIDES: So, Dr. Sternglass, you're

ln19 1 really offering Intervenor's Exhibit 11 which is the external
2 dose rates of the NUS Corporation of 1971, Ambient
3 Radiation Dose Rate Against the Town of Shippingport Reactor?

4 MR. STERNGLASS: No. 43, right.

5 BY MR. STERNGLASS:

6 Q Dr. Goldman, are you generally familiar --

7 MR. CHARNOFF: Excuse me, are we only talking
8 at the moment to the top?

9 MR. STERNGLASS: The first to the top, A; call
10 it A.

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CHAIRMAN FARMAKIDES: Are you talking about the graphs relating to the Town of Shippingport, Station number 10?

DR. STERNGLASS: Right. The first sheet.

CHAIRMAN FARMAKIDES: All right. Be specific, sir. Identify the exact space that you're talking about.

DR. STERNGLASS: Right.

BY DR. STERNGLASS:

Q Are you familiar -- do you generally recognize the pattern of external dose rates read by the original raw dosimeters, as reported in NUS? This is taken from the report. Do you generally agree with it? I mean subject to your further verification?

A (Dr. Goldman) I have no basis for questioning it, or agreeing with it.

Q All right.

Now, down below you see the on site Shippingport reactor, Station number 13. You have --

MR. CHARNOFF: Excuse me, Mr. Chairman and Dr. Sternglass. The chart says external dose rates, NUS Corporation. Is this represented to be a NUS chart, or is this --

DR. STERNGLASS: It's taken from data prepared by NUS, and then plotted in this manner.

MR. CHARNOFF: Who did the plotting?

DR. STERNGLASS: I did the plotting.

MR. CHARNOFF: I see.

25

wel 2 1

BY DR. STERNGLASS:

2 Q Now, would you tell me what is the top reading,
3 the maximum reading, for the Town of Shippingport, for that
4 time interval, which, by the way, begins in early '71 and
5 ends in late -- in early '72?

6 A (Dr. Goldman) I can't identify specific times
7 from the intervals shown, but on the top curve there --

8 Q Yes, at the --

9 A -- is a value shown of --

10 Q -- three --

11 CHAIRMAN FARMANIDES: Dr. Sternglass, let the
12 witness answer, sir.

13 THE WITNESS: 371 mR per year.

14 BY DR. STERNGLASS:

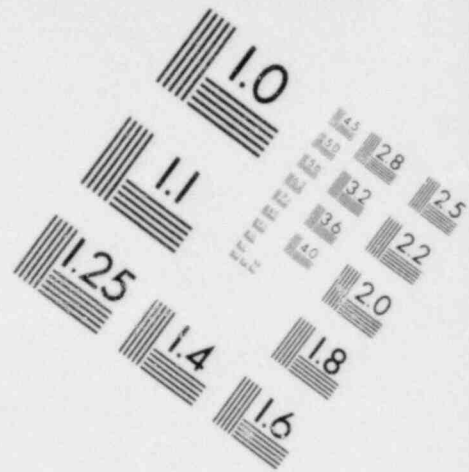
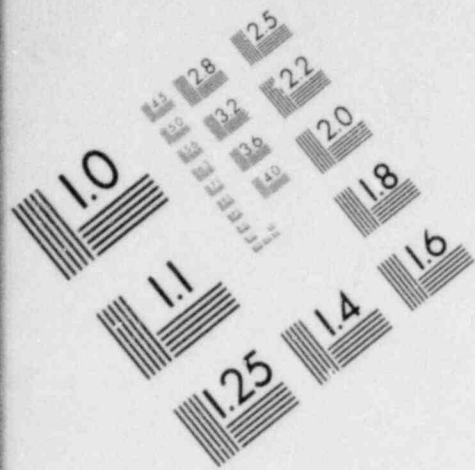
15 Q Would you say at the same time, down below, what
16 is the maximum reading for station number 43 on-site
17 Shippingport reactor?

18 A (Dr. Goldman) I wouldn't characterize it as a
19 reading, because I'm quite sure that none of our TLD's
20 reported 410 millirad per year. The rate that has been
21 extrapolated from the reading appears to be 410 millirem,
22 or mR, per year.

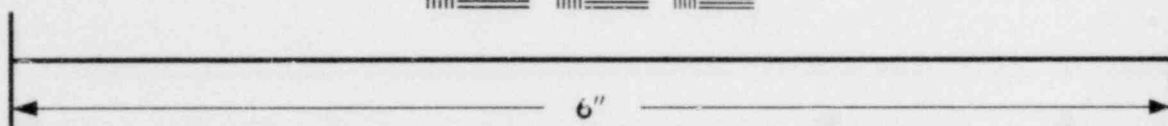
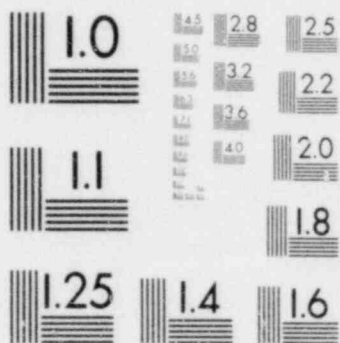
23 Q Now, I want to have you turn to the second page --

24 MR. BARON: Let's mark that B.

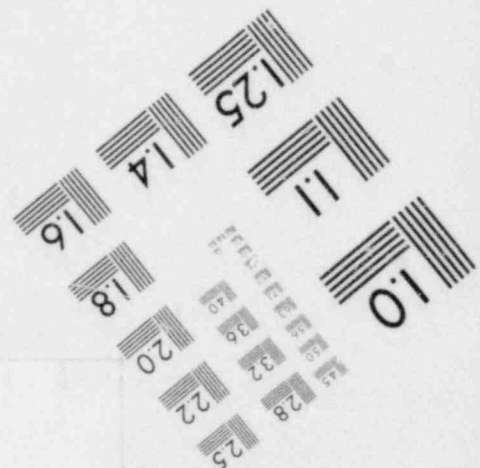
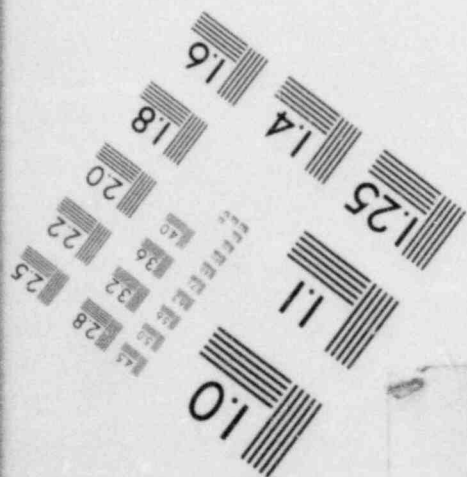
25 DR. STERNGLASS: Yes. Mark that as Exhibit 11.

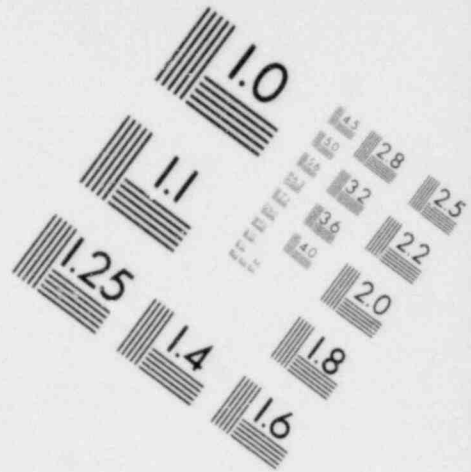
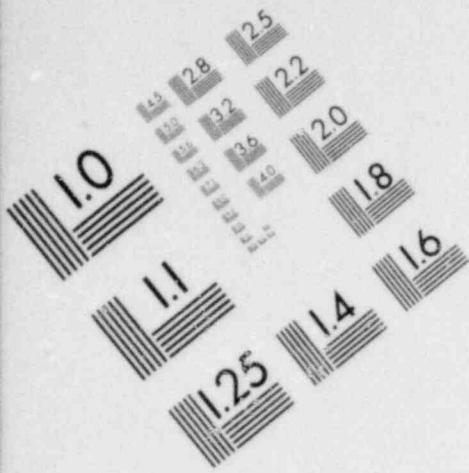


**IMAGE EVALUATION
TEST TARGET (MT-3)**

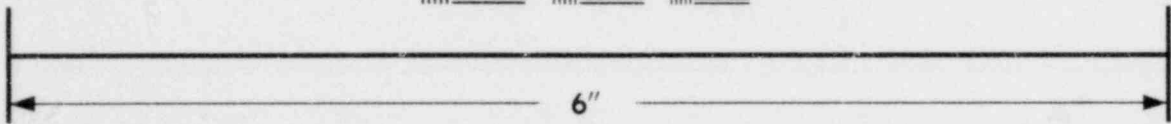
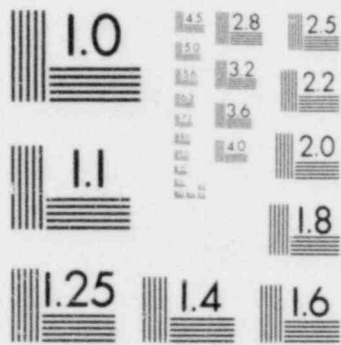


MICROCOPY RESOLUTION TEST CHART

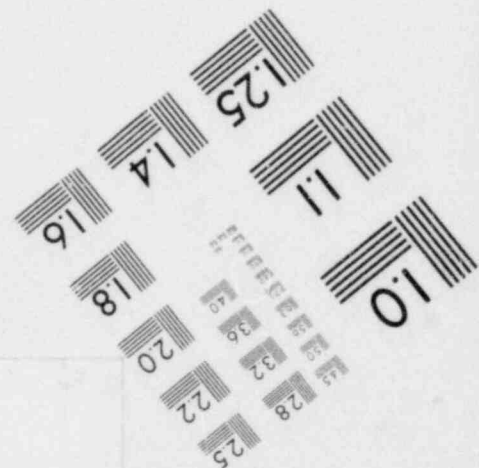
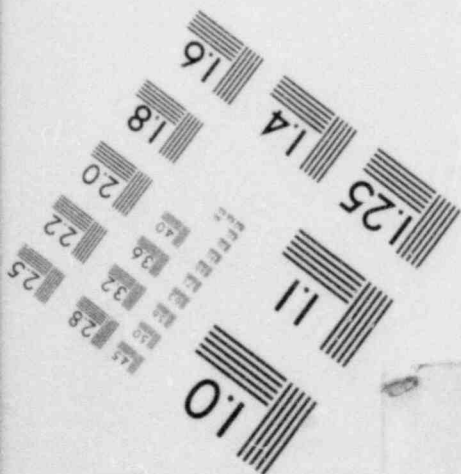




**IMAGE EVALUATION
TEST TARGET (MT-3)**



MICROCOPY RESOLUTION TEST CHART



wel 3 1

BY DR. STERNGLASS:

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Q This, then, refers to the period of highest dose reading, when 371 and 410 occurred in the Town of Shippingport, and I would like you to characterize which of these are now the highest on this basis for this time interval, February '72.

6

7

A (Dr. Goldman) Well, the highest indication there is still a bar headed 410 on site.

8

9

Q Right. And there's another station marked number 10 to the right, which is marked 371; is that correct?

10

11

A That's correct.

12

Q Right.

13

And to the left there are two other dosimeters shown, number 14 and number 15, at stations number 14 and number 15, characterized by Hookstown and Georgetown.

14

15

16

Would you read those numbers for me, please?

17

A 242, 259.

18

Q All right.

19

Now, Dr. Goldman, I'm going to ask you the following hypothetical question:

20

21

According to your testimony these dosimeters were all gathered together and shipped in a package down to-- is it New Mexico -- Santa Fe? Is that correct?

22

23

24

A I don't think I testified as to the method of shipment. You may confusing it with Mr. Crouse.

25

wel 4 1 Q Well, whichever, they were shipped. I understood
2 it was cosmic rays that was involved. Whichever, they were
3 shipped. They were shipped to New Mexico, is that correct?

4 A That's correct.

5 Q All right.

6 Now, Dr. Goldman, I would like you to explain to
7 me or to the Board how it is possible for a small package of
8 dosimeters, all of them in a small package together, that
9 some, the ones that are located upwind by a few miles, should
10 register less cosmic rays than the ones on the site?

11 MR. CHARNOFF: Objection. There is no foundation
12 for the question, that this reading was due to cosmic rays.
13 The testimony was that there were in-transit exposures,
14 which might come from a variety of sources.

15 CHAIRMAN FARMAKIDES: Would you rephrase your
16 question, Dr. Sternglass? You might ask Mr. Baron to --

17 MR. BARON: I've already indicated it.

18 CHAIRMAN FARMAKIDES: Incidentally, while you all
19 are discussing, let's be clear about this. Intervenor's
20 Exhibit 11, that first page will be 11-A, the second page
21 will be 11-B, the third page 11-C, the fourth page 11-D,
22 the fifth page 11-E, and the sixth page, 11-F.

23 DR. STERNGLASS: Right.

24 CHAIRMAN FARMAKIDES: All right, Dr. Sternglass.

25 DR. STERNGLASS: All right.

wei 5 1

BY DR. STERNGLASS:

2 Q Dr. Goldman, how are these dosimeters shipped?

3 A (Dr. Goldman) To the best of my knowledge they are
4 shipped by air parcel post to Santa Fe.

5 Q Santa Fe. Right.

6 Would you describe roughly the size of the package?

7 A I have never seen a package --

8 Q Right.

9 Would you say the chips are very large?

10 A No, the chips are small.

11 Q How large?

12 A I think Mr. Crouse described them. I have seen
13 the TLD chips I think twice in my life, and I don't think
14 that would qualify me to make dimensional analyses of them.

15 Q Right. But you would agree that the package is
16 not required to be an enormous package, is that correct?

17 A That's correct.

18 Q All right.

19 Now, would you, therefore, in your judgment, could
20 you explain to the Board how a given package containing some
21 20 or so dosimeters could by some miraculous way lead to
22 some dosimeters to receive much more dose than others, and
23 that it should be exactly those that were on the site that
24 showed the highest dose?

