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UNITED STATES ATOMIC ENERGY COMMISSION

Regulatory File Cy.

IN THE MATTER OF:

TOLEDO EDISON COMPANY
and
THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

Docket No. 50-346

(Davis-Besse Nuclear Power
Station, Unit 1)

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ATOMIC ENERGY COMMISSION

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Docket No. 50-346

Ohio National Guard Armory,
135 W. Perry Street,
Port Clinton, Ohio

Thursday, 28 January 1971

The above-entitled matter came on for further hearing, pursuant to notice, at 10:00 a.m.

BEFORE:

WALTER H. JORDAN, Member.

APPEARANCES:

(As heretofore noted.)

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C O N T E N T S

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P R O C E E D I N G S

CHAIRMAN SKALLERUP: Will the hearing come to order?

The Board would like to talk with Mr. Engelhardt, and other counsel, if they care to be present, can be present.

The Board wanted to rule on the Coalition motion and it asked for copies of those sections of the PSAR which Mr. Tedesco testified to. We received information which appears to be incomplete and we will be unable to rule on that motion.

Let me give you the materials which we were provided and ask if you would reconcile it with the testimony beginning on page 1290, and if you would, please, provide us with a copy of the Staff Safety Evaluation, Section 8 in particular.

As I recall, we were prepared to hear LIFE's direct testimony of Dr. Sternglass.

Are you prepared, Mrs. Bleicher?

MRS. BLEICHER: Yes.

Whereupon,

ERNEST STERNGLASS

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

MRS. BLEICHER: I believe Dr. Sternglass has been previously sworn, and he also stated his qualifications on the record. I therefore move that his qualifications as stated previously be incorporated into his testimony on behalf of the

Intervenor, LIFE.

CHAIRMAN SKALLERUP: So ordered.

DIRECT EXAMINATION

BY MRS. BLEICHER:

Q Dr. Sternglass, would you please describe for us your studies and the conclusions you have drawn from the studies with respect to the health effects as a result of radioactivity emitted under Part 20 Standards?

A Thank you.

I would like, this morning, to address the question as to the adequacy of the 10 CFR 20 radiation standards with regards to the amounts released, and the concentration of radionuclides which are to be discharged permissible under the 10 CFR 20 Regulations.

In particular, I propose to address myself to the question as to the main effects that we have been able to detect that are primarily relating to the infant, the fetus and the early embryo, which are the most sensitive members of our population in the general population.

In particular I would like to very briefly review the evidence that has accumulated in this area during the last 10 or 15 years, and to relate it to the question of the standards as they now exist.

Now, the evidence derives mainly from the following sources:

Number one, large-scale statistical studies of human populations exposed to diagnostic Xrays over a period of many years, carried out by a number of investigators, especially at levels per radiation exposure well below the 500 mr maximum per year to an individual as permitted under present 10 CFR 20 Regulations.

Number two, I would like to use the data that have been accumulated on statistical studies of populations exposed to fission products, radiation in the course of various nuclear tests, and atmospheric releases of various types; again, at levels of exposure to the population well below those not permitted under 10 CFR 20.

Then I would also briefly review the appropriate animal and laboratory studies relating to these effects at low doses; and finally, I would like to end by reviewing our latest statistical studies of health effects associated with known releases from nuclear power plants and fuel reprocessing facilities; again, at levels well below those permitted under present AEC regulations, Title 10 CFR 20.

If I may do so, I would like to distribute to the members of the Board copies of the relevant parts of my testimony relating to the releases from nuclear plants, and also provide copies -- extra copies -- for the record.

CHAIRMAN SHALLENBURG: Very well.

THE WITNESS: Now, the first of these relates to a

paper dated November 30, 1970, "Infant Mortality Changes Near A Nuclear Fuel Reprocessing Plant." Attached to it are a number of more recent diagrams illustrating the effects that we have since found.

The next document is "Infant Mortality and Nuclear Power Generation," submitted or presented at the hearings at the Pennsylvania Sentate Select Committee on Reactor Sitings, October 21, 1970, and submitted to the Bulletin of the Atomic Scientists.

The next document relates to and is entitled, "Infant Mortality Changes Near the Big Rock Point Nuclear Power Station, Charlevoix, Michigan," dated January 6, 1971.

Attached to these three documents is a diagram, a curve relating to an as yet incomplete record indicating and relating to infant mortality changes near the Peach Bottom plant in Pennsylvania.

MRS. BLEICHER: I would like to have these marked as LIFE's Exhibits 1, 2 and 3, if that would be appropriate at this time, so that the Board could look at these exhibits and the other parties here could look at them.

CHAIRMAN SKALLERUP: It would be appropriate. I think it would be desirable if copies were also provided to the Applicant and to the staff.

MRS. BLEICHER: Yes.

(The documents referred to were marked LITE Exhibits 1, 2, and 3 for identification, and were received in evidence.)

BY MRS. BLEICHER:

Q Dr. Sternglass, has another document entitled, "Low-Level Radiation Effects for Nuclear Fission Projects in the Environment," dated May 5, 1970 --

Unfortunately he has only one copy of this document with him today and he would like to refer to it in his testimony. May we have it marked as Exhibit 4 and give each party an opportunity to look at it before he refers to it?

Would that be acceptable?

CHAIRMAN SKALLERUP: Would you make an effort to provide copies for all parties?

MRS. BLEICHER: We will have Xerox'd copies of this document as soon as possible, perhaps this afternoon.

CHAIRMAN SKALLERUP This is going to be Exhibit 4.

MRS. BLEICHER: Yes.

MR. ENGELHARDT: Mr. Chairman, I received the document which LITE has identified as Exhibits 1, 2 and 3. I have actually four pieces of paper.

I realize we have had the material identified, but I have what appears to be three reports prepared by

Dr. Sternglass and a single sheet of paper entitled, "Infant Mortality Rate Per 1,000 Births." Is this detached, or something?

MRS. BLEICHER: No. I think I erred in saying we only have three exhibits. That could be marked as Exhibit No. 4 and the Low Level Radiation Effects from Nuclear Fission Products in the Environment paper that I just referred to can be marked as Exhibit No. 5.

Exhibit No. 4, as Dr. Sternglass just related, is a part of a study that is not yet complete, but it does illustrate the information he has available to him at the present time in graph form.

MR. ENGELHARDT: Dr. Sternglass will explain the significance of this chart in his testimony?

MRS. BLEICHER: Yes, he will.

MR. CHARNOFF: The applicant has no objection to the marking of these exhibits. We would like to reserve the right to determine whether this is or is not relevant as an issue in this proceeding.

CHAIRMAN SKALLERUP: Well, you have that right.

The issue here is whether 10 CFR 20 standards are legally appropriate and I gather this is the approach to the exhibits and Dr. Sternglass' testimony.

MR. CHARNOFF: I understand the purpose of his testimony, but not having seen these before, I want to reserve

the right to question the relevance of these at the appropriate time.

CHAIRMAN SKALLERUP: Well, we would be pleased to have you bring forward any question you like.

WITNESS STERNGLASS: May I proceed?

CHAIRMAN SKALLERUP: Yes.

WITNESS STERNGLASS: The earliest evidence, as I indicated, of the first possibility that low level radiation, far below that that had been believed to be effective in man in producing diseases, arose from a statistical study on large-scale surveys involving mothers exposed to diagnostic surveys first carried out in England by Dr. Alice Stewart beginning in 1956.