25 A In the instance of the four values shown here, I

wel 6 1 have no basis for explaining any apparent differences.
2 Whether this is true continuously for all of the measurements,
3 I don't know.

4 But I have no basis for explaining the apparent
5 differences that show up in this graph.

6 Q Would you not agree that the most natural explana-
7 tion of this fact, where the on-site dosimeter shows the
8 highest reading, the upwind dosimeter showed the lowest, and
9 the downwind dosimeter showed an intermediate reading, is
10 what you would naturally expect from a source diffusing from
11 the site with the pattern being a meteorological pattern,
12 with the winds coming from the west, typically, leading to
13 lower exposures for the dosimeters at Hookstown and George-
14 town, than for the one downwind near Shippingport?

15 A No, sir, I couldn't come to that conclusion at all.
16 I have no knowledge whatsoever as to what the meteorological
17 conditions were during the period March 19 to April 1, and
18 I would not, certainly, grant that any variations in four
19 readings are any basis for that kind of conclusion at all,
20 particularly when, to the best of my knowledge, there are
21 no differences in any air samples that were taken during the
22 same period, generally in the same locations, that would
23 support the magnitude of difference implied by these individ-
24 ual readings.

25 Q Dr. Goldman, are you aware of the estimated error

wel 7 1 a standard deviation that exists for each of these dosimeter
2 readings?

3 A Not specifically, no.

4 Q Would you agree that it is of the order of plus
5 or minus ten percent?

6 MR. CHARNOFF: Objection. The witness has just
7 testified that he's not aware of it.

8 DR. STERNGLASS: All right. Then let me rephrase
9 it.

10 BY DR. STERNGLASS:

11 Q Are you aware of the fact that the two standard
12 deviation cited in your own company's measurements generally
13 are of the order of 10 to 20 percent?

14 MR. CHARNOFF: Objection. With respect to these
15 particular TLD's?

16 DR. STERNGLASS: With respect to these TLD's, yes;
17 the sigma errors are listed in the tables.

18 WITNESS GOLDMAN: All right. We'll accept that,
19 if you say so.

20 BY DR. STERNGLASS:

21 Q Yes. Now, may I ask you whether you regard a
22 deviation by something like 5 to 6 standard deviations a
23 statistically significant difference?

24 A (Dr. Goldman) I think that an anomaly is indicated
25 that I would regard as statistically ~~insignificant~~ *significant*.

wel 8 1 Q Allright. That's all I think we need to establish
2 at this moment.

3 I would like to refer you now to 11-C, and this
4 is marked 22 June 1973, Ambient Radiation Levels, number 1,
5 with number 14. This refers to a correlation test between
6 the variations of the Hookstown dosimeter upwind, and the
7 control dosimeter which is number 1.

8 Are you generally familiar with correlation
9 techniques, sir.

10 MR. CHARNOFF: Mr. Chairman, sir, may we have an
11 identification of what this document is?

12 DR. STERNGLASS: It's 11-C.

13 MR. CHARNOFF: Yes, but what is 11-C?

14 CHAIRMAN FARMAKIDES: What is this?

15 DR. STERNGLASS: 11-C is the result, a printout
16 of computer correlation data between the variations of
17 dosimeter number 1 regarded as a control dosimeter, and kept--
18 supposedly kept in Pittsburgh, and with dosimeter number 14
19 kept in Hookstown to the southwest, 2-1/2 miles to the
20 southwest of the plant.

21 MR. CHARNOFF: What is the source of this
22 correlation?

23 DR. STERNGLASS: This is a correlation which was
24 prepared by one of my assistants under my direction in our
25 laboratory, using our computer, in which we used the data,

wel 9 1

6:00 p.m. 2

3 the raw data, reported by NUS, and did, essentially, a
4 correlation study which compares the month by month
5 variations found in Figure 11-A, and tries to see whether or
6 not the two go up and down together, you understand?

7 In other words, a high correlation means in this
8 case that the two are correlated. When one goes up, the
9 other goes down.

10 CHAIRMAN FARMAKIDES: I understand what you're
11 talking about, sir. I'm just waiting to hear what else Mr.
12 Charnoff has.

13 BY DR. STERNGLASS:

14 Q The question is, are you familiar with --

15 MR. BARON: No, wait.

16 CHAIRMAN FARMAKIDES: No, no. Excuse me, but --

17 MR. CHARNOFF: We're still trying to get an
18 identification of this. This is correlation of the data
19 plotted, where did you say?

20 DR. STERNGLASS: No, no. It's taken from --

21 CHAIRMAN FARMAKIDES: Look. It's very obvious
22 what Mr. Charnoff is driving at. Let me talk to MR. Charnoff,
23 Mr. Baron and Dr. Sternglass and Mr. Davis.

24 Let's take a five-minute recess.

25 (Recess.)

CHAIRMAN FARMAKIDES: We will proceed, please.

I think, Dr. Sternglass, you were asking questions.

wel 10¹

BY DR. STERNGLASS:

2 Q Now, this happens to be addressed to Mr. Crouse.

3 CHAIRMAN FARMAKIDES: In other words, the last
4 question to Dr. Goldman has been withdrawn?

5 DR. STERNGLASS: For the moment, yes.

6 CHAIRMAN FARMAKIDES: Fine.

7 BY DR. STERNGLASS:

8 Q This question will then be addressed to Mr.
9 Crouse.

10 MR. BARON: Excuse me. Mr Chairman, for the
11 record, then, maybe we ought to put into evidence at this
12 time Intervenor's Exhibits 11-A and 11-B.

13 CHAIRMAN FARMAKIDES: Any objections?

14 MR. CHARNOFF: I'm going to object to Exhibits
15 11-A and 11-B being received in evidence, Mr. Chairman.
16 There has been no showing of basis here, unless it is
17 founded on anything other than an assertion by Dr. Sternglass
18 that he prepared it. As I understand it, he's prepared these
19 charts, and perhaps when he testifies he could introduce
20 these, but I don't think it's appropriate to introduce them
21 into evidence on cross when it's a document prepared by
22 Dr. Sternglass.

23 CHAIRMAN FARMAKIDES: Mr. Davis?

24 MR. DAVIS: We have no objection.

25 CHAIRMAN FARMAKIDES: I'm going to sustain the

111 objection. I think this is properly an exhibit to be
2 brought in through Dr. Sternglass. So you may reintroduce
3 it later, Mr. Baron.

4 MR. BARON: All right.

5 BY DR. STERNGLASS:

6 Q Mr. Crouse, have you had this examined, the
7 exhibit entitled Intervenor's Exhibit number 12, entitled
8 Radioactivity in Drinking -- well, I'll withdraw the word
9 "Drinking Water," just leave the word "water." It really
10 should be water which is ultimately used for drinking. But
11 it may be going through, you know, a treatment plant. But,
12 you know, this is the raw data from the Ohio EPA data,
13 similar to the one you have examined, and discussed, in your
14 own testimony.

15 Have you had a chance to examine this?

16 MR. CHARNOFF: May I understand this document,
17 Mr. Chairman? I don't know who prepared it --

18 CHAIRMAN FARMAKIDES: Yes. Mr. Baron, could you
19 kindly identify, please, this document for the record?

20 MR. BARON: It's been prepared by Dr. Sternglass --

21 DR. STERNGLASS: -- based on the Ohio EPA monthly
22 readings of radioactivity, and this refers to the average
23 radioactivity, average value for the particular location
24 sited; namely, --

25 CHAIRMAN FARMAKIDES: And you've marked this as

wel 12¹ Intervenor's Exhibit number 12?

2 DR. STERNGLASS: Right.

3 MR. CHARNOFF: Could we have the base points
4 identified? I could hardly read that. The left-hand point
5 is Toledo?

6 DR. STERNGLASS: Right. The one next to it is
7 Port Clinton. Mark that Port Clinton. The center one is
8 called Sandusky. The next one is called Lorain. And the
9 final one is called Cleveland.

10 BY DR. STERNGLASS:

11 Q Now, in your testimony --

12 MR. BARON: Wait, Dr. Sternglass.

13 MR. CHARNOFF: Does this represent numbers taken
14 directly from Ohio reports, or does it represent some
15 additions or subtractions or multiplications of numbers in
16 the Ohio reports?

17 DR. STERNGLASS: The values of the report in EPA
18 are added up and divided by 12. In other words, this is
19 the average of the numbers listed in the Ohio --

20 MR. CHARNOFF: So these are sums that you arrived
21 at?

22 DR. STERNGLASS: Yes.

23 MR. CHARNOFF: By adding suspended and dissolved --
24 what is this, beta or alpha, or what is it?

25 DR. STERNGLASS: This refers to, let's see -- the

wel 13 1 actual measurements -- I can refer you to the exact page.

2 MR. BARON: We'll withdraw the question, Mr.
3 Chairman, and we'll make an effort to introduce it in
4 testimony in rebuttal.

5 CHAIRMAN FARMAKIDES: All right. Let's proceed.

6 MR. CHARNOFF: Mr. Chairman, I don't want to let
7 that remark go by with any misunderstanding. As I understand
8 rebuttal testimony, rebuttal testimony is not an occasion
9 for totally new direct testimony.

10 MR. BARON: No, that's in my understanding, also,
11 Mr. Charnoff, and I assure you it'll be direct --

12 CHAIRMAN FARMAKIDES: Look. You understand that
13 the Board wants to develop a record. We're being flexible,
14 yes, but we're not going to be so terribly flexible that
15 we're going to prejudice any party.

16 MR. CHARNOFF: I understand that, sir.

17 CHAIRMAN FARMAKIDES: So I think this was a good
18 idea to withdraw this at this time. Mr. Charnoff's question
19 was seeking to determine whether or not he was going to
20 object.

21 So let's proceed.

22 DR. STERNGLASS: Excuse me for just a minute.

23 (Pause.)

24 CHAIRMAN FARMAKIDES: Off the record.

25 (Discussion off the record.)

wel 14,

CHAIRMAN FARMAKIDES: Back on the record.

2

Let's proceed, Mr. Baron.

3

4

5

6

MR. BARDON: Mr. Chairman, at this point we have no further cross-examination of Dr. Goldman and Mr. Crouse. We will hopefully develop these points in direct response through rebuttal testimony.

7

CHAIRMAN FARMAKIDES: All right.

8

Staff, any cross?

9

10

MR. DAVIS: Yes, the Staff does have -- excuse me -- no, no cross-examination.

11

CHAIRMAN FARMAKIDES: No cross? All right.

12

The Board conferring.)

13

Let's go to redirect before we go to the Board's questions.

14

15

Any redirect?

16

MR. CHARNOFF: Yes, just one or two questions of Dr. Goldman.

17

18

REDIRECT EXAMINATION

19

BY MR. CHARNOFF:

20

Q Dr. Goldman, there were some questions asked with respect to the strontium soil data that you have obtained, I guess during the period of 1972 at the Beaver Valley monitoring program.

21

22

23

24

Could you tell me what the soil strontium analyses in 1972 showed relative to the levels of strontium that are

25

wel 15¹ being found in the reanalyzed 1971 samples?

2 A (Dr. Goldman) Approximately the same.

3 Q A question was asked of you before by Mr. Baron
4 indicating that assuming that Dr. Sternglass -- I'm sorry --
5 assuming that the NUS data in 1971 was not analyzed incorrect-
6 ly, and that that first reported data was correct, would
7 Dr. Sternglass' hypothesis be right or wrong, and you
8 indicated that even so, he would be wrong.

9 Could you generally state your reasons for that
10 response?

11 A Well, I think it's based on two considerations.

12 First, the analysis of what was physically
13 available in the Shippingport plant, and, therefore,
14 potentially available as a source for environmental contamina-
15 tion, the analyses that have been made by AEC and EPA, and
16 to a limited extent by NUS, ^{for} the Eugene Light Company,
17 indicate that there was just not enough radioactive material
18 available for release from the plant to cause the observed
19 contamination, without having a major release of radioactivity
20 which would have been immediately obvious and require
21 emergency plans to be activated, et cetera.

22 That's one aspect of it.

23 The second is that the behavior of the material
24 attributed to Shippingport by Dr. Sternglass is not
25 consistent with respect to the strontium-90, for example in

16 1 soils, the claim that it decreases with distance from the
2 plant, if, in fact, really the case should be a consistent
3 pattern. If it decreased with distance from the plant in
4 the spring and the summer, it should also have decreased
5 with distance from the plant in the fall and winter.

6 And even with the originally reported data, it
7 did not do so in the fall and winter; it was either constant
8 with distance, or somewhat higher the farther one went from
9 the plant. That is, it increased with distance.

10 But just based on the original data reported,
11 the analysis by Dr. Sternglass is not consistent with a
12 release from the Shippingport plant, or a continuing release
13 from the Shippingport plant, because the environmental
14 behavior of the analyses was such as to be inconsistent
15 except for the two sets of samples that he cited, the spring
16 and summer samples, of soil.

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6:00 p.m.
PREMIUM

1 Similarly with the milk finding the drop in
2 activity in the winter of 1971 is not consistent with a
3 substantial release from the plant, and cannot be correlated
4 with meteorological conditions which would be necessary if
5 the material were to have originated at the plant.

6 For example, dairies with the highest strontium-90
7 activity in the milk normally reported initially for 1971
8 were in a direction in which the wind direction and frequency,
9 as I recall, is something on the order of two or three percent
10 of the time. This would just not be consistent with normal
11 dispersion patterns.

12 There was no indication it varies predominantly
13 in the downwind direction, that the downwind direction had
14 higher strontium-90 than those in the upwind or infrequent
15 wind directions, which would also be expected if the source
16 of the strontium-90 were the plant.

17 Therefore, it is for these reasons that I responded
18 to Mr. Baron's question that neglecting the changes in
19 analyses and even assuming that the original analyses were
20 valid, I find no support for Dr. Sternglass' theory that
21 Snippingport must have been the source of the observed
22 material.

23 MR. CHAIKOFF: Thank you.

24 I have no further questions, Mr. Chairman.

25 CHAIRMAN FARMACIDES: Any further recess?

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1 MR. BARON: No, sir.