The first indication of a problem in this area occurred when, as a result of an effort to find out why leukemia had increased in England after 1950, she had carried out a study in which she interviewed mothers and found out that among the mothers who had had diagnostic X-rays during pregnancy, there was approximately a 90 percent greater or almost twice as many cases of leukemia and cancer among their offspring as among those who had no X-rays.

By 1958 she had accumulated a much larger number of cases and again her study was confirmed.

Furthermore, by 1962, Dr. Brian MacMahon, under sponsorship both by the Public Health Service and the Atomic

Energy Commission had carried out a check study, a separate and independent study of this particular phenomena, and also concludes as a result of the study involving some 800,000 children born in New England and New York hospitals, a fraction of whom had of course received X-rays, that indeed he confirmed the indication that again there was something like a 40 to 50 percent increase or almost half as many cases of leukemia and cancer among the children that had received a few diagnostic X-rays.

It was in this sense that since one diagnostic X-ray normally amounts to only anywhere from 200 to 400 millirads, that we are dealing with a situation which comes within the province of the kind of levels that we normally encountered from the environment and which at the present time by federal regulation is permitted under 10 CFR 20 to be given to the maximum individual in the society, the average being one-third of that or 175.

The key points about this study may be summarized as follows:

Number one, both Dr. MacMann and Dr. Stewart later indicated a growing risk with increasing number of X-rays from one to two to three in a proportionate increase in the number of cancer and leukemia cases seen.

Now, this was confirmed in more detail in a paper published in June of 1970 by Dr. Alice Stewart involving her

review of some 19 million children, a fraction of whom were X-rayed over a longer period of time, approximately a decade and a half in England. Again using hospital records, she concluded:

Number one, there was evidence for a direct linear relationship or a proportionality between the number of X-rays given and the chance of cancer and leukemia.

Number two, she was able to arrive at the conclusion that the early embryo in the first trimester was approximately 15 times as sensitive as the late fetus to a given amount of radiation, or the risk was 15 times greater.

Now, in view of the fact that her figures established a dose to double the incidence of leukemia and cancer of about 1200 millirads for the late fetus near full-term, her conclusion amounts to the fact that the early fetus requires only about 80 millirads in the first three months of pregnancy in order to indicate a statistically significant increase or doubling of cancer and leukemia in the next 10 years of life.

Now, 80 millirads represents no more than what we normally receive from cosmic radiation in the course of a year. Therefore, her conclusions apply, as had been suspected by a number of people, including Dr. E. V. Lewis at Cal Tech and many other individual researchers, that a significant part of all of our present cancer and leukemia cases in children, possibly 10 to 20 percent, may actually be due to normal cosmic

rays in our environment and other environmental radiation.

In fact, Dr. Stewart also concluded that possibly as many as 18 percent of all leukemias in adults may be due to medical diagnostic X-ray side effects.

Since the dose from medical X-rays is on the order of 50 mr per year, and we are talking about doses on the order of 100 mr per year to various parts of the body for the average population, we are in effect once again dealing with indications of effects well below those levels now accepted under 10 CFR 20.

Now, the important significance of all this is that since we are dealing with the embryo which is developing very rapidly in the first few weeks of life, there is not an adequate time for repair as normally occurs for high doses of radiation in the adult when given radiation to the hand or the body -- they are put in conditions and so forth where repair mechanisms can take place and indeed do take place so that we of course have radiation therapy made feasible in that way. The normal cells manage to repair under the action of fairly intense radiation.

The indications for the embryo, as well as Dr. Alice Stewart's paper of July of 1970 indicated that the embryo represents a different situation: That the embryonic cells are not able to repair and resist. They have not yet acquired the ability to fight off cancer and leukemia to the same degree

mature cells have.

Furthermore, Dr. Stewart found that not only leudemia but all other types of cancers are approximately doubled by the same amount of radiation in her July of 1970 paper. As a result, we are now confronted with mounting evidence which, of course, is in effect accepted by the National Council for Radiation Protection in the releases that I referred to in my testimony yesterday, and which appeared in nation-wide newspapers the day before and yesterday, that the National Council on Radiation Protection has recognized the increased hazard of a given amount of radiation to the early embryo, to the infant and to the fetus in utero, and has recommended a lowering of the permissible doses given to pregnant women in atomic energy-related industries where radiation is experienced by the worker from the normal value annually of 5,000 mr down to 500 mr, or by a factor of 10 times.

It is my believe and my contention that if that kind of a lowering of the allowable doses is recommended by a body of men who have for many years examined this subject, then I believe, if it is recommended for those who are working in the plant, that I believe the general population also must have its average radiation permissible exposure reduced -- unless we are willing of facing the possibility of asking women who live near nuclear facilities to move away during the time

of pregnancy. This clearly is not a feasible situation --

CHAIRMAN SKALLERUP: May I interrupt for the Board a minute?

WITNESS SKALLERUP: Yes.

CHAIRMAN SKALLERUP: The Board will go off the record.

END#2

(Discussion off the record.)

CHAIRMAN SKALLERUP: Thank you, Dr. Sternglass. Please continue.

THE WITNESS: This then is the nature of the evidence that we have derived on the basis of the consideration of diagnostic X-rays over the last 15 years and it has already become incorporated in certain federal radiation documents where in fact the idea has been accepted that the infant in utero requires the average near full-time only doses on the order of 2 to 5 rads for doubling and that the younger the child is the greater the sensitivity and that the minimum of sensitivity is reached in middle age, increasing again towards the older age.

Now, the next line of evidence that has accumulated in the last 10 or 15 years relates to the statistical studies on the effects of past releases of fission products into the environment in the course of both weapons testing and the detonation of peaceful nuclear explosives for the building of canals and the moving of mountains. The actual testing of nuclear weapons of course began first in New Mexico in 1945, then moved to the Pacific in '46 and '48, Russia began testing in '49, Nevada tests began in 1951 and by 1958 a larger series of tests including hydrogen bomb tests had been completed in the Pacific began about '53 to '54 and in '58 there was a moratorium during which time the actual levels began to decrease both in the air and the

quiet, then resumption of testing took place in the fall of 1961 and continued throughout 1962.

Since 1962 only China and France have continued to test in the atmosphere. We have on occasions carried out cratering shots which have indeed released some amounts of radiation into the environment as documented in various radiological health data reports.

Now, while examining the possibility that low level diagnostic X-rays can produce increases in leukemia, I examined the situation and brought to the attention of the scientific community about Dr. Ralph Lapp, who published a paper in, I believe, the fall of 1962 in Science, pointing to the fact that at some time nuclear tests such as the Simon shot, a 40-kiloton shot carried out in Nevada in April of 1953, deposited small amounts of radiation in the form of fission products.

This test had been monitored by people from the Health and Safety Laboratory of the Atomic Energy Commission in New York by Dr. Eisenbud and it was concluded that a 200 curie per square mile deposition had taken place, that the activity on the whole on the ground gave an external gamma dose of no more than 100 millirems or millirads, it is the same unit in this case, in the first 10 weeks after the deposit came down.

Again we are dealing with 100 mr which is below the

value regarded as acceptable even for the average population of 175 mr.

Neverthless, at the time it was not widely recognized to what degree the material not only provides external radiation similar to X-rays but also gets into the food chain and re-concentrates in the cow, in the vegetables, in the fish, the streams, the reservoirs, drinking water, et cetera.