2 CHAIRMAN FARMANIDES: Mr. Davis?

3 MR. DAVIS: None, sir.

4 CHAIRMAN FARMANIDES: All right, then. The Board
5 has a couple of questions:

6 MR. SHON: I want to direct my question, I think,
7 to Mr. Crouse. I believe you suggested that part of the
8 thermoluminescent dosimeter readings might have been an
9 artifact of handling; and in particular of exposure to
10 -- during an aircraft trip?

11 WITNESS CROUSE: That's true.

12 MR. SHON: The amount that we are talking about
13 was a number like 300 mr per year? This was the largest
14 number?

15 MR. CHARNOFF: I'm sorry. Mr. Crouse was
16 addressing himself to the Biotest TLD's. The number you are
17 talking abt it is derived from the Shippingport TLD's --

18 MR. SHON: Okay. I see. The Shippingport TLD's.
19 Were these also explicable on the same basis?

20 WITNESS GOLDMAN: To a very large extent, yes.
21 The exposure periods for these TLD's were not consistent --
22 they were not constant; some of them were for a period of
23 a few weeks; some of them were for a period of more than a
24 month. The contribution of the in-transit exposure, that was
25 of variable importance.

1 MR. SHON: I see.

2 What magnitude of in-transit exposure would they
3 have had to have received to receive an mr?

4 WITNESS GOLDMAN: In the range of 10 to 25 mr.

5 MR. SHON: I see.

6 And that is consistent?

7 WITNESS GOLDMAN: Yes, sir.

8 CHAIRMAN FARMANIDES: That is all.

9 Thank you very much, gentlemen.

10 (Witnesses Goldman and Crouse
11 excused.)

12 CHAIRMAN FARMANIDES: We will proceed with the
13 Staff -- I'm sorry, does the applicant have any further
14 direct?

15 MR. CHARNOFF: May I have a moment?

16 (Pause.)

17 MR. CHARNOFF: I have ~~no further~~ ^{Statement from} questions.

18 CHAIRMAN FARMANIDES: I am talking so you have
19 any further ~~direct witnesses~~ ^{his standpoint}, or are these your only direct
20 witnesses?

21 MR. CHARNOFF: Oh, that's right, sir.

22 CHAIRMAN FARMANIDES: All right, fine.

23 Staff?

24 MR. DAVIS: The Staff will now recall Dr. Frigerio
25 to the stand.

1 Whereupon,

2 N. FRICERIO

3 resumed the stand as a witness on behalf of the Regulatory
4 Staff and, having been previously duly sworn, was further
5 examined and testified as follows:

6 FURTHER DIRECT EXAMINATION

7 BY MR. DAVID:

8 Q Have you aided in the preparation of the
9 Environmental Statement prepared by the Regulatory Staff
10 which predicts the dose to the public, population, surrounding
11 the Davis-Besse facility from radiological releases?

12 A Yes, I have.

13 Q And you therefore, of course, are familiar with
14 the models used in that prediction?

15 A Yes, quite familiar.

16 Q Do you consider this model adequate to predict
17 the probable environmental impact of the operation of the
18 Davis-Besse station?

19 A Yes.

20 Q And are the predictions used in developing the
21 model conservative?

22 A Yes, they are conservative, generally by something
23 of the order of a factor of three.

24 Q Upon what do you base your statement that they
25 are conservative to the order of a factor of three?

A Measurements completed at various nuclear

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1 facilities -- not all of them power plants. Some of them
2 are fuel reprocessing plants, some of them other types of
3 facilities, such as the National Laboratories, as compared with
4 our model predictions of what the readings would have been;
5 and we find that in general we are between a factor of
6 one and a half and three higher than the actual measured
7 values. So we took the models at that point.

8 Q Have you studied the prepared testimony and heard
9 the oral testimony today submitted by Dr. Sternglass dealing
10 with the allegation that the computational methods used in the
11 preparation of the model for the Davis-Besse Final Environ-
12 mental Statement are inadequate?

13 A Yes, I have.

14 Q Did you find any specific discussion in that
15 testimony which specifies what actually was wrong with the
16 method for determining the dose to population from his model
17 using the Final Environmental Statement?

18 A Nothing that we could identify with knowledge of
19 models having to do with these things.

20 Professor Sternglass has cited some data which
21 he alleges is inconsistent with the models we used; but we
22 were unable to find any indication of what models he thought
23 we used, or what model he used himself.

24 But we did do the calculations for some of these
25 using our models and compared them with the data he cited.

jrb6

1 Q Have you -- have the conclusions that you have
 2 expressed dealing with the adequacy of the conservative nature
 3 of these models used in compiling the Final Environmental
 4 Statement changed as a result of your study of the testimony
 5 and of the oral testimony today?

6 A No, on the contrary, the values that Professor
 7 Sternglass brought to our attention have sort of added another
 8 confirmatory point for the models.

9 For example, with respect to the ~~Plumbrook~~ *Plum Brook* liquid
 10 releases, Professor Sternglass contends that computational
 11 methods, the ones used in the Davis-Besse RES, are in error
 12 by factors of 10^3 to 10^5 ; and he used the word "dose,"
 13 although in point of fact, he does not give any dose values.

14 However, he does give concentration values taken
 15 from the Ohio EPA reports, and we used precisely the ones he
 16 gave. For liquid releases from the Plumbrook reactor facility
 17 the Ohio EPA gave a maximum value in 1970 of 2009 picocuries
 18 per liter, measured at the facility as a grab sample. Now,
 19 using this as our base value, and what values we could
 20 obtain from Plumbrook for its flow velocity during the year
 21 1970, and the values we already have for diffusion parameters
 22 of Lake Erie in the area of Sandusky -- and I might
 23 footnote here: That the area of Lake Erie near Sandusky
 24 differs from that around Davis-Besse in that it is the
 25 transition zone between the Western Basin and the

1 Central Basin. It changes quite rapidly on the slope.

2 Using these values, we obtained a value of 47
3 picocuries per liter at the Sandusky-Huron water intakes.
4 That is, at the intakes -- not within the drinking water.
5 This compares with the 1970 maximum of 20 picocuries
6 per liter reported by Professor Stora glass, and compares with
7 the average EPA value of something of the order of 12 or
8 13 for that year at those intakes.

9 Thus, our methodology -- far from underpredicting
10 the measurements -- slightly overpredicts the results by
11 some factor between one and a half and three, which is our
12 usual experience.

13 Now Professor Stora glass gives no values for the
14 beta drinking water doses at Sandusky-Huron. He gives
15 values for the concentration at the intake, but no values
16 for dose. However, from the 1970 values given by the Ohio
17 EPA for the whole year, the month by month values, we computed
18 these doses to be something less than one millirem per year.

19 If this dose were entirely due to the operation
20 of the Plumbrook facility, it would represent excellent
21 agreement with the closest analogue at the Davis-Besse plant,
22 which is the Camp Perry drinking water -- Table 5.3, of the
23 FES.

24 These should not be identical since the
25 hydrological, operational, chemical factors of the two

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1 facilities are quite different. But, they could well be
 2 close, since the releases are comparable between the two
 3 plants and, in fact, they are.

4 So, with respect to releases from Plumbrook all
 5 we can say is: Using Professor Sternglass' own values, we
 6 come out with excellent agreement; and we can't see any
 7 basis for saying that the doses have been overpredicted by
 8 some unknown factor.

9 Q Thank you.

10 MR. CHARNOFF: I'm sorry -- did you say
 11 "overpredicted" or --

12 THE WITNESS: I said we cannot see any basis for
 13 saying or for supporting Professor Sternglass' contention
 14 that he has predicted them correctly, in other words,
 15 saying that we have "underpredicted."

16 BY MR. DAVIS:

17 Q Would you please comment on the same testimony
 18 as it relates to the gaseous releases from the Plumbrook
 19 reactor?

20 A Yes.

21 With respect to gaseous releases from Plumbrook,
 22 Professor Sternglass contends that releases estimated at

23 12 curies per year gave an excess gamma dose at TLD Station
 24 ~~T-24 which is in Sandusky, I believe~~ *T-24 which is in Sandusky, I believe* -- it's another

25 *that it's in a*
 dairy of 37 mr₀ per year during the last two quarters of
to building

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1 1972, relative to doses at the same station during the first
2 quarter of '73.

3 In other words, the excess in late '72 over what
4 is measured in early '73 is about equivalent to 37 mR a year.
5 Using the methodology of the Final Environmental Statement,
6 and the meteorological sets we can deduce from Sandusky,
7 Put-In Bay, and various other lake points, we predict a
8 gas-borne dose of only .04 millirem per year at the T-24
9 Station.

10 IF I may footnote here for a moment: The TLD
11 dosimeter does not measure biological effectiveness, and so
12 it is proper to speak of its readings in terms of
13 milliroentgens per year. Our models go on to predict
14 biological effects of this, so we express this in terms of
15 units applicable to biological hazard, namely: millirem per year,
16 and we are in agreement with Professor Sternglass from a
17 previous cross-examination that the factor relating these
18 two is between one and two. And so, at most, there is a
19 factor of two ~~factor~~ between roentgen and rem.

20 In any case, there was a discrepancy on the order
21 of 10^3 between Professor Sternglass' allegation and our
22 computations. Accordingly, we addressed ourselves to the
23 methodology used in the dosimetry, namely, the TLD's.

24 We noted that Professor Sternglass' value was
25 based on a single point for 1972, that for the October -

jrbl0

1 December quarter dosimeter, the dosimeters for the previous
 2 quarter had been stolen for the station; the monthly dosimeters
 3 for September and October were reported as unreliable due to
 4 inflight irradiation. And we inferred -- and it was an
 5 inference -- that the dosimeters for the last quarter had
 6 probably been in the same flight -- this is an inference.

7 Secondly, this single quarterly point is in
 8 strong disagreement with the November and December monthly
 9 dosimeters at the same site. Using the same methodology,
 10 comparing the last quarter of '72 with the first quarter of
 11 '73, the monthly dosimeters give a dose rate of minus-4.6
 12 mr per year.

13 The highest dose rates observed in the 13 stations
 14 were the quarterly dosimeters early in the second half of
 15 '72, but not Sandusky, as alleged by Dr. Sternglass; but at
 16 Oak Harbor, T-9, at Lacarne, T-15; these are 33 and 27
 17 miles, respectively, from Plumbrook.

18 Another reading equal to that at Sandusky is
 19 at Route 2, ^{2 + Duff} ~~Bath Road~~, which is also about 35 miles from
 20 Plumbrook.

21 The remaining dosimeters in the quarterly samples
 22 show a pattern that can only be called erratic, and certainly
 23 not one which indicates Plumbrook is the ^{centroid} ~~center~~ of dose.

24 LND
 #13
 Linda fls

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#14 1 For the monthly dosimeters at these 18 stations,
lnl 2 again, for these three quarters, Sandusky was one of the
3 lowest stations reported and well below the average for all
4 18 stations, 57 mr per year versus an average of 70.

5 We also noted that the quarterly groups,
6 particularly the last quarter of 1972, gave an overall
7 average of about ~~57~~ ⁹⁰ mr year whereas the quarterly group for
8 the first part of 1973 gave an overall average of about 67.
9 There was a discrepancy, therefore, of some 23 mr per year
10 over the entire system of 18 stations.

11 The most obvious answer, certainly the one that
12 appeals to me most having dealt with TLDs is simply that
13 all of these TLDs during that last quarter were in some way
14 irradiated and irradiated as a group together; not within
15 their respective stations.

16 Another possibility, somewhat more remote, would
17 be that somehow or other all of the quarterly dosimeters
18 in the early part of 1973 were heat or warmed in some way --
19 it wouldn't take too many degrees and this would cause them
20 to fade by in this case. It's inconceivable that the general
21 background changed 30 mr per year across this entire system;
22 and, in fact, no such observation was made by the various
23 federal and state monitoring networks in this area.

24 So we concluded, therefore, that Professor
25 Sternglass selected a single aberrant point and that all the

1n2 1 other points supported a dose rate certainly no higher than
2 0.04 millirem per year computed by FES methodology for
3 Plumbrook gas releases.

4 BY MR. DAVES:

5 Q And have you also made a study of the same
6 testimony as it relates to liquid or gaseous releases from
7 the Shippingport reactor?

8 A (Dr. Frigerio.) Yes, we have. We applied our
9 FES methodology again to the releases from Shippingport as
10 recorded by Dr. Sternglass and also as independently reported
11 to the AEC.

12 This methodology gave values for strontium-90,
13 for I-131 and for ambient gamma dose some one-tenthousandth
14 the supposedly measured values cited by Professor Sternglass
15 so certainly there was a disagreement between the calculation
16 and what was purported to be measurement.

17 However, the values which we obtained by this
18 methodology, while not in good agreement with the selected
19 points reported by Professor Sternglass, were in excellent
20 agreement with the values reported by the United States EPA,
21 Eastern
22 /Environmental Radiation facility, those published in radiation
23 data and reports and those reported by the Ohio EPA Shippingport
24 sampling station which is located at East Liverpool, Ohio.

25 For example, the monthly values given by the Ohio
EPA for 1969 through 1971 at the East Liverpool station showed

1 the 1971 values to be the lowest of the three years and the
2 values to decrease constantly from 1969 through 1971, rela-
3 tively little erratic behavior.

4 This is quite contrary of the values suggested
5 by Professor Sternglass where 1971 is supposed to be the
6 highest year. We examined the NUS TLD data and the way in
7 which it was reported, including all of the errors that one
8 might expect from the type of handling and concluded that it
9 was certainly well within our experience that TLDs would,
10 in fact, give large discrepancies of this sort when handled
11 in the way they were.

12 Perhaps I ought to footnote that for a moment.
13 In general, if one wishes to read TLDs to within three or
14 four percent with any reliability, it is absolutely essential
15 to anneal them within a day or so of placing them in the
16 station, to place some kind of temperature monitor alongside
17 them to read them within a day or two of removing them from
18 the station.

19 Failure to do this sort of thing very easily
20 gives rise to large discrepancies. This is well known with
21 those who deal with TLDs. It is for that reason in our
22 own measurements we invariably parallel TLDs with ionisation
23 chambers and this was not done in any of the studies given
24 here and makes them suspect on the face of it.