By hindsight Dr. Ralph Lapp was able to calculate that infants in that area as a result of drinking the milk and other possible sources may have and probably had accumulated as much as 10 to 30 rads to their thyroids as a result of the tendency of iodine to reconcentrate in the human thyroid. He pointed out that therefore we should examine whether or not increases in various types of diseases had taken place and he specifically mentioned thyroid cancer. He urged such tests should be carried out in Utah and other areas where greater intensities of fallout had ascended.

We were talking about levels not far above cosmic ray levels or from the natural environment.

Within a half year hearings took place in June and August of 1963 in the course of which Chairman Holifield of the Joint Committee of Atomic Energy and the Senators from Utah and others urged that such studies be carried out in accordance with Dr. Lapp's suggestion.

s As I indicated yesterday such studies were initiated

but never published and never had in fact been carried out on a national scale. However, in the course of examining the possibility that leukemia might have increased, they calculated the possible doses and it might well have doubled the possible doses both internally and externally to the embryo and fetus in utero.

Early in 1964 a set of data was published by the New York State Health Department indicating rises in leukemia did indeed take place for children under 10 years of age for which data was complete and it showed a peak occurred some six or seven years after arrival of a fallout and this is similar to the peak that occurred in Hiroshima and Nagasaki six to seven years after the individuals there were exposed to radiation.

Furthermore there was a shift in age distribution such that children were dying towards older age. Instead of dying mainly at two to three years old, leukemia seemed to be striking them at ages 5 to 10. This shift had been noticed by Dr. Alice Stewart and Dr. MacMahon for children who received X-rays in utero and again this tended to corroborate the hypothesis that we may be dealing with an effect on the children in utero, due to the radiation both externally and internally.

This particular study, while examining it further, I detected in that same area of Albany-Troy, New York, a

halt in the decline of fetal mortality which happened to be going on at a steady rate since the early '50s and then suddenly within a year or so after the arrival of the fallout in Albany-Troy drastically leveled off and then began to rise again and only in the last two years has fetal mortality in all of New York had this area begun to come down again.

Then we examined infant mortality all over the United States and found that in state by state, down-wind from the testing, there was a rise and decline of infant mortality above the projected rates based on the previous 15 years history, in unison, following within a few years after the onset of nuclear testing in the early '50s and ending dramatically within three to five years after 1962.

Or, in other words, in the last three to four years infant mortality has once again dramatically resumed its decline and in fact will of course have gone down to far lower values as for instance is shown in one of the figures that I have attached, that is, incorporated in one of the papers I referred to.

I refer you to Exhibit No. 2 -- no, I am sorry, it is in another one.

End #3

I believe it is in Exhibit Number 1, "Infant Mortality Changes Near A Nuclear Fuel Reprocessing Plant," Figure 3.

If you turn to this, you will see that the infant mortality rate here is plotted for both Illinois and North Dakota. In that situation you will notice that infant mortality in North Dakota and Illinois from 1955 to 1960 were roughly the same, despite differences in urban and rural characteristics.

After 1966 and '67, Illinois showed a rise, and stayed high while North Dakota drastically declined from nearly 25 per thousand live births to just under 18.

We have seen similar drastic declines in infant mortality since the end of nuclear testing all over the world. I have recently examined the data for the State of Maine, and Nebraska; and especially in the State of Maine, infant mortality has come way down to levels which were predicted by the projection based on the 1935 to 1950 performance.

In addition, we carried out detailed studies of the correlation of various nuclide isotopes in the food and the diet, the milk, with the changes in infant mortality from state to state wherever such reliable data had been gathered by the U. S. Public Health Service.

The U. S. Public Health Service started a milk network for monitoring the milk back in 1957, and 9 states were

included in that by 1958. As a result of this correlation we find a very strong correlation between the rising levels of strontium-90 and other isotopes that go along with it in the milk and the changes in infant mortality with correlation coefficients in all cases in excess of .92, except in Utah where the correlation was only .84.

Since then we have extended these studies to England and have found that similar phenomena took place in Northern Europe where the fallout from the testing carried small amounts of radioactivity into the diet following the prevailing northeasterly path in the clouds from Nevada, and across the Atlantic.

Again we find as we go down in Europe from the northern part to the southern part there is a decline in change in infant mortality. The effects are less wherever there is less fallout coming down, because the Nevada test tended, on that first path around the earth, to be concentrating in the northern parts of Europe.

The measurements of doses carried out during this time by the Atomic Energy Commission and the Public Health Service indicated that when averaged over a period of 70 years, as appropriate for the adult, doses from nuclear testing to the population probably never, on the average, exceeded 5 or 10 percent of what they would have gotten from cosmic rays, and these are relatively low external doses. Even internal

doses turned out not to be extremely large; in fact small, compared to what you would get from the natural environment.

All of these, of course, are lower than the 10 CFR 20 values which allow as much as 5 mr to an individual, or 175 per year. If these changes are associated with the arrival of small amounts of fallout of this type, then we are dealing with health effects which apparently took place at levels well below those that had been regarded as acceptable for the population.

Again, the reason is to be found in the fact that the early fetus and embryo is so much more sensitive than the adult. Because if we have these concentration mechanisms whereby the strontium-90 goes to the bone and then decays to yttrium -- yttrium decays, leaves the bone and has a constant turnover, and as has been shown by Dr. Grau in Germary, tends to seek out the organs that control growth, such as the pituitary, thyroid, the other glands and organs connected with the fighting of infections, we have a situation where one does not get growth malformations to any large degree, one does not get any serious changes in the babies born, but one simply finds that they are slightly immature and under-developed.

As a result of this kind of an effect, it was not possible to immediately relate it to and definitely connect it with these levels of radiation. This, of course, has happened in the past. It is impossible for instance to relate a given

cancer, a eukemia case, to radiation. It could occur spontaneously, and there is no difference that can be detected in the individual case.

The same is true for lung cancer. It can never be proven that a given case of lung cancer was produced by radiation or not. Therefore, all one can do in these cases is to look for very close associations, both in time and space, to tie down whether or not levels at doses of 10 CFR 20 or lower were indeed connectable with -- in a statistical manner -- with these levels of radiation.

Now, in order to avoid the problem of having to depend on an extrapolation from a declining baseline of infant mortality, declining steadily through the 30's and 40's, we examined separately the incidences of leukemia and other congenital defects in Utah, which is a study that had been suggested at the time of the '63 hearings during which I testified on this matter in Congress. And these results are incorporated in Exhibit 5.

Exhibit Number 5 which you do not have in front of you, unfortunately, but I would try to indicate the nature of the evidence here, in Figure 1 of this testimony, Exhibit Number 5, there is a plot of the annual number of leukemia cases for children 5 to 14 years old in Utah, compared relative to the number of accidental deaths in that same age group, since we wanted to compare it with some other condition of death which presumably was not affected by any significant

degree by fallout.

We see that following 3 to 5 years of known arrivals of fallout in Utah, as documented by AEC and Public Health records, and releases of announced nuclear explosions, we find that peaks occurred which in some cases rose seven-fold above the values in 1949; going down again in between when moratoria existed.

This, therefore, is strongly suggestive, although again cannot be regarded as conclusive proof, of a possible association between low-level radiation regarded as acceptable save level at the time, and increases in leukemia in that area.

Now we, since then, in another study managed to get population estimates and correct it for the change in the number of births per year. These did not in any way change the pattern of rising and declining leukemia cases.