25 Q Thank you. Might I have one moment, Mr. Chairman?

Ln4 1 CHAIRMAN FARMANIDES: Yes.

2 BY MR. DAVIS:

3 Q Dr. Frigerio, would you please give a brief
4 description of the model that we used in the Final Environ-
5 mental Statement for computation of the dose to the population
6 surrounding the Davis-Besse station?

7 A There are two groups of models. One hydrologic, one
8 atmospheric.

9 The hydrologic model accepts the total
10 quantity of radioactivity released and the ~~spectrum~~ ^{spectrum of nuclides} from the
11 values given in Section 3.5 of the FES, as given, and computes
12 their concentration from the average annual flow through
13 the effluent pipe.

14 This then results in a concentration for each
15 nuclide at the effluent. From that point on the method
16 involves the Okubo-Pritchard diffusion model for hydrology
17 with parameters obtained from Dregue and dye studies done in
18 the various Great Lakes and in the case of Davis-Besse for-
19 tunately specifically in the area about Davis-Besse using
20 the diffusion velocity, et cetera, parameters that these are
21 used to calculate the expected diffusion of the radionuclides
22 out along the lake shore and eventually in the general
23 economy of the lake.

24 Other data are obtained from sampling studies
25 in the lake as to how well it mixes, what sort of thermocline

Ln5 1 separation one can expect and so forth; and this then finally
2 results in a pattern of concentrations on down through the
3 lakes and out toward the ocean.

4 Generally speaking, for purposes of the FES we
5 stop our calculation of hazard at about 50 miles; however,
6 we have the rest of the numbers if anyone is interested; but
7 they make no significant addition to the impact. With
8 respect to the atmospheric dispersion again the plant
9 parameters are first determined, such things as the heat load,
10 the number of vents, the number and quantity of nuclides
11 passing up each vent, the velocities being exhausted from the
12 vents, their heights above ground, the interactions of these
13 clouds with the buildings in the area, and, if necessary,
14 with certain features such as forests.

15 That was not necessary in the case of Davis-Besse,
16 but on rare occasions it does modify the local meteorology.

17 In the case of Davis-Besse, the cooling tower
18 was taken into account, and these are then employed in what
19 is called a Martin model, also called a steady state model,
20 in which the meteorology and these measured parameters are
21 combined in a set of equations to predict the steady state
22 concentration of nuclides in the environment as a function of
23 distance and direction from the station.

24 Again, we carry this out several hundred miles
25 but generally only report the first 50. I think these two

1 fundamentally and briefly describe the methodology.

2 MR. DAVIS: Thank you.

3 That is the extent of the Staff's direct on

4 Issue 9.

5 CHAIRMAN FARMAKIDES: Thank you.

6 Cross for the Applicant?

7 MR. CHARNOFF: We have no cross.

8 CHAIRMAN FARMAKIDES: For the Intervenor?

9 MR. BARON: None, Mr. Chairman.

10 CHAIRMAN FARMAKIDES: Do you have a question?

11 MR. SEON: I would like to ask one question.

12 In general, then, would you say that your model,
13 your models, both the hydraulic and meteorological, when
14 checked against the measured data either agreed with it in
15 cases where the measured data was small or at very low doses
16 or very low contamination levels and that in the cases where
17 it disagreed, you felt the measured data was suspect for one
18 reason or another?

19 THE WITNESS: In the case of the allegation as
20 made by Professor Sternglass, yes.

21 In the case of all our other tests, our other
22 comparison, we have not encountered the same problem; and,
23 in general, our predictions have been either in agreement or
24 somewhat higher than the measurements.

25 However, I should point out that we very seldom

ln7 1 compare against TLDs unless we are -- we ourselves have
2 checked their operation; and we much prefer ion chamber
3 and other types of measurements.

4 CHAIRMAN FARMAKIDES: Okay, thank you, sir.

5 This completes then the direct on Issue 3.

6 We'll go back to Mr. Baron for whatever else you have.

7 You wanted some rebuttal, sir?

8 MR. LARON: Yes, sir.

9 Off the record?

10 CHAIRMAN FARMAKIDES: Off the record.

11 (Discussion off the record.)

12 CHAIRMAN FARMAKIDES: Okay, back on the record.

13 Off the record.

14 (Discussion off the record.)

15 CHAIRMAN FARMAKIDES: Let's go back on the record.

16 Whereupon,

17 ERNEST J. STERNGLASS

18 resumed the stand as a witness for the Intervenor and,
19 having been previously duly sworn, was examined and testified
20 further as follows:

21 FURTHER DIRECT EXAMINATION

22 BY MR. BARON:

23 Q Dr. Sternglass, let's begin your rebuttal
24 testimony by going first to Dr. Goldman's testimony.

25 A Yes.

1 InS Q Now, do you have specific rebuttal with respect to
2 testimony prepared by Dr. Goldman?

3 A Right, the specific point that I wish to address
4 myself to is a question of whether or not as Dr. Goldman has
5 stated to his best knowledge and belief the dosimeters could
6 have acquired those high readings during flight or in transit
7 to New Mexico.

8 And I'd like to clarify the nature of the data
9 which led me to believe that it is not possible to explain
10 the high spurious readings that were obtained by dosimeters
11 around the Shippingport site solely by the hypothesis that
12 they must have acquired it from various sources, cosmic
13 rays, whatever, on the flight to New Mexico.

end 14

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wel 1 1 Q Now, in doing that do you wish to use any
2 exhibits? First of all, have you distributed them to the
3 various parties?

4 A Exhibit 11 is involved in this question, and I
believe it was distributed.

✓ Q It was 11-A and 11-B?

7 A 11-A and 11-B have already been discussed.

8 Q All right. Let's go back and first of all
9 indicate for the record and the panel how Exhibits 11-A and
10 11-B were prepared, who prepared them, and what was the
11 source material, et cetera?

12 A Right. Exhibits 11-A and B were prepared from
13 the four quarterly reports of the NUS Corporation as
14 originally publishing the external dose rates, uncorrected
15 for any other parameters.

16 In the original tables, if I could refer to the
17 actual data, I believe I have a copy of the NUS reports
18 here, and refer specifically to which tables are the basis
19 for this data, so we can identify them --

20 Q Who prepared them, or under whose direction were
21 they prepared?

22 A They were prepared under my direction, and by
23 myself. With my *assistants* ~~assistance~~ and by myself.

24 The dosimeter readings that form the basis for
25 these plots, these graphs, are contained in, for instance, in

wel 2 1 Table 9 of NUS-804 of January 1972 -- that is the date of
2 the report -- it's a table 9. Table 9 is headed, "Ambient
3 Radiation Levels Thermoluminescent Dosimeter Readings.
4 Millirems Exposure Period on Location," and then it gives
5 the locations. One is marked control dosimeter, 4510, et
6 cetera, and there's a series of dosimeters. And for the
7 periods exposed, this is the actual reading as reported,
8 which includes in-transit readings.

9 Now, since these are variable periods, sometimes
10 two weeks, sometimes three weeks, sometimes four weeks,
11 they were corrected to a per-hour, or per-day basis, and
12 then multiplied by 365, to give the dose rate per year in
13 millirems per year.

14 For instance, if the dose rate were 10 millirems
15 in a given month, it happens to be exactly one month, then
16 for the year this would be 10 times 12, or 120 millirems
17 per year.

18 And these values obtained from each of the four
19 quarterly reports of the NUS Corporation are plotted in this
20 manner in millirems per year.

21 Q Referring to what, now?

22 A 11-A and 11-B.

23 Q All right.

24 A These were the direct, uncorrected, unmodified
25 values, simply based on a common base of millirems per year.

wel 3

1 It could have equally been done for micrograms per hour,
2 or millirems per day, but I just happened to choose millirems
3 per year because 100 millirems per year is a maximum dose,
4 if it were sustained throughout, that could be tolerated at
5 the fence, and 170 would be millirems per year, would be
6 the dose rate for the year.

7 Now, the reasons why I believe that these could
8 not be explained solely by transit radiation is as follows:

9 I draw your attention to the upper set of data
10 in 11-A, and you will notice that the second from the last
11 reading is only 86 millirads per year. Well, now, that
12 happens to be a time after repairs had been made in the
13 reactor, when strontium-90 in the milk had come down to
14 normal levels, and when the soil data on strontium-90 had
15 also come down to normal levels.

16 And so, in fact, we know from the measurements
17 carried out by the AEC since then, in the areas flyover and
18 other data, that a rate of the order of 70 to 80 to 90
19 millirems per year is in fact not an unreasonable value for
20 this area.

21 Now, therefore, I'm arguing that it would be a
22 high degree of coincidence that at the very time when
23 strontium-90 has disappeared from the environment, when the
24 cesium in the milk has gone down again after repairs were
25 made, and suddenly the dosimeters do read what we know to be

wel 4

1 the correct value for that area, and yet at other times we
2 regard them as inaccurate, why should they be reading a
3 proper value, 86, 73 mr at the very time when we know from
4 other independent measurements that there is very little
5 ambient radioactivity left? It would require a great stretch
6 of the imagination, in other words, to believe that this is
7 a pure coincidence, that the low values are really 6 and 73,
8 recorded for sites 10 and 43, when everything had disappeared
9 from the environment and the milk was down to normal, should
10 be erroneous?

11 I regard number 1, and I suggest that the reason-
12 able and common-sense interpretation is that, if anything,
13 they might have been in error by possibly 10 or 20 percent,
14 because that is typically what one would expect from a
15 flight.

16 In fact, I have examined, to the best of my
17 knowledge, types of dose rates that exist in airplanes, and
18 typically one would expect a dose of 1 to 2 millirads for
19 a flight to Santa Fe and return. And that would be only
20 about a 10 percent -- 10-20 percent -- change. It could not
21 explain a two or three hundred percent; as you see the
22 peaks in the early parts of '71 were up to 410 mr and 371 mr.
23 And 410 mr per year, divided by 12, would be about 40, 35
24 mr per month. And that 35 mr is a tremendous amount, compared
25 to what you could acquire in a flight down to New Mexico.

wel 5 1

That's number one.

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A second point that leads me to believe that these could not be entirely explained by that hypothesis is that these dosimeters, at the time when the emissions were highest and they were farthest above the ambient radiation levels, that as shown in 11-B, Hookstown and Georgetown, read --

7

Q Now, let me stop you, Dr. Sternglass.

8

Where did the material come from?

9

A From the identical source. They simply are the number 14 and number 15 dosimeters, compared with number 43 and number 10. And they come from the identical source from the same table. They are simply a reduction of the data to a normal base of so many millirems per year.

14

I contend that any reasonable interpretation of this kind of a pattern, when we know from the NUS meteorological data that the preferential wind direction is from the northwest and southwest, that that would mean, unless explained in some other way that I cannot understand, that the idea that the fact that the dosimeter should be so low upwind, and lower than on the site, and then the downwind one is in between, that kind of a pattern is exactly what you would expect if they really read the correct exposure.

23

Now, there's a third point that leads me to believe that these dosimeters are in fact reading reasonably accurately, except for a small correction; and that is, I

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wel 6¹ have calculated from the NUS data on the soil concentration
2 of strontium-90 on the ground, what would be the dose from
3 betas and gamma: given to a dosimeter placed six foot above
4 the ground, knowing that the strontium-90 in the soil was
5 according to the original readings?

6 And when I calculated that, I found that these
7 levels would be expected from that kind of a distribution
8 of strontium-90 on the ground.

9 In other words, that since these dosimeters were
10 kept in thin plastic bags, which are transparent to beta
11 rays of the order of 4 or 5 mev, which are strontium-90,
12 yttrium, beta rates, it is easy to calculate on the basis of
13 a paper, for instance, that Gibson published in the Journal
14 of Atmospheric and Terrestrial Physics, just exactly that
15 for a given amount of strontium-90 in the soil you can
16 calculate what the dose would be to a dosimeter put six
17 feet aboveground. And it substantially agrees with these
18 readings.

19 In other words, the high strontium-90 in the
20 soil is consistent with these high data.

21 Now, I would like to proceed to an explanation of
22 these correlation curves and what their meaning is.

23 Now, again we have used as a basis --

24 Q Now, what are you looking at?

25 A I'm now looking at Exhibit 11-C, which is the

wel 7 1 first of the correlation studies of ambient radiation levels.
2 Number 1 was number 14, Hockstown, to the southwest, upwind,
3 dated 22 June, 1973.

4 I'd like to explain how I arrived at these
5 numbers and what their significance is.

6 Again, the basic source of data is the NUS
7 quarterly reports on dosimeter readings. We have simply
8 taken the actual numbers given for each dosimeter; in this
9 case, number 1 and number 14, and 1 is called X and the
10 other is called Y. And we have taken the readings throughout
11 the year. As you can see, they go up and down, up and down.
12 And this test is a test which simply fits a least square
13 curve. If you plot, say, the dosimeter for one local n on
14 one axis, and the dosimeter for the other on the other axis --
15 and may I use the board for that explanation? Would that
16 help you?

17 DR. SHON: I don't think it's necessary.

18 CHAIRMAN FARMERIDES: I think it's clear.

19 THE WITNESS: In other words, plotted on one
20 axis, the dosimeter reading is for number 1; the other axis,
21 reading it for the other dosimeter. If the two are correlated
22 they should fall along a straight line. In other words,
23 when one goes up the other goes up; when one goes down, the
24 other goes down.

25 This test is a key test of significance of this

1 correlation.

2 The figure says, the printout correlation 0.813,
3 is a statistical measure of the degree to which one dosimeter
4 follows along with the other. It's like a batting average.
5 If that reading were 1.00, the two would have perfect
6 correlation.

7 In other words, when one goes up, the other one
8 goes exactly up by the same amount, et cetera.

9 Now, when you carry out this test it simply shows
10 that whatever happens to one dosimeter happens to the other.

11 Now there is another quantity that this program
12 calculates, and that is the slope of this line. And the
13 slope of this line is given by the constant "A" and you see
14 there's an equation on the top of the column. That is the
15 equation of a straight line.

16 Now, what this simply does is when "A" is a
17 measure of the steepness of that slope, if "A" is less than
18 unity, as it is for this case, it means that one dosimeter
19 there is in fact not exactly equal in reading to the other,
20 it's somewhat lower. In this case, 73 percent of the other
21 one. And the "B" is just the intercept of this plot.

22 But what this really tells us when we carry out
23 this correlation is that the two are highly correlated with
24 the T test of this value. It means they simply go together.

25 Now, what we have done is we have carried out

wel 9 1 these correlations for all the dosimeters with number 1, and
2 that is shown on 11-E.

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Take 16
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1 The control dosimeter -- I'm sorry -- on page 11F.
2 11F shows the result of a correlation test -- I'm sorry,
3 it may have gotten cut off in the Xerox -- that is a correla-
4 tion test in which we correlated No. 1 with all the other
5 dosimeters. And the first column, headed "Correlation
6 Coefficient" shows you that there is one dosimeter with
7 which No. 1 is most highly correlated; and that is No. 38,
8 for a correlation coefficient is ~~0.812~~ ^{0.942}.

9 Now, this is very interesting and very difficult
10 to understand in any particular way because, according to
11 testimony reported in the EPA report by the NUS Corporation,
12 the control dosimeter was supposedly kept in Pittsburgh.
13 Now, if it is kept in Pittsburgh, 25 or 30 miles away, it
14 should be very poorly coordinated with all the others. But,
15 indeed, this empirical and objective test showed that many
16 others are down 2.6, .7 -- but there is one dosimeter with
17 which it is highly correlated. In other words, it follows it
18 exactly up and down. And this happens to be one on the
19 site.

20 And it is therefore my suggestion, and now let
21 me summarize what I believe this data shows:

22 That either inadvertently or advertently the
23 control dosimeter that was supposed to be kept 25 miles
24 away was in fact kept near the site, in fact, near Dosimeter
25 38. That is what this objective test leads me to conclude.

1 And if, therefore, someone is asked: what is
2 the dose produced by this reactor, and someone says, "Well,
3 it doesn't show any difference from the control," then this
4 individual would tend to believe that there was no gaseous
5 emission from that reactor because the control was kept right
6 along with the others.

7 This would explain why they all went up together,
8 including the control, up and down together, and why it was
9 necessary to construct the story that the dose was actually
10 received in flight.

11 And this is a very serious charge of which I
12 am fully conscious of. And you must investigate this problem,
13 namely: whether or not, with knowledge or without knowledge
14 of the proper authorities, someone somehow kept the
15 control dosimeter near the site, which would then explain
16 why the report issued by Duquesne Light Company to the EPA
17 reports for that year no release.

18 Because if the control dosimeter experienced
19 exactly the same history as the one on the site, there is
20 no difference between them, then anyone higher up would
21 conclude that indeed there was no release from that plant.

22 This is the substance of what I believe is one
23 of the most crucial points that must be clarified before we
24 can understand what is going on. This, to me, is one of the
25 most disturbing and serious problems, that with the knowledge

1 And therefore this is what I did. That is the
2 nature of the transformation, and no other.

3 MR. CHARNOFF: So long as it is clear that the
4 annualized figures here are not NUS figures.

5 THE WITNESS: That is correct.

6 MR. CHARNOFF: And that they represent simply
7 Dr. Sternglass' adjustment of those numbers, I have no objec-
8 tion to their being received in evidence.

9 CHAIRMAN FARMAXIDES: Staff?

10 MR. DAVIS: No objection.

11 CHAIRMAN FARMAXIDES: I want to be clear about
12 one thing, Dr. Sternglass:

13 The charge that you made is a serious charge,
14 and I want to be clear that I understand you, sir. You are
15 not basing it on evidence, or any facts that you have. You
16 are basing it on a conclusion from the data that you have
17 reviewed?

18 THE WITNESS: That is correct. Circumstantial
19 evidence, purely circumstantial evidence.

20 CHAIRMAN FARMAXIDES: Excuse me, sir.

21 The Board would like to ask some questions, sir.

22 There will be no objection, then, and it will
23 be received with the permutation that the Applicant's counsel
24 has already pointed out. So it will be received as Intervenor's
25 Exhibit 11-A through F.

jrb4

1 or without the knowledge of levels of management, somehow
jrb 3 2 the true doses were not reported simply by the dosimeter
3 being in the wrong place.

4 MR. BARON: At this point, Mr. Chairman, I would
5 then like to offer in evidence what has been marked as
6 Intervenor's Exhibits 11-A, B, C, D, E, and F.

7 CHAIRMAN FARMAKIDES: Any objections?

8 MR. CHARNOFF: I just want to get one
9 clarification, if I may:

10 Do I understand that 11-A and 11-B are annual
11 values plotted by Dr. Sternglass from data from annual
12 values in the NUS report? Or are they annualized from
13 much smaller intervals than the data -- than an annual value
14 in the NUS report?

15 CHAIRMAN FARMAKIDES: That's a good question.

16 THE WITNESS: Shall I answer?

17 CHAIRMAN FARMAKIDES: Yes, please.

18 THE WITNESS: I said it could have been expressed
19 in millirems per hour or per day or per month. I chose
20 to express it in millirads per year. They were annualized
21 by me, but the same result would have happened if you
22 recalculated it on microrems per hour base; and that is all
23 that had to be done, because, you see, the intervals all have
24 different lengths, and therefore, a simple reading is
25 not adequate. You have to correct it to the same time base.

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(Intervenor's Exhibit 11-A, Chart entitled "External Dose Rates (N.U.S. Corp) Ambient Radiation Dose Rate, 1971" was marked for identification and was received in evidence.)

Intervenor's Exhibit 11-B for identification, a Chart entitled "Highest External Dose Rates Near Shippingport recorded by N.U.S., March - April '71," was marked for identification and was received in evidence.)

Intervenor's Exhibit 11-C, a Chart entitled "Ambient Radiation Levels #1 with #14 (Hookstown, S.W.) (Upwind), was marked for identification and was received in evidence.)

Intervenor's Exhibit No. 11-D a chart entitled "Ambient Radiation Levels #1 with #10 (Shippingport Area) (East - Downwind)" was marked for identification, and received in evidence.)

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jrb 6

(Intervenor's Exhibit No. 11-E, a chart entitled "Ambient Radiation Levels #1 with #38," was marked for identification and was received in evidence.)

CHAIRMAN FARMERIDES: Why don't you all proceed with your cross first?

MR. BARON: We have other items.

THE WITNESS: I have none. I'm sorry. I took quite a bit of time because of the seriousness of this charge made it necessary for us to explain it.

CHAIRMAN FARMERIDES: All right, let's go, then.

MR. SHON: Your assertion is based entirely on the correlation coefficient between Dosimeter 1 and Dosimeter 38. Dosimeter #38 was at the site. You ~~assert~~ ^{assert} this shows Dosimeter #1 was at the site?

THE WITNESS: A high probability.

MR. SHON: Dosimeter #10 was elsewhere at the site?

THE WITNESS: No, it was about a mile and a half away at Shippingport.

MR. SHON: Were any of these others at the site?

THE WITNESS: Yes, many of these others were in different locations, and some were two, three miles away.

MR. SHON: And they showed no such correlation?

THE WITNESS: They showed correlation, but it

1 didn't agree. The highest correlation happens to appear
2 for one particular site.

jrb7

3 MR. SHON: Okay.

4 THE WITNESS: And less so for the one off-site.

5 CHAIRMAN FARMAKIDES: Proceed, Mr. Baron.

6 MR. BARON: That I assume this is accepted into
7 evidence?

8 CHAIRMAN FARMAKIDES: Yes, it has been received.
9 The parties have not objected.

10 BY MR. BARON:

11 Q Let's go back to the notes you were making on the
12 testimony that Dr. Goldman presented.

13 What is the next point to which you wish to
14 offer some rebuttal?

15 A The first piece of testimony of Dr. Goldman
16 relates to his questioning of the validity of my quarter
17 measurement -- of my interpretation of the water measurements
18 in the Ohio which he maintains are wrong in terms of being
19 in the wrong quarter and being in the wrong time period,
20 and being for the wrong location.

21 I would like to submit in evidence Intervenor's
22 Exhibit No. 16 -- unfortunately this is not in order.

23 CHAIRMAN FARMAKIDES: Off the record.

24 (Discussion off the record.)

25 CHAIRMAN FARMAKIDES: Back on the record.

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1 Mr. Baron?

2 MR. BARON: The next number will be 12-- we'll
3 have to make changes on all the numbers -- that's easy.

4 CHAIRMAN FARMAKIDES: Off the record.

5 (Discussion off the record.)

6 CHAIRMAN FARMAKIDES: Back on the record.

7 (The document referred to,
8 a chart entitled Table 47,
9 Summary Sheet of Radioactivity
10 Measurements Reported in Log
11 Book", was marked Intervenor's
12 Exhibit No. 12 for identification.)

13 BY MR. BARON:

14 Q With respect to Intervenor's Exhibit No. 12 for
15 identification, please explain the significance of this and
16 what was involved in its preparation, and so on.

17 A This relates to the testimony of Dr. Goldman,
18 and with regard to the Ohio and other Rivers which I used
19 in order to calculate that there was an excess radioactive
20 release in the area -- in the general area -- of Beaver
21 County which I attributed to the operation of the Shippingport
22 plant.

23 My own conclusions were based on this table, which
24 is Table No. 47, taken from page 145 of the Master's Thesis
25 of Mr. C. E. Moss, who did this study at the Graduate School

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1 of Public Health in the University of Pittsburgh.

2 Q Dr. Starnglass, let me ask you this: Were
3 you his advisory?

4 A I was on his committee.

5 Q All right.

6 Did you review all this information yourself?

7 A I did.

8 Q Would you adopt this as your own table if you
9 were to prepare something of this kind?

10 A To the best of my knowledge, he was the one who
11 gathered this data from the Department of Health in the
12 records located in Pittsburgh.

13 Q All right.

14 A And if there is a month during which a reading
15 may have shifted from one month to the next because it was
16 too close -- or very close together -- this may or may not
17 have been done by him, but I was not aware of this. I
18 assumed that this is substantially correct data.

19 Q All right.

20 But for the purposes of drawing a conclusion,
21 that one is to draw a conclusion from this exhibit, did this
22 suffice? Did it serve your purpose?

23 A It served my purpose and, in fact, it was
24 originally gathered for another purpose altogether.

25 Q All right.

jrb10

1 Q Please indicate to the panel the significance
2 of what we have here.

3 A Right.

4 MR. KARMAN: May I interject?

5 Many of the numbers are illegible on the copy
6 we have.

7 THE WITNESS: I am sorry.

8 The importance of this data is that it summarizes
9 all the available data in one table for all the rivers of
10 Western Pennsylvania with regard to levels of radioactivity
11 measured by the State of Pennsylvania surface water quality
12 network; and it shows those years for which data is available
13 and those for which it is not.

14 And this explains why in some cases, especially
15 for the year 1964, which is, by the way, the first year --
16 near the top of the column -- it should be 1964 -- why it
17 was not possible to use every possible station that became
18 available later.

19 After 1967 many more stations went into operation,
20 and only at the beginning, the first few years, were there
21 a few stations available on the basis of which one could make
22 such an estimate.

23 And I would therefore suggest, number one, that
24 any small change where one number is moved from one quarter
25 to another, does not make a significant difference in the

1 overall result.

2 Number two, that it was impossible to choose
3 all the stations completely freely because there was not
4 data available before 1967.

5 This is the nature of the data as it happened to
6 have been gathered by the State Department of Health, to the
7 best of my knowledge at the time.

8 And having examined it again, I conclude that
9 our choice of stations was not in fact particularly seriously
10 affected by whether it was 20 or 40 miles upstream. And the
11 reason is the following:

12 If one chooses a station that is too close, like
13 Swickey(?) -- five or ten miles away -- ten, fifteen miles
14 away -- then one is influenced by the radioactive deposition
15 from an airborne release that settles on the land; and that
16 is indicated to be a serious problem by the data in the
17 January 20 -- the May 8, 1973 Shippingport Report, which
18 is appended to my Item 7 testimony, and which was admitted,
19 the table showing the various rivers.

20 And in that table you will notice that the
21 Raccoon Creek and Beaver River, which are within a few miles,
22 but upstream from Shippingport, often showed high amounts
23 of radioactivity, far above that in the Ohio, which could
24 only be explained by a gaseous release having settled on that
25 land.

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1 And therefore, it is not appropriate to use
2 Zwickey(?) because it is within a ten or twenty mile radius
3 where significant amounts of gaseous activity has settled on
4 the land and washed in the river.

5 BY MR. BARON:

6 Q Now, let me ask you this question:

7 Now, you say that this chart was part of a
8 thesis --

9 A Yes --

10 Q -- submitted as individual --

11 A And accepted by the University.

12 Q Did he receive his Doctorate?

13 A He received his Master's Degree and he is now
14 a Staff Member of the Bureau of Radiological Health in
15 Washington, D. C.

16 Q I see.

17 Is there anything else on this?

18 A Yes, I would like to substantiate this further
19 by the following piece of evidence which we will call
20 Intervenor's Exhibit -- I have here marked No. 14, but which
21 will now have to be changed to No. 13.

22 Q Are you still on that same point?

23 A Yes, it's related to this.

24 MR. BARON: Well, let me offer 12 at this
25 time.

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CHAIRMAN PARMAKIDES: All right.

Any objections?

MR. CHARNOFF: Yes.

MR. DAVIS: Yes.

CHAIRMAN PARMAKIDES: Mr. Charnoff?

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MR. CHARNOFF: Yes, sir, I object.

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3 First of all, I think it has been testified that
4 the State of Pennsylvania data is accompanied with error
5 bands. I don't see any of that reflected in this particular
6 data. It seems to me that by definition, it is not an
7 accurate, therefore, translation or transfer of the State of
8 Pennsylvania data and on that ground alone, I would object.

9 I have no idea what the competence was of
10 Mr. Moss when he compiled this data. I don't understand
11 how it can be received in evidence without any support and
12 given the fact that the EPA, as Dr. Goldman has analyzed
13 the state data and found that the material from one quarter
14 has been moved from one quarter to another.

15 MR. DAVIS: In addition to that, Mr. Chairman,
16 as it had been indicated, this data is illegible and it's
17 of no use at this time.