Thereupon we looked at and gathered from the U. S. Vital Statistics information on congenital malformations in the age group 0 to 4 years. In that case, congenital malformations began to rise from 75 a year to a peak of 125 per year in 1957-58, declining again after the end of testing back down to about 80 per year, while accidental deaths remained level throughout this period.

Again, this could not be regarded as proof of causation, but it is certainly highly suggestive that there are some 490 children that died, in excess of expectations at

levels that had been believed to be quite safe. Furthermore, we examined the deaths in Utah of children 5 to 14 that had been born congenitally defective, and that is reproduced in Figure 3, in which children were plotted that died of congenital defects or complications such as mongolism, and then developed leukemia.

These are known to be anywhere from 10 to 100 times more sensitive to the development of leukemia, having been born defective, than, say, normal children.

Similarly, the accidents plotted underneath again show no striking rise, but in this case the number of deaths typically went from an average of 2.9 per year to as high as 19.

That corresponds to more than a six-fold increase, declining again after the end of testing.

Deaths in Missouri, age group 5 to 14, again of congenitally defective, turn out to be the most sensitive indicators of environmental affects such as this. We see an average of 12.3 per year, rising to 38 or 39 per year in '63, the last year after the diet peak in radioisotopes, declining again in 1966.

Thus, we find this, state for state, throughout the United States. In Georgia, again the same pattern, rising from something like 11.4 to 40 deaths per year, and declining afterwards. We find it in Texas, rising from 11

per year to a high of over 72 per year, and declining again.

And we find this throughout the United States, where we know that fallout arrived as a result of various rainouts and depositions of tests, as published subsequently.

We also have examined the kind of conditions of which children and in fact adults of all ages, died in Japan after the Hiroshima-Nagasaki bombs were detonated.

Again, we know in the city itself leukemia rose 5 to 7 times, and we find a second peak as published by Dr. Chuco. Elsewhere in Japan similar rises took place even at distances greater than a few thousand meters from the point of detonation, again due to fallout from these tests, which of course, is unavoidable, although not nearly as intensive as when the test was carried out in New Mexico, where the fireball touched the ground and large amounts of activation products and other fisaion products were thrown into the air and descended in a matter of minutes and hours.

Again we find sharp rises took place in certain types of cancers, and only those types of cancers, in fact, which we know are connected with the organs of the reticular epithelial system, the system which controls the effect of infections, the glandular system which controls the formation of hormones. We find a considerable rise after a level for many years in Japan among males, panoreatic cancer started to rise in about '45 and '46, gradually rode up sharply thereafter.

It was practically level before, and rose up to almost a factor of eight times. Prostate cancer, thyroid cancer, lung cancer -- all of those cancers rose sharply, while the general cancer, like esophagus, rectum and stomach, similar in the female ovarium cancer rose, and we know yttrium seeks out both the male and female reproductive cells.

Thus again there is no proof, but highly suggestive indications that there is an internal concentration of isotopes in the environment that seem to give us greater effects than had been predicted on the basis of the then accepted radiation standards.

We also looked at the situation in Utah over a period of years for leukemia deaths in the age group 5 to 14. This is exhibit 8, in which we show the accumulated excess number of leukemia cases per year, which is what we plotted relative to accidental deaths, increased with the known thyroid dose, as measured by Dr. Mayes at the University of Utah, and reported in his testimony in August of 1962 at the hearings of the Joint Committee on Atomic Energy. Again we find a direct linear relationship between the accumulated thyroid dose to the infants in Utah and the probability of excess number of leukemia deaths resulting in that area. The dose required to double the normal number of leukemia cases was only 3 rads to the infant thyroid. 3 rads must be compared with levels of a half rad that we are talking about

in 10 CFR 20. And I will come to that with regard to other guidelines now accepted.

For instance, the PAG guides for accidental exposure of the population to a single event that is not expected to be repeated permit 30 rads to the infant thyroid, and this, I believe, is far in excess of what can be regarded as an acceptable accident if it appears to increase the risk of leukemia and cancer by ten times.

end 4

Especially important is the fact that in the National Council of Radiation Protection for standards that have just been suggested to be considered by the environmental protection agency, one of the areas singled out that requires downward revision is indead the iodine dose to the thyroid. Of course this is especially true in infants where the thyroid dose is 10 times larger than for the adult, and in the fetus for which it is another factor of 10 or 100 times greater than for the adult.

This has been established by studies of Dr. Merrill Eisenbud, published in Pediatrics, I believe, in a special issue in January of 1969.

Therefore, we are dealing with a situation where once again the unexpected concentrations in the diet and the unusual internal concentrations in the human body has defeated our early attempts to use physical means to merely estimate the overall external radiation doses as a way of evaluating hazard from fission product.

Now, part of the problem also deals with the problem of inhallation hazard. Again 10 CFR 20 establishes certain standards for the concentration of radioactivity, both beta and alpha, per cubic foot in the air which is acceptable in terms of inhallation.

In order to see whether we could detect any effects on respiratory diseases associated with both peacetime-testing

and nuclear emissions from reactors, we examined the U. S. Vital Statistics with regard to respiratory disease deaths other than pneumonia and influenza, which is shown in Figure 9 in Exhibit 5. In this case we are comparing New Mexico and New York.

We would naturally expect, offhand, that in areas as heavily polluted as New York, which is the highest index of ordinary pollution in the country, that under those conditions we would expect that New York would show by far the highest death rate due to respiratory diseases such as asthma, emphysema, chronic bronchitis, et cetera, both in children and adults. As a matter of fact, this used to be true before 1945. But, as this curve shows, ever since about early 1950, clean air of New Mexico has led to a higher, almost twice the rate of respiratory disease deaths in New Mexico as in New York.

We have found the same thing for Wyoming, relative to Illinois; Wyoming relative to Pennsylvania, within the last few years. And in every case, we have looked at the areas that are now covered with fine radioactive dust, plutonium, strontium, all the others, cesium and and long-lasting, 28-year half-life materials, plutonium -- 24,000 years. The areas in the dry areas of the West were areas with beta activity anywhere from two to five times as high as the west areas in the East, we find consistently the respiratory disease rate is higher there even though the concentrations are far below

those permitted under present 10 CFR Part 20 standards.

Furthermore, we examined the incidence of lung cancer as another possible indication of possible effects on man due to various environmental effects. This refers to Figure 10 of our document number 5. It is entitled Mortality Rate from Malignant Neoplasms for the Bronchia, Trachia, and Lungs, for males for 75 years -- white, because the diagnosis for white has been better over the years than for the non-white population.

Here we plotted the populations of individuals dying of lung and other respiratory disease cancers. Again we find in the 1950's to early 1950, lung cancer was essentially level or even coming down for this age group, and males, as you know, showed a higher increase than females. And suddenly after 1950, there was an enormous rise, going from something like a minimum of 80 per 100,000 population to as high as 200 by 1964.

This rise continued and at this point we find it both going on at twice the rate in the dry, clean areas of the West as compared to the heavily ordinarily polluted area of the East.

CHAIRMAN SMALLERUP: Dr. Sternglass, did you say that was with respect to the male white population in general?

WITNESS STERNGLASS: This happens to be a specific age group which we know to be sensitive, namely the 75 to 84

years old. We have examined it for all other age groups as well and it is in fact plotted in statistical summaries published by Dr. Moriyama on total mortality changes in the United States, published by the National Center for Health Statistics in the early 1960's and in these publications, these same changes in respiratory disease deaths, lung cancer deaths and all of these other diseases, especially leukemia, is found to take place for all age groups but more so for very old than the middle-age group and much more so for the five to 14 than for the zero to five.

So it would be differences which are consistent about which we know about the relevant sensitivity of age groups.

CHAIRMAN SKALLERUP: Excuse me, the Reporter would like a break.

We will resume in 10 minutes.

END#5 (Recess.)

CHAIRMAN SKALLERUP: Will the hearing please come to order?

THE WITNESS: I have just indicated, we received indications from our statistical analyses that there may be an association with relatively low levels of radioactivity in the air and changes in various respiratory diseases.

Now, in examining the causes of death --

DR. JORDAN: Could I ask a question?

I am confused a little bit about the level of radioactivity in the air in the western states or the dry states as compared to the eastern states.

You say this is demonstrated in the results from that. Are these radioactivity levels, are these radon level or fission product levels?

THE WITNESS: They are gross data radioactivity in surface air and these are listed in that manner.

DR. JORDAN: So it would not be radon since that is alpha.

THE WITNESS: That would be the case. Mainly our data are most complete on beta activity in the air which are largely fission.

DR. JORDAN: It is fission product activity that you are measuring then?

THE WITNESS: That is right. As a matter of fact, your comment is appropriate simply because prior to 1945

we did not have these high respiratory diseases in that area even though we had national radon activity.

We were mining uranium though not at the rate we are mining it now and we know we had problems in the piling of accumulated products from the mine that had been blown about but at this point our indication is that our main problem comes from fission products.

Now, with regard to respiratory diseases, I think it is important to keep the following in mind. It does not mean and I do not want to imply that other causes of lung cancer are not very important. As a matter of fact, it is my conviction that it is the unfortunate combination of low level of radiation which is always present, plus intense smog and fog and dirt and dust from soot-bearing coal dust and everything combines to make these things first.

I may also add smoking is definitely a factor which further enhances what we now call a synergistic manner the net result of all of these pollutants is far worse than any one alone. I think this is known in the case of uranium miners where it has been established that uranium miners die at about 10 times the normal rate of lung cancer but when they smoke they die at 100 times the normal rate of lung cancer. It does not mean cigarettes are not a very important factor in lung cancer and the same would be true for emphysema and other respiratory disease.

We must reduce all sorts of pollution for any one is much less serious than the combination. As a matter of fact, this is the sort of thing which our present radiation standards under 10 CFR Part 20 also don't take account of. If you release radioactivity in an area of high pollution you have a greater problem than in an area with very little dust or smoke. These interactions are things which so far have not been adequately taken care of because inadequate studies have been done to identify the relative contribution of different factors in our environment.

This is not only true for radiation but every one of our environmental agents.

I would like to briefly mention the animal and laboratory studies that tend to substantiate these findings of a statistical character. I think it is important to realize that animal studies can never be carried out at the same low levels, shall we say, as which we experience in the human environment. If we did we would all be dead of cancer. The point is that laboratory studies can only be carried out on a relatively small number of animals at a time. 100 or 1,000 animals is a large number and sometimes we have to look at a million people in order to be able to see small changes in these health statistics.

So it is natural, therefore, that one must give large doses to the animals in order to see effects in only a

ındful, say in effect that only half of the fetuses born are born dead and things of this sort.

As I mentioned yesterday, there are indeed a series of experimental studies that have been carried out in the lakes a few years and some of which have been published carried out in '46 and '47 but never published. That is an unfortunate fact that some experiments were carried out indicating the effects on the fetus and were only published in full last year, although they were carried out way back in 1946 and '48 in Argonne National Laboratories. But some of these experiments indicated that at levels where gross abnormalities are not observed in the offspring, if low level radiation begin to the mothers during pregnancy or prior to pregnancy there are detectable effects of a slight nature, namely, lowering of weight at birth, increase in fetal deaths, rises in slight infant mortality and weakening and general underdevelopment at birth.

Now, from studies of clinical situations, we have long known that such diseases is high membrane disease and early respiratory distress among infants is highly associated with immaturity.

Therefore, from these animal studies and the fact that we see similar lower weight of newborns in the United States since the early '50s, which is beginning to once again decline back to normal weight babies, as discussed by

Dr. Helen Chase of the American Journal of Public Health, I believe the October or November issue of 1970, she points out that this trend towards immaturity of babies in the United States began by coincidence, again, early in the 1950s and reached a peak in the mid '60s, early '60s and has begun to decline again.

This again relates to the question of how much of an effect and what is the nature of the effect of these low levels of radiation.

CHAIRMAN SKALLERUP: When you speak of immaturity, you mean at time of birth, immaturity in development at that time?

THE WITNESS: That is right. There are two different things going on. Number one slight prematurity in birth which naturally leads to underweight and also full term babies that were born slightly underweight and therefore less able to resist diseases and infections, et cetera.

It is well known that many immunities build up only in the last few months of the interuterine life and early immunity is still transmitted by the mother through breast feeding and so forth.

Therefore babies born slightly immature, their ability to reduce an epidemic of measles or pneumonia is decreased.

In examining our statistics we find high correlations

in the year following testing and large increases in the air of nuclear fission products and rises in all infectious diseases going back down again which mainly affect the very young and very old. So this idea that immunity is really something that can be affected and may be a greater hazard of growth malformations is an idea that has not been fully enough examined.

However, it was known way back in 1967, and I refer to a recent article by Paul Jacobs in the February Atlantic issue of 1971 in which Paul Jacobs points out way back in 1957 when he first investigated possible health effects of Nevada testing he saw a report in which a paragraph was later on deleted when it was released for publication in which the possibility of infectious diseases rising as a result of nuclear test was discussed but was missing.

I have a copy of this article with me and the exact paragraph is contained in there.

So we do have the knowledge and the suspicion that we are not merely having to worry about gross malformations but we must look at the more subtle effects and this I believe is not incorporated in the levels of 10 CFR 20 as they are now formulated. They simply were based on what was known about the adult radiation worker in the factor and the medical hospital exposed to radiation and I believe those levels for the adult male may indeed not require radia

changes.

Therefore, my concern is primarily directed towards those members of the population that happen to be what we call, in health physics, the critical members of the population. Those that are the most sensitive. Just as we deal with critical organs in the human body which are more sensitive, we also deal with certain critical members of our population and unless we focus on them we will not conquer this problem of how to develop atomic energy safely in such a way that we can indeed have an acceptable ratio of risk-benefit.

Now, I would like to briefly turn to the last of my points that relate to the evidence that the 10 CFR 20 values need to be reexamined in the light of our new knowledge. That deals with the question of our studies on nuclear facilities where we have a situation where very well known and quantitated amounts of radiation were released because by law every atomic energy facility is required to keep an exact log of the amounts of releases, both of liquid and gaseous effluent.

We are fortunate in this particular case in the sense that no other polluters are required to keep such logs, we cannot even pin down to what degree other pollutants are acting on the environment with nearly as great an accuracy as we can in the case of radiation.

Therefore we have examined the possibility of

changes in infant mortality around various nuclear facilities for which we had indeed known levels of discharges as reported by the Atomic Energy Commission and the Bureau of Rad Health.

Now, our first study concerned itself with the facility which is indeed the first major nuclear power generator built for purely commercial purposes. That is the Dresden study, Morris, Illinois, as discussed in my reference number 2.