18 CHAIRMAN FARMAKIDES: Fine.

19 Mr. Baron, your response, sir?

20 MR. BARON: I have no response.

21 CHAIRMAN FARMAKIDES: The objections are granted,
22 sir.

23 MR. BARON: All right.

24 BY MR. BARON:

25 Q Dr. Sternglass, I'm sending you now what's
marked Intervenor's Exhibit 13. Please identify what this is,

ln2 1 the source of it, the author of it, et cetera.

2 A This is marked Table 4 taken from my own
3 testimony just recently presented at Shippingport.

4 Q All right.

5 It's a table that you prepared yourself?

6 A That I personally prepared and that I'm personally
7 responsible for.

8 Q All right.

9 A It lists for the years 1962 to 1971 the water
10 activity, radioactivity measurements at East Liverpool in
11 picocuries per liter carried out by the Ohio EPA or the
12 Ohio Health Department which has been -- which is in the
13 public record and which I suppose will be made a public part
14 of our documentation.

15 Q All right, and what is the purpose of this
16 particular Exhibit 13 with respect to testimony from
17 Dr. Goldman?

18 A Right, this represents an independent test check
19 on the validity of the Pennsylvania environmental radioactivity
20 measurements in the Ohio River are carried out at the same
21 location; namely, Easter Liverpool, the idea being that the
22 independent corroboration of the Pennsylvania data by the
23 East Liverpool measurements of the EPA in Ohio adds significant
24 support to my contention that indeed in 1964 and again in
25 1966 and again in 1968 and especially in 1970 there were high

ln3 1 release of radioactivity from the Shippingport facility
2 which showed up in the strontium-90 in the local milk and also
3 in the river water as we have plotted in the figure of river
4 data of the May 9, 1973 report to the Governor of Pennsylvania
5 which is part of Section 7.

6 This data shows in the first column -- let me
7 explain what this is. The average level for the year of
8 whatever radioactivity measurement was carried out in the
9 early years, it was total activity including alphas; later on
10 it changed so that I had to maintain a constant sum of alpha
11 and beta activity throughout this period; and this is compared
12 in the second column or actually after the year column.

13 The first column on East Liverpool. The second
14 column is a column relating to Toledo which is a control
15 which I'm using here as a control; Toledo being on Lake
16 Erie more or less upstream and fairly far removed from
17 Sandusky so that we can now take the ratio of East Liverpool
18 to Toledo and in the fourth column we have the water activity
19 ratio.

20 We know East Liverpool and Toledo and you'll see
21 that they reached an all time high of 2.00 in 1970, the year
22 that we believe the largest release occurred of radioactivity
23 by gaseous pathway and also in the years '64, '65 when it
24 was significantly above the normal ratio which was more like
25 .7 or .6.

In4 1 Now, interestingly enough, as an independent
2 check on the NUS measurements of the milk, this water data is
3 also compared with the excess strontium-90 near Shippingport
4 relative to the U. S. average value in picocuries per liter
5 and again you will see that for 1970 the Shippingport area as
6 calculated from the Pittsburgh milk relative to the level for
7 Pennsylvania as a whole showed a high excess strontium-90 in
8 its milk; namely, 11.7 picocuries per liter; whereas in 1967
9 it was only 8.1 and in 1964 when the river showed a high
10 ratio of activity, so did the milk in Shippingport as calculated
11 from the measured health service measurements for the
12 Pittsburgh area, the Pittsburgh area receiving about one-third
13 of its milk from the counties around Shippingport.

14 MR. CHARNOFF: Mr. Chairman, I'm going to object
15 to this testimony as highly incompetent on its face.

16 When one compares East Liverpool on a river with
17 Toledo on a lake miles away and says one is the control for
18 the other totally ignoring Plumbrook and Enrico Fermi No. 1
19 up in Michigan, then what we're dealing with is absurdities,
20 sir; and I submit that this whole testimony is incompetent
21 on its face; and it ought to be struck.

22 CHAIRMAN PARMARIDES: Mr. Baron?

23 MR. BARON: I cannot respond to that, Mr. Chairman.
24 I'm not capable. I think Dr. Sternglass would have to respond
25 to it.

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1 CHAIRMAN FARMERIDES: No, I think the Board can
2 decide its independent judgment here.

3 Excuse me.

4 (Board conference.)

5 CHAIRMAN FARMERIDES: The Board is going to
6 strike Intervenor's Exhibit 13. We see no relevance.

7 MR. BARON: Which is your next number,
8 Dr. Sternglass?

9 THE WITNESS: Right, the next point raised in the
10 testimony by both Dr. Goldman and Dr. Frigerio relates to the
11 question of whether or not some unexpected high gaseous
12 release could have occurred. What exhibit would that be?

13 CHAIRMAN FARMERIDES: Fourteen.

14 The next one is 14.

15 THE WITNESS: And this relates to the question --

16 CHAIRMAN FARMERIDES: Let's be very clear.
17 With respect to Intervenor's Exhibit 12, that was not
18 received into evidence. The objections were granted.

19 With respect to Intervenor's Exhibit 13, this was
20 stricken.

21 Off the record.

22 (Discussion off the record.)

23 CHAIRMAN FARMERIDES: Let's go back on the
24 record.

25 Mr. Baron, can you start, please?

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BY MR. BARON:

Q Again, Dr. Sternglass, identify these charts.

A This relates to the testimony of Dr. Goldman which admitted that particulates could in principle wash into the rivers but it would not be a reasonable explanation for reactor discharges; and this testimony relates to the evidence that strontium-90 apparently escaped in large quantities from the Shippingport reactor as measured and reported in this chart; and I would like to give the origin of this chart now.

CHAIRMAN FARMAKIDES: All right, let me ask you one thing: Give us your conclusion with respect to this chart, sir, and then let the Board ask the questions that it wishes to do.

THE WITNESS: Would you like me to explain what the chart is very briefly?

CHAIRMAN FARMAKIDES: All right.

THE WITNESS: This chart is simply taken of direct data reported by the Atomic Energy Commission's HASL Laboratory 214 for the second and third quarters of 1966 for the areas of Hawaii, Illinois, Ohio. There is a site in Ohio about 70 miles from Pittsburgh -- New Jersey, in New York City and Bermuda.

Now, what this chart indicates, my conclusion from this chart is that in the second quarter of 1966 when

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1 the Naval Reactor Branch Report shows a high local fallout,
2 that this local fallout did not derive from nuclear testing
3 which would have been highest in Hawaii; but, indeed, appears
4 to have been released from the Shippingport reactor indicating
5 substantial evidence that a large and unknown, an unexpected
6 release of strontium-90 amount to of the order of .9 to one
7 millicurie per square kilometer per month appears to have been
8 originated in Shippingport since it directly dropped off in
9 all directions away from this site; and this is the nature
10 of the testimony that I would like to submit.

11 MR. CHARNOFF: I move that that testimony be
12 struck since it is based on Intervenor's 14 which, again, I
13 submit is incompetent by comparing Hawaii, Illinois, Ohio,
14 New Jersey, New York and Bermuda without showing a number
15 of points in between.

16 It does show that Ohio 70 miles away was relatively
17 close to the Shippingport site, and then he has a whole
18 variety of points miles and miles away from this site that no
19 competent conclusion could be drawn from a comparison of
20 this chart.

21 CHAIRMAN FARMAKIDES: Dr. Sternglass, could you
22 respond to Mr. Charnoff's comment?

23 THE WITNESS: Yes, sir, the data are not my own.
24 They are directly taken from HASL 214. There appears to be
25 no other reasonable explanation, especially since in the third

1n8 1 quarter when the local radioactivity at Shippingport showed
2 also very low values, this same enormous peak of more than
3 tenfold above the rest of the country did not occur; and
4 it's possible by these sensitive techniques of measuring
5 strontium-90 to detect releases of the order of a few
6 curies which are not unreasonable for other reactors and
7 have been seen in other reactors where particulates were
8 measured; and it agrees when you calculate the strontium-90
9 levels in the milk from this deposition of millicuries per
10 square kilometer per month using the United Nations Scientific
11 Committee Report, it leads to strontium-90 levels of the
12 observed amount in the Shippingport area within plus or minus
13 50 percent.

14 In other words, it does seem to suggest and support
15 the testimony that somehow strontium-90 got out and found
16 its way into the local milk.

17 MR. SHON: Mr. Sternglass, are there any data
18 points other than the one which is high here and the other
19 five which seemed considerably lower?

20 THE WITNESS: Any points in between?

21 MR. SHON: Yes.

22 THE WITNESS: There's probably one in California,
23 but there are not too many stations in a direct path on the
24 same latitude. I had to use only those stations for which I
25 could find data. HASL did not measure in every state. These

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1 were the only states for which this data were available, and
2 I tried to get this as close to Shippingport as possible.

3 MR. SHON: Is Bermuda on the same latitude?

4 THE WITNESS: More or less within 100 miles or so.
5 Generally, fallout from weapons tests stays within a band
6 of the order of a few degrees of latitude; in other words,
7 typically 60. It diffuses sideways as it goes along and goes
8 along the globe.

9 CHAIRMAN FARMAKIDES: So you're saying this band
10 is Hawaii, Illinois, Ohio, New Jersey, New York and Bermuda?

11 THE WITNESS: More or less around the globe at
12 that latitude.

13 CHAIRMAN FARMAKIDES: And you're saying the basis
14 for this graph that you have developed here is from HASL 2147

15 THE WITNESS: Right, the exact data which is a
16 public document available from the Atomic Energy Commission's
17 document room.

18 MR. SHON: And it diffuses in about the same
19 pattern in both directions, east and west, as your graph
20 shows?

21 THE WITNESS: It's slightly bias towards one
22 direct but not very much. This is the data which to me is
23 the most startling that I have yet discovered.

24 It's in the last few days that I discovered it,
25 but it confirms the high values which are in the 1966 Office

ln10 1 of Naval Research Report; and, incidentally, the highest
2 local value of alpha activity in the rivary which also reached
3 maximal values of 29 picocuries ten to the minus nine
4 microcuries per milliliter.

5 MR. SNOW: That was alpha activity you were
6 talking about a moment ago?

7 THE WITNESS: This is mainly beta activity, but
8 alpha generally accompanies something when there is a leak in
9 a fuel element.

10 In other words, when a leak springs, you have both
11 beta and alpha. Both beta and alpha activities reached very
12 high levels at this site according to the Naval Reactor
13 Report.

14 I'll just give you the first quarter of beta
15 activity of 12.4 millicuries per square mile per month.

16 The second had 96.56 millicuries per month, and
17 it dropped again so that the average period it was only 54.
18 In other words, there appears to be a direct measurement at
19 the local site confirming a high release of gaseous activity
20 for the air.

21 CHAIRMAN FARMAKIDES: There is a motion to strike
22 before the Board. Any further comments? Staff?

23 MR. DAVIS: The Staff would support the Applicant's
24 motion.

25 CHAIRMAN FARMAKIDES: Mr. Baron?

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MR. BARON: No comment.

CHAIRMAN FARMANIDES: The Board will not accept the motion to strike at this time. We will continue.

Are you going to offer it into evidence?

MR. BARON: Yes, Mr. Chairman.

CHAIRMAN FARMANIDES: Are you offering it at this time?

MR. BARON: Yes, Mr. Chairman.

CHAIRMAN FARMANIDES: Mr. Charnoff?

MR. CHARNOFF: I would call the Board's attention to the various charts showing Shippingport releases very low in '66. Look, with all due respect, Mr. Chairman, this is an inquiry to get at some element of truth in this matter --

CHAIRMAN FARMANIDES: Yes, I understand, Mr. Charnoff.

MR. CHARNOFF: I understand the difficulty of the Board, but I must say that to accept into evidence a document that compares five or six points like this --

CHAIRMAN FARMANIDES: You have voiced an objection.

MR. CHARNOFF: I certainly do.

end 14

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1 CHAIRMAN FARMAKIDES: All right.

2 Staff?

3 MR. DAVIS: The Staff would support the denial
4 of the motion to put it into evidence.

5 CHAIRMAN FARMAKIDES: And the Board also agrees
6 with the objection, and Exhibit 14 of the Intervenor is not
7 admitted into evidence.

8 Proceed, sir.

9 (Mr. Baron distributing documents.)

10 MR. BARON: This will be 15.

11 CHAIRMAN FARMAKIDES: Off the record.

12 (Discussion off the record.)

13 CHAIRMAN FARMAKIDES: Back on the record.

14 Mr. Baron?

15 BY MR. BARON:

16 Q Dr. Sternglass, you have before you what has been
17 marked as Intervenor's Exhibit 15 copies of which have
18 been distributed to all parties concerned, three to the
19 stenographer.

20 Now, again, bearing in mind the attitudes with
21 regard to the other charts and so on, please quickly explain
22 the source material which led to the production of this
23 chart, and who was responsible for it, and then how this
24 relates to whatever Dr. Goldman had testified.

25 A Right. This relates to the testimony of Mr.

1 Crouse, in which case he questioned whether or not the
2 maximum values are appropriate to use in the water going
3 away from Sandusky in either direction; toward the west,
4 Toledo and Cleveland, in the other direction.

5 This is a plot of radioactivity. It should not
6 be marked "drinking water," but surface water and water. The
7 distance from the Plum Brook Reactor, taken from, again, the
8 Ohio EPA data.

9 Q By yourself?

10 A By myself; and it averages, the yearly levels at
11 the site, reading from left to right, Toledo, Port Clinton,
12 Sandusky in the center, Lorain, and then Cleveland, to the
13 right. And this is designed to show -- and my interpretation
14 of it is as follows:

15 That when one does take what Mr. Crouse says is
16 a more meaningful value, namely, the average rather than the
17 maximum value for a year, an average for a year, for this
18 there can be no question as to the timing of the samples at
19 one location with respect to another. That when one does
20 take the average value for the water, then one does indeed
21 find the same general trend that I had pointed out for 1970
22 in my earlier graphs for alpha activity, separately, and
23 beta activity, namely, that there is a tendency, which of
24 course is not perfect, for the sites around Sandusky and
25 nearby Port Clinton, especially Sandusky and Port Clinton,

wel 3

1 to be higher than for the sites at Toledo and Cleveland,
2 some 40-50 miles in either direction, again suggesting
3 very strongly that one deals with an emission from the
4 Sandusky reactor, which indeed can be sensed and seen all
5 the way to Lorain and Cleveland. In support of what I had
6 earlier contended, is rises and declines in all of these
7 sites together, since as you can see, in 1964 they were all
8 high. In 1965 they all came down. And in 1966 they came
9 down further, as both total fallout levels and total releases
10 from this reactor decline.

11 And this is the substance of what I would like
12 to submit.

13 MR. BASON: All right.

14 Mr. Chairman, at this time we'd like to offer
15 into evidence Exhibit 15.

16 CHAIRMAN FARMAKIDES: Any objections?

17 Mr. Applicant?

18 MR. CHARNOFF: Yes, I object, Mr. Chairman. Dr.
19 Sternglass has made charts like this before, and he always
20 has Huron, for example. And I don't see that on there.

21 Is there some reason for that?

22 THE WITNESS: No, I'm sorry, I did not have Huron
23 on my other charts.

24 MR. DAVIS: No objection.

25 MR. CHARNOFF: Well, I have no objection to this

wel 4

1 being received. We may want to put rebuttal testimony in
2 on these charts.

3 CHAIRMAN FARMAKIDES: I think that's a good idea,
4 rebuttal testimony on the charts.

5 MR. BARON: Fine.

6 CHAIRMAN FARMAKIDES: It will be so received.

7 (A document entitled
8 Radioactivity in ^{Surface}~~Drinking~~
9 Water with Distance from
10 Plumbrook Reactor was marked
11 as Intervenor's Exhibit 15
12 and was received in evidence.)

13 BY MR. BARON:

14 Q All right, Dr. Sternglass, what is the next
15 document?

16 A I think that just about takes care -- I believe
17 this is the main substance of my testimony, except for one
18 point. And that is, I believe -- let me just check my notes.

19 Q Is it in response to something that --

20 A Oh, yes, absolutely, absolutely; oh, yes.

21 A couple of small, minor points which I can
22 easily point out: It was testified by Dr. Goldman that no
23 particulates had been discovered in the ^{vicinity}~~discovery~~ of the
24 Dresden boiling water nuclear power reactor.

25 I have with me the official EPA report on the

wel 5 1 Dresden Reactor, entitled "Radiological Surveillance Studies
2 at a Boiling Water Nuclear Power Reactor," published by the
3 U. S. Department of Health, Education and Welfare, BRH/DEK-70-
4 1, and there, on page 72 it reads as follows:

5 "The downwind sample of snow near Dresden contained
6 strontium-89, while the upwind sample did not, suggest-
7 ing that the strontium-89 was released at the Dresden
8 stack."

9 Furthermore, on another page, it refers to
10 radiiodine, which is another particulate of considerable
11 biological importance, and there, with regard to iodine in
12 the cattle thyroids -- I'm sorry, I'll have to just find the
13 right page for a minute, if you'll permit me.

14 Q Is this in response to something that --

15 A Yes, again, with regard to Dr. Goldman's
16 testimony that there is no evidence for releases of these
17 particulates from reactors such as Dresden.

18 It says here on page 79 of this report:

19 "The excellent agreement between measured values
20 and the estimate based on I-131 released at the Dresden
21 stack suggests that Dresden was a source of the iodine-
22 131."

23 And that is the substance of my rebuttal testimony
24 on this subject.

25 Just a couple of more small points.

wel 6

1 DR. SHON: Dr. Sternglass, in reading from that
2 report, you mentioned excellent agreement between the
3 predicted and the amount of iodine found. Presumably -- was
4 this done by a method similar to what has been used to
5 predict Davis-Besse releases, for example?

6 THE WITNESS: No, I don't think -- let me read
7 the context, then, a little better.

8 This is what it is:

9 "Measurements were made on cattle thyroids in that
10 area."

11 That's what this is, it's Section 7.7, and it
12 says here:

13 "There are sensitive indicators on iodine-131
14 on the pasture, cattle thyroids, and potentially in
15 milk. However, 12 picocuries of iodine-131 per gram
16 of thyroid has been taken to be equivalent to 1
17 picocurie of iodine-131 per liter of milk."

18 The point of this is that there's some question
19 of whether or not iodine-131 can ever be released in
20 significant quantities from nuclear reactors. And the point
21 is, as shown in Table -- I'll read the whole section here.

22 "Results and discussion as shown in Table 7.7,
23 thyroids from the three heifers that had grazed 2.3
24 kilometers east of Dresden contained measureable
25 amounts of I-131, while the other thyroids did not."

wel 7

1 In other words, it is an upwind and downwind
2 situation.

3 MR. CHARNOFF: Mr. Chairman, I'd like to object
4 to this testimony, if it's rebuttal. The fact is that Dr.
5 Goldman was talking about decay period with coolant circuits
6 and waste gas holdup systems with the power plants, which
7 would be preclude anything except the longer-live noble
8 gases from getting out. And he specifically said there may
9 possibly be some very small quantities of radioiodines.

10 The Dresden reactor is a reactor with very short
11 holdup time, a boiling water reactor. It's just unrelated
12 to this testimony here.

13 (The Board conferring.)

14 CHAIRMAN FARMERIDES: We're going to strike that
15 last answer of Dr. Sternglass to Mr. Shon.

16 Mr. Shon is going to rephrase his question,
17 because I think there was no communication there.

18 So let Dr. Shon rephrase his question.

19 DR. SHON: The amounts of both particulate and
20 iodine, which would not be this particulate, necessarily,
21 found around Dresden were said in that report to be very
22 small, were they not?

23 THE WITNESS: Small, but quite detectable.

24 DR. SHON: That's all I wanted to establish.

25 And they were also in agreement with predictions

wel 8

1 of theory, were they not?

2 THE WITNESS: No, because it says here that the
3 agreement was with measured values at the stack.

4 In other words, what they were testing is between
5 the actual measurements at the stack, not with the theoretical
6 calculation.

7 CHAIRMAN FARMAKIDES: You're reading from what
8 page?

9 THE WITNESS: I'll read it again. On page 79:

10 "The excellent agreement between measured values
11 and the estimate based on I-131 released at the Dresden
12 Station..."

13 Because they had made measurements of I-131 at
14 the stack, and then they compared it with what was found,
15 say 2 kilometers away.

16 DR. SHON: I - -

17 THE WITNESS: So I do not in any way --

18 DR. SHON: Our present discussion here is of
19 the theory relating to releases, and --

20 THE WITNESS: Let me clarify my answer. My
21 answer is with regard to the diffusion theory for a given
22 amount coming out.

23 But my question does not relate to
24 the theory of diffusion. My question relates, and my question
25 about the validity of all the calculations, is with the

wel 9

1 assumptions underlying namely the source term. In other
2 words, how much of the particulate is actually entering at
3 the point of release.

4 I have no quarrel with the subsequent theory for
5 the diffusion of the material of the stack. That, I believe,
6 is in quite good shape.

7 What I believe is the real problem, and I think
8 I can end on this note, is that we are uncertain, apparently,
9 about some of the source terms or the input into the theory,
10 rather than the computer program.

11 The question is one relating to the amounts which
12 are going out and then diffused.

13 MR. BARON: Anything else, Dr. Sternglass?

14 DR. STERNGLASS: That's it.

15 CHAIRMAN FARMAKIDES: Thank you very much, sir.

16 Mr. Baron, that is it? Do you have anything else
17 you want to say, or are you through?

18 DR. STERNGLASS: I feel that at this moment I
19 have pretty well exhausted all of us.

20 CHAIRMAN FARMAKIDES: We understand your points.
21 I think you made yourself very clear.

22 Is there any recross?

23 MR. CHARNOFF: Just two questions, if I may.

24 RECROSS-EXAMINATION

25 BY MR. CHARNOFF:

WEL 10

1 Q One is in connection with that article from page
2 79 you just read.

3 Would you mind reading the next two sentences,
4 please, Dr. Sternglass?

5 A "In the absence of the background samples, however,
6 one cannot be certain if the I-131 analyses in milk by the
7 Dresden contractor are correct. For example, the I-131
8 in the thyroids may have originated from fallout."

9 Q Thank you.

10 I'd like to refer you to Exhibit 11-A, and 11-F.

11 Do you have that -- Intervenor's Exhibits?

12 A Yes, I believe I do have it right here.

13 A is the first page --

14 Q That's right.

15 Do you know how long Shippingport was shut down
16 in the fall of '71? In what month, Dr. Sternglass?

17 A The data are not very detailed. I obtained this
18 information from Nucleonics Week, and I do not exactly
19 know the precise number of hours or days it was shut down.
20 But apparently it was shut down for a number of weeks, a
21 week or so, because the power level during that month
22 dropped to almost zero.

23 Q In November, or October, or September? What
24 month?

25 A September. Sometime like that. Around September.

wel 11 1 Q I see. And what happened in the following
2 months, do you know?

3 A After the repairs had been carried out power
4 levels were again increased. And in the following few
5 months, strontium-90 levels in the soil and in the milk
6 dropped, until they reached a minimum -- in early
7 January-February -- in January, '79.

8 Q How would you explain, then, the sudden increase
9 from ELD readings on Exhibit 11-A, for what I assume is the
10 month of December?

11 A We have asked for a daily log of the plant, and
12 this has now, for the first time, been promised by the
13 operator to the people on the board of the Shippingport
14 hearings, and we have not been able to examine in detail the
15 log. But it could be that that represents the release of
16 heldup gases, which typically are accumulated for a month
17 or two before they are released again.

18 In other words, the holdup tank is designed for
19 something like a sixty day holdup, and then one gets spikes
20 of releases, oh, every two months or so, and until we see
21 the exact logs of the Shippingport reactor we cannot tell
22 whether this coincides with one of their planned releases
23 from the storage tank.

24
25

1 BY MR. CHARNOFF:

2 Q Sir, you indicated that --

3 A Is that the last page?

4 Q Yes, sir.

5 You indicated that TLD at Station 38, exhibited
6 a high correlation with the control at Pittsburgh?

7 A Right.

8 That, and of course, No. 40 also almost had the
9 same correlation point.

10 Q At what point, sir, .5, .6, .7, .8, .9, would
11 you begin to say the correlation is not as high as it
12 might be with No. 38?

13 A Well, you can see that from the next column which
14 is called a "T-Value" and a T-value is a measure of the
15 degree to which the points fit the straight line. And you
16 will see that the T-value of that column is by far the
17 highest, 9.72, compared to typically, 3 or 4 or 5 -- all the
18 others.

19 So the T-value of 9.7 for that many degrees of
20 freedom is regarded as significant at the level of less
21 than .001, or one chance in a thousand, that this is an
22 accidental correlation.

23 Q A T-value of 3 or 4 would be a poor
24 correlation?

25 A It is less; it is just a matter of degree. And

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1 the best, the highest value exists for the highest T-value.

2 Q Where is TLD Station 43, sir?

3 A 43 -- has a value of 3.8. I -- the reports of the
4 NUS Corporation do not specify the precise location of each
5 dosimeter, except saying they are around or near the
6 perimeter. But the ones for 14 and 15 are definitely offsite
7 and No. 10 is offsite. Essentially, nearly -- 43 and 45 here
8 are listed very close to the main perimeter of the plant.

9 I would have liked to have had in fact an
10 opportunity to examine the precise location, but this was not
11 given in the NUS data.

12 Q Could I refer you to Intervenor's Exhibit 11-B?

13 A 11-B?

14 Q Doctor, what station is that that is reflected
15 as onsite with the highest annual reading of four-ten?

16 A It happens to be number 43 for that particular
17 release.

18 Q I see.

19 And what is the T-value for 43 on 11-F?

20 A The T-value for 43 on 11-F -- oh -- 43 -- the
21 correlation between No. 1 and 43. --

22 Q That's right.

23 A -- is .474, 3.8 -- it's --

24 Q The T-value is 3.8?

25 A It's medium significance, something that the level,

1 oh, something like .01 or .05.

jrb3

2 Q Striking a lesser correlation, or a poorer
3 correlation than 33?

4 A Well, that depends on the -- somewhat less, yes.
5 And it would depend on the wind directions because, naturally,
6 a single reading depends on the particular prevailing winds
7 during a given period of release in time.

8 MR. CHARNOFF: I have no further questions of
9 Dr. Sternglass.

10 MR. SHON: Well, I note that just ^{looking} ~~look~~ at your
11 correlation coefficients, the correlation with No. 33 is
12 high; that, as Mr. Charnoff pointed out, ^{with 43} ~~with 33~~, which is
13 also onsite is low.

14 THE WITNESS: Not as low as some of the others.

15 MR. SHON: And No. 14, for example, which is
16 in Hookstown, and supposedly upwind and not reflecting site
17 behavior, is again higher than that with No. 43?

18 THE WITNESS: Again, it's a question of how
19 many samplings you have. It's a question of wind direction
20 to some degree. But the general pattern seems to be that the
21 ones -- Georgetown and Shippingport -- tend to be less highly
22 correlated; but this, of course, is always a question of
23 statistics.

24 I am sorry; maybe we don't even understand each
25 other. 4.72 is not as high as 9.7, the T-value of 9.7 is

1 is very high, and there is no other one that comes even
2 close.

3 MR. SHON: It's clearly higher than 3.3, isn't
4 it?

5 THE WITNESS: Yes, but the -- it's getting
6 marginal in terms of differentiation. Whether you like a .01
7 probability or whether you accept the .05 probability, it
8 isn't all that very great in difference.

9 CHAIRMAN FARMAKIDES: Thank you, sir. Thank you
10 very much.

11 Any further cross?

12 MR. DAVIS: None.

13 CHAIRMAN FARMAKIDES: Thank you very much,
14 Dr. Sternglass.

15 (Witness Sternglass excused.)