Now, this study which I refer you to would be -- called "Infant Mortality and Nuclear Power Generated," dated October 18, 1970, Exhibit No. 2. What we did is we did two different studies which was mentioned in the letter of Dr. DeGroot yesterday, we looked at both counties individually and the State of Illinois as a whole.

With regard to the State of Illinois as a whole, I refer you to figure 1 of Exhibit 2 which shows you a plot in the upper part of the curve of infant mortality rates per thousand live births in Illinois and New York compared.

You see whereas in the mid-'50s, end of the '50s, Illinois-New York had very closely the same rates of 25 per thousand and then there was of course another test series in 1961-62 which deposited large amounts in the diet in New York City.

We did have New York decline along the dotted line down to 21 by 1968 but Illinois shows an uncharacteristic

peak, very different from every other state in the entire northeastern United States and this peak as you will see is highly correlated with gaseous emissions as obtained from the Bureau of Rad Health studies on the releases of the Dresden reactor.

You see there was a small peak first, followed by a much larger peak that peaked between '65 and '66 and during that time, within a year, we find a rise and decline closely following this in Illinois that was not reproduced in New York.

Now, if you will turn to the plot that I have attached behind -- behind the references which contains a graph marked Illinois, Indiana and Ohio, you will notice this peak was not contained merely to Illinois but also appeared to occur by coincidence in Indiana, only about 50 miles downwind from the prevailing westerly winds and there was no real indication that it reached all the way to Ohio, although that happens to be a small peak.

So we can see effects that appear from as far away as more than 50 miles from the plant.

If you turn to the next page which is a graph containing Illinois, Michigan, Ohio, Michigan being located across the lake from Illinois, we also see a small indication of a peak that happens to occur in Michigan at the time of the peak in Illinois when the Big Rock Point plant emitted

its gases. These gas emissions were very high. I was personally and I can say this without any hesitation, extremely surprised that many years, in fact 13 years after the Shippingport plant was built with releases of as low as 0.001 curies per year, that the Dresden plant was emitting last year, according to the latest information I have from testimony by Commissioner Name' given during the Senate hearings in Pennsylvania, the releases last year from the Dresden plant were 800,000 curies or nearly a billion times more than was possible to achieve at Shippingport.

To my mind that kind of a release in the face of this kind of statistical evidence and the possible serious implications seemed to me unconscionable and it is for this reason I have been so concerned in examining all the other facilities that have not up to now been examined by anyone in the government.

In addition to looking at Illinois we also examined the individual counties and the counties indicated are shown in figure 4. I think of this Exhibit 2 and you will see that surrounding Grundy County where the reactor is located, we have looked at all the five counties surrounding them and then took six counties, a group of the same number of counties in the same geographical location but more than 40 miles away at the time west and we compared the changes in infant mortality the year following the large release between

'64 and 1966.

In other words, a minimum in 1963 and we saw a rise sharply in '63 and '64 so we looked at the next year and '64 then is our comparison with '66.

In figure 5 of that Dresden report you will see in the upper part the percent change upward in the counties clustered around the reactor going up as much as 140 percent, whereas the control counties way to the west showed only small increases and possible decreases in some cases such as Knotts, Stevens, and Lee Counties.

Now, in addition we carried out correlation studies in which we compared the change in respiratory disease deaths in these states. Particularly we compared Illinois with Ohio and Illinois with New York and Illinois with Pennsylvania. We found in every case Illinois began to exceed in emphysema, respiratory deaths and asthma, those types of deaths, only after the onset of the reactor operation in 1959.

Prior to the decade of '49 and '59 Illinois respiratory deaths rose only about 10 percent despite the doubling or 100 percent increase in normal power generation by conventional means. Between '59 and '67 respiratory deaths in Illinois rose almost 10 percent per year or about tenfold the rate that it had. This rate was not nearly as great in polutted Pennsylvania and polutted New York which did not have such a large reactor emitting these enormous quantities

of fission gas into the air.

Having examined the situation around Dresden we turned towards other situations and particularly we looked at the Big Rock plant of a similar type, namely, a boiling water reactor located in Charlevoix, Michigan and discussed and presented in Exhibit 3, called "Infant Mortality Changes Near the Big Rock Point Nuclear Power Station in Charlevoix, Michigan."

Again we have a situation where the emissions reached levels as high as a few hundred thousand as shown in figure 1. I draw your attention to figure 1, Exhibit No. 3, where we have plotted the 10 nearest counties directly to the east of the Big Rock plant, lumped them together because they are small rural counties typically having only four to eight thousand people in each county.

In order to have enough statistics to get a meaningful number we lumped together the 10 counties towards the east and compared them with another group of counties more than 40 miles further to theeast and another group of counties more than 40 miles to the northwest, in the northeast corner of Michigan.

We compared these counties and figure 1 shows you, I believe quite clearly, that infant mortality as to the end of nuclear testing in 1962 declined straight down year by year until 1965 and in 1965 the radioactive releases in '64

began to be significant, in '65 they had begun to be more significant and by 1966 they were up to close to seven or eight hundred thousand curies of fission gases and then declined again.

You will notice a deviation upward, a complete reversal in trend of the decline which continued in North Dakota and other areas as I indicated to you before that were not subject to these large gaseous releases.

In order to see what happened in the other counties we return to figure 2 of the same exhibit and you will see that the 10-year by county turned up, the six distant counties to the northwest went down all the way to nearly 10, from 28 in a very dramatic way to 10 per thousand births. Then they began also to go up because the gases as we have seen in the case of Indiana and Michigan carry for more than 40 or 50 miles and you see that the nearby counties for 1967 went up whereas the six more distant counties actually declined a little bit between 1966 and '67.

We are continuing our analysis and of course expect to be able to come up with similar plots for each of the facilities and I would like to merely indicate two more very briefly that show the same kind of pattern. That is the nuclear facility which is not a power plant but a fuel reprocessing plant located in West Valley, New York and it is Exhibit I.

The reason why we are so concerned about this nuclear

processing plant is that it is the first commercial plant of its type. Many people were concerned that once this very difficult and hazardous operation had become commercial our corners would be cut and releases would take place which indeed happened as documented in Rad Health report, it is one of the few places of any AEC installation that actually approached and for a brief period actually exceeded the present 10 CFR 20 standards.

The important thing is that the releases are documented in many reports and have been of concern of the Public Health Service and the Compliance Division of the AEC.

There have been numerous efforts to shut it down and it is my understanding that major changes and revisions are being planned for this particular facility for reducing emissions.

I draw your attention again to the situation which I think is most clearly shown in this figure 1 or the figure which deals with the location of the plant in order to give you an idea of where it is located. It is located at Cattaraugus County. The plant is 25 miles south of Buffalo, located on Buttermilk and Cattaraugus Creek which emptied into Lake Erie.

Here we have another intensive source of liquid effluent which is being dumped into Lake Erie and this brings up the question which is mentioned of course in the petition,

namely, that we must not only regard this particular source as a potential source of hazardous effluent concentrations in Lake Erie but all the other nuclear facilities that are indeed now dumping a certain amount of radioactivity into Lake Erie.

End #6

That includes the Fermi plant in Monroe, only about 30 miles from here, Northport, Detroit. It includes the Nuclear Fuel Services Plant, which is probably by far the greatest single source of serious radioactive effluents than any plant in the United States.