16 CHAIRMAN FARMAKIDES: Anything further?

17 MR. CHARNOFF: Yes, sir, we have about one-minute
18 of rebuttal sir. I would like to call Mr. Crouse.
19 Whereupon,

20 RICHARD P. CROUSE

21 resumed the stand as a witness on behalf of the Applicant and,
22 having been previously duly sworn, was examined and testified
23 as follows:

24 MR. CHARNOFF: I would like to have marked as
25 Applicant's Exhibit 15-A, B, C and D for identification,

b5
1 four graphs prepared by Mr. Crouse, from the Ohio Department
2 of Health EPA monitoring program data, using the annual
3 average total activity untreated lake water which was used
4 by Dr. Sternglass in Intervenor's Exhibit 15.

5 I have only a single copy of each of these.
6 We will reproduce these tomorrow morning, and I will show
7 them to the parties and the Board just briefly.

8 (Mr. Charnoff displaying documents to parties.)

9 FURTHER DIRECT EXAMINATION

XXXXXXX
10 BY MR. CHARNOFF:

11 Q Mr. Crouse, can you explain what appears on
12 Applicant's Exhibits 15-A, B, C, and D?

13 A These exhibits show the total activity in
14 untreated lake water at the six sampling sites on Lake Erie.

15 Exhibit 15-A is for the year 1963; that was the
16 year immediately preceding the period in Dr. Sternglass'
17 Exhibit 15.

18 Q Intervenor's Exhibit 15.

19 A Applicant's Exhibit 15-B is the year 1967, the
20 year being the first following the three years in Dr.
21 Sternglass' exhibit.

22 Exhibit 15-C is the year 1969; and

23 Exhibit 15-D is the year 1971.

24 These exhibits are -- help plotted the average
25 annual total activity values at the six sampling sites.

jrb6-

1 Q Mr. Crouse, would you tell me whether those
2 exhibits show a pattern of the high point in Plumbrook with
3 slopes away from the Sandusky reactor to Cleveland and
4 Toledo?

5 A No, they do not.

6 Exhibit 15-A shows a peak at Toledo, Ohio, with
7 a minimum at Cleveland.

8 And Exhibit 15-B shows a maximum at Port Clinton
9 and Sandusky with minimums at Lorain; but that curve is very
10 flat that year.

11 Exhibit 15-C shows the maximum value occurring
12 at Toledo, Ohio, and essentially a straight line from there
13 on, Lorain and Cleveland being at the same value.

14 Exhibit 15-D again shows a maximum at Toledo
15 and Huron this year, with minimums at Port Clinton, Lorain,
16 and Cleveland.

17 The data are all very similar.

18 MR. CHARNOFF: Thank you, Mr. Crouse. I have no
19 further ~~questions~~ ^{questions}.

20 CHAIRMAN FARMAKIDES: Any further examination,
21 Mr. Baron?

22 DR. STERNGLASS: Yes, sir.

23 CHAIRMAN FARMAKIDES: Dr. Sternglass will ask the
24 questions.

25 Please proceed.

jrb7

CROSS-EXAMINATION

XXXXXX

BY DR. STENGLASS:

Q Referring to 7-1, which I believe was admitted into testimony relating to the Plumbrook Nuclear Reactor liquid releases, part of Contention 7, Applicant's Exhibit 10-B, would you tell me --

MR. BARON: Well, let's let the man get it.

(Pause.)

MR. CHARNOFF: I believe that Dr. Stenglass characterized that as Applicant's Exhibit -- and I hope more correctly it would be Intervenor's.

CHAIRMAN FARMANIDES: All right, sir.

BY DR. STENGLASS:

Q Now, Mr. Crouse, would you indicate to me what happened on this graph according to this graph, assuming it is correct, in the year 1966, the year in which you felt -- or 1967 -- what happened in those years? How do the levels compare with the years '64, '65, for instance?

A I am not clear exactly what curve you mean on that page?

Q Well, both the upper one and the lower one. The yearly average concentration and the peak of monthly concentration.

A The peak of monthly concentrations --

Q Would you say it is lower?

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1 A It's lower than --

2 Q In '64, in '65 --

3 A Than three of the data points you have, but
4 not significantly than the others.

5 Q Would you say that in 1967, '66, '67, in that
6 time period, the levels of reported average concentration
7 was something like less than one-tenth as high in terms
8 of peak concentrations as in '64 and '65?

9 A Yes, if you choose just to look at those two
10 data points, I would have to agree.

11 Q Yes.

12 Q Would you therefore say that the lower the releases
13 are the more likely they are to be hidden by the presence
14 of fallout? Would that be a correct assumption?

15 A I cannot make any conclusions as far as releases
16 are concerned from this graph.

17 Q Uh-huh.

18 Q You are unable to conclude from this graph
19 that the Plumbrook releases were highest during the period of
20 '64 to '66?

21 A I don't understand what you mean by "Plumbrook
22 releases."

23 MR. CHARNOFF: Objection.

24 Q Are you referring to peak concentrations or the
25 yearly averages?

jrbs

1 DR. STERNGLASS: Peak monthly concentrations
2 as measured at Plumbrook.

3 THE WITNESS: That has no relation to what the
4 releases are at the Plumbrook facility.

5 BY DR. STERNGLASS:

6 Q I'm sorry. We seem to be having some problem.

7 Would you not agree that the most likely
8 hypothesis for release levels of the order of 9,000 to 10,000
9 picocuries per liter would be releases in that brook, which
10 are hundreds of thousands of times higher than those of any
11 other river in the area?

12 Would you not agree that they are related to the
13 Plumbrook operation?

14 MR. CERNICOFF: Mr. Chairman, the interrogator is
15 arguing with the witness.

16 DR. STERNGLASS: No, I'm just asking a
17 question.

18 BY DR. STERNGLASS:

19 Q Would you not agree the level of radioactivity
20 of that order is unlikely to be associated with the
21 Plumbrook reactor?

22 CHAIRMAN FARMAKIDES: Sir, do you understand the
23 question?

24 THE WITNESS: I think I do.

TAKE 19

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820 1 A (Mr. Crouse.) I think I do. In order to answer
1a1 2 it --

3 CHAIRMAN FARMAKIDES: Put in whatever assumptions
4 and qualify.

5 THE WITNESS: Okay, I can't answer that just yes
6 or no. This maximum curve that is on this graph, this
7 curve shows what the specific activity was in a given one
8 ^{grab}graph sample, the highest one in a given year, at least
9 that's how I interpret it.

10 Now, that stream may not have had any flow in
11 it at the time it may have been stagnant and they took a
12 sample and it could have given a value of that magnitude.

13 Now, I cannot draw any conclusion as to what a
14 release from a facility would be of a stagnant sample.

15 BY MR. STERNGLASS:

16 Q Would you say that the year 1962 to 1966 in some
17 radical way differ from all the other years with regard to
18 flow in that particular brook?

19 A I don't know what the flow was in the brook
20 at the time that these samples were taken, that's all I'm
21 saying.

22 CHAIRMAN FARMAKIDES: Dr. Sternglass, you're
23 asking this witness to make conclusions from your data, sir,
24 your graph. To say the least, it's rather difficult.

25 MR. STERNGLASS: Well, I appreciate the difficulty

ln2 1 and all I can say --

2 CHAIRMAN PARMARIDES: Perhaps you can ask
3 questions that are a little bit less complex.

4 BY MR. STERNGLASS:

5 Q All right. Are you aware of the fact that during
6 the period 1963 to 1965 the Plumbrook reactor reports indicate
7 relatively high discharges into the river according to their
8 own measurements?

9 A I have reviewed the operating reports and I
10 could not find anything on liquid activity releases. I tried
11 and tried to find total curie amounts of releases, and I
12 could not find this.

13 Q Well, we have submitted this as part of our
14 testimony. Are you aware of that information? Perhaps the
15 witness is not aware of that information and appendix which
16 was added to our submission, Appendix 2, Section 6, there is
17 a report by the NASA operator of the μ pc values for every
18 month of these years.

19 CHAIRMAN PARMARIDES: We ^{understand} ~~under~~ that, sir; but
20 we really are addressing ourselves now to the rebuttal
21 testimony.

22 MR. STERNGLASS: Right, and the question then is
23 is he aware for the year 1963 to 1965 when Plumbrook showed
24 very high activities, these are also the years when according
25 to the operator they released relatively large amounts in

ln3 1 excess of the npe?

2 MR. CHARNOFF: Mr. Chairman, I'm going to object
3 to this. We have put on rebuttal testimony to show that the
4 slope is not always what Dr. Sternglass would suggest.

5 Even if you examined his own chart on 7-1 where
6 the highest yearly average concentration is, 1963, the
7 witness's chart for 1963 which was not one of Dr. Sternglass's ---
8 plot, I think it's 15A -- happens to show that the peak point
9 was not at Sandusky.

10 Now, I don't know where Dr. Sternglass thinks
11 he's going, but I think he's well beyond --

12 MR. STERNGLASS: May I put another question
13 to the witness?

14 CHAIRMAN FARMANIDES: Go ahead.

15 BY MR. STERNGLASS:

16 Q Would you agree that during the period of
17 highest strontium-90 and total beta activity in the fallout,
18 it's like 1962, 1963, when the weapons testing was raining
19 down.

20 The major tests of the '62 series were coming
21 down -- would you say that that is a time when it is difficult
22 to find the additional releases from any small reactor?

23 MR. CHARNOFF: Objection.

24 CHAIRMAN FARMANIDES: Sustained.

25 MR. STERNGLASS: How do I phrase that? I guess,

ln4

1 in that case, we cannot proceed.

2 CHAIRMAN FARMAKIDES: You can talk to ~~you~~^{your}
3 counsel, sir, if you wish; but that question is highly
4 improper.

5 (Discussion off the record.)

6 BY MR. STERNGLASS:

7 Q Would you agree in general that it's difficult
8 as Dr. Goldman has testified to see releases from specific
9 local reactors in the presence of natural fallout?

10 MR. CHARNOFF: Objection as to relevance to the
11 rebuttal testimony.

12 MR. STERNGLASS: It's very relevant.

13 MR. CHARNOFF: Well, I think we ought to have
14 a showing.

15 CHAIRMAN FARMAKIDES: Could you please read
16 that last question of Dr. Sternglass's?

17 (The Reporter read the question as requested.)

18 MR. CHARNOFF: Objected to on the basis of
19 relevance.

20 CHAIRMAN FARMAKIDES: What is the relevance?

21 MR. STERNGLASS: The relevance is as follows:
22 that in the year 1963 when Mr. Crouse finds no strong peaking
23 in the center near Lorraine that that was a period of very
24 high fallout coming down and, therefore, tended to mask any
25 small addition from that reactor; and I'm, therefore,

1n5 1 suggesting that, as Dr. Goldman has stated, that during periods
2 of extremely heavy fallout like '62 and '63, it's indeed
3 difficult.

4 CHAIRMAN FARMANIDES: All right. We'll ask the
5 witness to answer. Do you understand the question, sir?

6 THE WITNESS: As I understand it, he has asked
7 that if you have a high ambient background, it makes it
8 difficult to find small levels --

9 CHAIRMAN FARMANIDES: All right, do you
10 understand the question?

11 THE WITNESS: That's what I thought was the
12 question.

13 BY MR. SPENGLER:

14 Q What's your answer?

15 A Is that the question that you asked?

16 Q Yes.

17 A Yes, I would agree in high background levels,
18 very low levels are hard to find.

19 Q And would you therefore say that a trend to
20 peak produced by a small source in the presence of a large
21 radioactive fallout in the ambient environment is
22 hard to detect as it occurred in 1963?

23 MR. CHARNOFF: Objection, there's no foundation
24 for that question. There's nothing in the record to suggest
25 that there was high or low fallout in 1963.

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CHAIRMAN FARMAKIDES: Is there any foundation?

MR. STERNGLASS: Yes, sir.

CHAIRMAN FARMAKIDES: What is that, sir?

MR. STERNGLASS: Yes, total radioactive levels.

CHAIRMAN FARMAKIDES: No, no in this record.

MR. STERNGLASS: In the record in the Ohio EPA
levels --

MR. BARON: Is it in this record?

MR. STERNGLASS: Yes, we have submitted or are
going to submit the entire Ohio EPA data.

CHAIRMAN FARMAKIDES: Objection sustained.

Rephrase your question, sir.

Mr. Baron, you can help him.

Can I see the counsel, please, perhaps Dr.
Sternglass can join us.

(Bench conference.)

CHAIRMAN FARMAKIDES: Let's go back on the record.

Okay, proceed, Mr. Baron.

MR. BARON: That's all, Mr. Chairman.

CHAIRMAN FARMAKIDES: All right, that then completes
the direct of all parties with respect to the new issue.

We'll adjourn --

MR. CHARNOFF: Sir, do you say completes the
direct or the direct, rebuttal, cross and everything?

CHAIRMAN FARMAKIDES: Well, completes the entire

ln7 1 Issue 9.

2 We have remaining before us now several motions.
3 We'll treat them in the morning. We have a stipulation of
4 the parties, perhaps two stipulations of the parties, which
5 is fine. What time, gentlemen, shall we meet in the morning?

6 MR. BARMAN: Six.

7 CHAIRMAN FARMAKIDES: Six o'clock in the morning,
8 you say?

9 (Laughter.)

10 CHAIRMAN FARMAKIDES: Well, it's about nine
11 o'clock now, so let's think in terms of perhaps 9:30 in
12 the morning.

13 Mr. Baron, I know you've got a way to go home.
14 Mrs. Stebbins, you too. Do you want to make it later?

15 MR. CHARNOFF: I'd like to suggest ten o'clock
16 for the following reason: I think we really can conclude
17 a stipulation on Contention 1 but we also have to talk about
18 the documents before we meet and nobody really wants to
19 talk about them tonight.

20 I think we should meet at ten and Mr. Baron and
21 I can meet here at 9:30.

22 MR. BARON: When we meet at ten, we're going to
23 talk about the proposed exhibits.

24 MR. DAVIS: Does this have to be on the record?

25 CHAIRMAN FARMAKIDES: Off the record.

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(Discussion off the record.)

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CHAIRMAN PARMAKIDES: Let's go back on the

record.

We'll recess until tomorrow morning at 1

Thank you very much.

(Whereupon, at 3:50 p.m., the hearing was
recessed, to reconvene at 10:00 a.m., Tuesday, August
1973.)