This particular plant, located in Cattaraugus County went into operation in 1966. In April of 1966, the emissions started to rise, and by October of 1966 they were so high that in early '67 the plant had to be reduced -- the operation-- in order to cut down the amount of strontium-90, cesium-134 and 137, and krypton-85, which were the principal emissions.

I draw your attention to Figure 2, which shows the typical nearby county, Genessee County to the northeast, within about 30 minutes. And see Genessee County since 1960 had infant mortality rates below those of New York State, and was declining after the test in 1963. And then after '65, and since '66, the plant went into operation full term, in '67 it shot upward way above New York State, in a very typical manner, for reasons unknown.

I already mentioned Figure 3 showing in other places like North Dakota these mortalities did go down continuously. I would like to refer to you the attached sheet which follows the last paper refers in this same exhibit, where you will see on top of the map of New York I have not plotted the changes in infant mortality between 1966 and 1967, the year following this large rise - You will see within a radius of approximately 40 to 60 miles all the counties without exception went up in infant mortality and all the counties further away to the East of New York went down. To the degree that we have already looked at it.

As a matter of fact, New York State as a whole went down during that period and so did polluted New York City go down during that same period. Furthermore, we examined the situation further down in Pennsylvania. As you can see, Warren County and McKean County in Pennsylvania also increased. And we looked at it and in the next sheet you see see what happened in 1966, going down the Allegheny River, in which all the other gases and effluents brought down by the rain and snow in the watershed in the upper valleys came down and followed along the direction of the Allegheny River.

You will see going down the river there were rises in infant mortality which did not take place generally in the more remote communities except in one or two counties of very small population where less than 12 children died per year.

In order to show you how anomalistic this situation is, the next map will illustrate the situation for 1963 - 64. It is the curve marked 1963 - 64 and it shows what happened between 1963 and 1964 before the plant went into operation. And you will notice there are no rises along the length of the Allegheny and no significant rises in the nearby counties of the Nuclear Fuel Services Plant.

Thus, the pattern between '66 and '67 was quite atypical and we cannot prove it, but we do know that during that period cesium in the milk, iodine in the milk, and strontium-90 in the milk of the Erie and Pittsburch milkshed rose to levels higher than they had been since the end of nuclear testing.

Also, in the next sheet of Exhibit 1 is a plot entitled, "Infant Mortality Rate Per 1000 Births, Venango County." Venango County isthe most populous county of Pennsylvania along the Allegheny River. When you look at the figures you will notice there was a rise in Venango among infant mortality during the time of nuclear testing, and it then went from 23 down to 13 per thousand, after which the Nuclear Fuels Services Plant started its operation, and since it is operating, Venango jumped up and exceeded the rest of Pennsylvania for the first time in the last 10 years, and has remained up during the period of operation of the plant.

There is one more case that we have had a chance

to look at so far. The study is not completed, but the indications are of great concern to us. They are in some ways of a greater concern than the case of the other three studies, because they refer to a plant which I personally had not expected to produce any serious problem in terms of health effect. That is the Peach Bottom plant, a high temperature, gas-cooled nuclear reactor located between York and Lancaster Counties near the Maryland Border in Southern Pennsylvania, some 40 to 50 miles from Philadelphia.

We have looked at a number of counties and I have plotted the case of infant mortality changes in the case of these counties.

You will notice in 1962, '64, and '65, these three counties showed very closely the same pattern declining from 22 to about 18 per thousand deaths, whereas Lebanon County continued downward, reaching steadily downward, year by year, and coming down to just above 12 per thousand; Lancaster, after the onset of operations of Peach Bottom reversed its trend and went from almost 11 back up to 19, or a 50 percent rise in a matter of two years for reasons unknown.

At the same time, the milkshed of Philadelphia County, and I have the figures with me, as obtained from the Bureau of Radiological Health of the Pennsylvania State Health Department, showed that during this period of '60 to '65, iodine values in the milk rose in Pennsylvania, in Dauphine

County and Erie County from the plant up near Buffalo, as far as we know, the only state in the entire Northeast where fresh iodine showed up in the milk during much of this period, except in a few isolated other cases.

Also strontium-90 and cesium increased in the milk. We have not had a chance to extend these studies to other isotopes, but we intend to pursue this matter further because at this moment we do not know precisely what the main mechanism or pathway is through which these isotope releases from the plant reach the fetus.

I would like to take a few minutes now to summarize this part of my testimony very briefly, and put it in to context with regard to the petition submitted by LIFE.

I believe that as a result of these very, very many different statistical bits of evidence, and the animal studies that have now appeared, and the fact that the National Council of Radiation Protection has also recognized the greater sensitivity of the fetus and the early infant, that we indeed must consider a re-examination of the validity of present 10 CFR 20 rules. Especially as they regard the most critical members of the population, the various isotopes that tend to concentrate, the fact that many different sources of contributing to the diet, and the water and the air in the same area, that we must indeed in the face of what appears to be probable, not proven but probably or possible, highly

possible effects on these most critical members of our society, achieve a near-zero release of radioactivity to the degree practical a. indeed has been announced by the AEC, but not spelled out in sufficient detail.

It was my belief and it is my personal judgment, in the light of the studies that I have carried out over the last 10 years, if we do not now proceed to enforce it, this idea of zero releases as was obtainable in the Naval power reactors, that we are heading for a very serious, major problem of irreversible nature that cannot be avoided if we are not willing to believe the kind of statistics that have begun to accumulate.

In particular we must re-examine each and every isotope, many of which we had in the past thought were relatively harmless. Among these is tritium, which is mentioned in the petition.

Because part of the studies, as published last year in the Ninth Hanford Radio-Biology Symposium indicate that tritium, too, may be a far more serious problem because it tends to be incorporated in the DNA that carries the genetic code, especially during early embryonic and fetal development, as now documented by numerous studies, when both given in the form of water and given in the form of tritiated thiamadine and other organic compounds, these tritium compounds tend to be incorporated in many cases permanently in the brain cells of

monkeys and in other cells that have been studied, thereby completely vitiating our early hope that tritium would pass through the body of the adult relatively quickly, and therefore represent a very serious radiation hazard.

I have already discussed the problems of concentration in my previous testimony with regard to the testimony on behalf of the Coalition. I mentioned the critical pathways. I therefore believe, in view of this evidence, that this Board should very seriously consider the need to impose much more stringent emissions than are now proposed by the applicant.

Thank you.

DR. JORDAN: A couple of items that I would like to have you expand on -- first of all, the last item, the injection of tritiated thiamadine seems to be quite different than the injection of tritiated water to the stomach, and would you say a little on that?

WITNESS STERNGLASS: Yes.

I believe that the individuals who could best testify on this detailed problem of tritium in this matter are some other witnesses who are scheduled to appear. Particularly the Professor from Minnesota, Dr. Huver, and many other people who have examined in greater detail the chemistry of tritium in these compounds.

The concern is not that when we drink water it gets converted to thianadine or anything like that; it -- the concern is that the tritium being processed by other organisms and

other fish and wildlife and so forth, will produce organic compounds which we then take in and then present more of a problem than when it comes in the form of tritiated water.

DR. JORDAN: All right.

The other concerns your testimony of the last time which I have read, but was not here at the time.

There were questions raised on it yesterday and I am still puzzled a bit, and I will not try to heckle, believe me. I am only trying to get it straightened out on your feeling here: That was with regard to the crypton-85 and Xenon and the daughter products and the possible concentrations there, and that part, I must say, confuses me, and I still don't know what you have in mind in the case of that.

JRB#7 Would you expound on that?

THE WITNESS: Let me preface my remarks, that my detailed knowledge and analysis is mainly based on the Dresden plant. That is because that is available to me in sufficient detail to be concerned about it.

I acknowledge in the Dresden plant naturally the holdup time is much less than it would be in any pressurized water reactor now contemplated. I understand that.

Referring now to the Dresden and Big Rock plants which are indeed boiling water reactors, the problem appears to be as a two-fold hazard.

Number one, it is an unanticipated hazard. There are rather large amounts, like 2 curies per second released at Dresden of xenon-138, which has a 17-minute half-life. At a wind of 20 or 30 miles an hour, 2 or 3 half-lives away, you still have quite a lot of this material. That decays to a radioactive daughter called cesium-138. Even if one now inhales the xenon-138 and normally one would exhale it, but if one is in an equilibrium situation where it gets into the fatty tissue and changes to cesium-138, then it can be transmitted from the placenta to the fetus, and that is the kind of mechanism I am worrying about.

DR. JORDAN: Okay.

DR. WINTERS: Dr. Sternglass, do you believe or do you have any evidence that tritium reconcentrates?

THE WITNESS: I must say that many people have

suspected this, but I can not claim to have examined the situation of tritium reconcentration in adequate detail to be able to comment on it really significantly here.

DR. WINTERS: At another point in your testimony you noted that New York City has a lower incidence of effects. Yet, I recall they have the operation of the Indian Point plants.

How do you explain that?

THE WITNESS: Yes, I will be glad to comment on that. I have in front of me a document entitled "Radiological Surveillance Studies at a Boiling Water Nuclear Power Reactor," published by the New York Department of Health, Education and Welfare, in March of 1970, and the number, BRH-DER-70-2. And I refer you to page 15, and I will read to you the releases from Indian Point plant and compare it with Dresden.

For the year 1963, Indian Point released only .0072 curies of gaseous waste in the form of noble and activation gases. That same year, Dresden released 71,600.

In the year 1964, Indian Point Number One released 13 curies and Dresden 521,000.

Therefore, all the way through Indian Point released thousands of times less than Dresden, and therefore I believe it is consistent with the idea that Indian Point happens not to be nearly as serious a problem as Dresden, although we have not yet looked at Indian Point counties in detail. And

I would like to reserve judgment as to whether or not Indian Point One can get a clean bill of health until we have had a chance to look at it.

DR. WINTERS: My next question, have you examined data on the State of Washington, say, for example since 1944 to date?

THE WITNESS: Yes, I have, and I would be glad to give you my present tentative information, although our study is not yet complete.

DR. WINTERS: And could you include in that question, say, the State of Idaho since 1955, South Carolina and Georgia since 1955?

THE WITNESS: Since this particular study is not yet complete, let me give you and summarize our preliminary findings which I may not even have with me. But I recall to the best of my ability the following situation:

We examined infant mortality with counties containing the Hanford facility, and the counties around, and we did this for the year 1942, '45, '50, through that period.

Hanford was constructed in '43, began to go into operation in '44, and by '45 had unfortunately a number of early accidents whereby a fuel element caught fire and sizeable amounts of radioiodine and strontium-90 were released, at the time when no one had any real knowledge as to how to properly control these things. This was wartime, and these are

reported in the Atomic Energy official publication called "Meteorology and Atomic Energy," and the chapter dealing with the history of meteorology and atomic energy details how these accidents happened to take place.

We therefore compared infant mortality changes between 1943 and '45, and after these non-accidental releases took place and we did indeed find in the counties containing the Hanford reactor and the immediate counties just to the east, infant mortality rose to about 150 percent.

In the counties farther to the north and farther to the southeast and southwest, both in Idaho and northwest Washington, infant mortality did not rise or actually declined.

These are our preliminary findings.

We also examined subsequent rises in the Columbia River beta activity, and found rises in fetal and infant mortality in the year thereafter. These studies are still not quite complete.

CHAIRMAN SKALLERUP: Has Dr. Sternglass concluded his testimony?

MRS. BLEICHER: He has concluded his testimony on behalf of the Intervenor, LIPE.

CHAIRMAN SKALLERUP: Can we have a conference with counsel? After we have this conference, we will break for lunch.

(Recess).

CHAIRMAN SKALLERUP: The hearing will come to order.

We will recess, to resume at 1:30.

(Whereupon, at 12:00 noon, the hearing was recessed, to reconvene at 1:30 p.m., this same day.)

end #8

AFTERNOON SESSION

(1:30 p.m.)

CHAIRMAN SKALLERUP: Will the hearing please come to order.

Mr. Engelhardt, will you please describe the materials.

MR. ENGELHARDT: Mr. Chairman, in the transcript of yesterday's proceedings, at page 1219 where we, the staff, were responding to a motion by Mr. Baron on behalf of the Coalition, we referred to certain sections of the PSAR as containing certain information relative to the matter of Mr. Baron's motion.

It would appear that certain of those numbers were garbled in the record and in order to straighten out this matter I would again ask Mr. Tedesco to provide the Board with the appropriate references to the PSAR and to the staff's Safety Evaluation with respect to these matters.

Mr. Tedesco has prepared a copy of the PSAR for the Board to follow in the course of his identification of Sections if that would be of use to the members of the Board.

CHAIRMAN SKALLERUP: The material you are referring to is the same material you provided the Board before the lunch break?

MR. ENGELHARDT: That is correct.

CHAIRMAN SKALLERUP: I then would like to ask

Mr. Tedesco to provide the accurate references with respect to the material on 1219 which appears to be inaccurate.

Whereupon,

ROBERT REDESCO

having been previously duly sworn, resumed the stand on behalf of the Regulatory Staff and was further examined and testified as follows:

MR. TEDESCO: I will address myself to the requirements that we find in 50-34a of the Commission's Regulations.

This regulation relates to the nine objectives for equipment to control releases of radioactive material in effluent-nuclear power reactors. 50.34a(b) states that each application for a permit to construct a nuclear power reactor shall include:

1) A description of the preliminary design of equipment to be installed pursuant to paragraph A of this section.

In this regard the information necessary is contained in either the applicant's application or our Safety Evaluation as follows:

1) With regard to liquid waste and the description of the preliminary design of this equipment, Section 11.1.2.1 found on page 11-10.

Additional information is given in Figure 11-1 and 11-2, in our Safety Evaluation, in Section 8.2.1, found on

pages 55 through 57.

The next item relates in preliminary design aspects on systems gaseous materials. In the applicant's application this information is found in Section 11.1.2.2, found on page 11-11.

Further information is given in Figure 11-3.

This matter is also discussed in Section 8.2.2, pages 57 to 59, in the Safety Evaluation.

These matters on design aspects with regard to solid material may be found in the application in Section 11.1.2.3, found on page 11-12, and in Figure 11-2.

There is further information relating to the general systems design aspects provided to us in response to certain questions that were asked of the applicant, in particular in response of Staff Question 11.2, which is found on page 11.2-1.

Further, in General Aspects, Section 11.1.5, found on page 11-13 of the application, going down to Item 2 of the particular regulations, item(2)(ii) requires that the applicant provide an estimate of the quantities of each of the principal radionuclides expected to be released annually to unrestricted areas in liquid effluents produced during normal reactor operations.

In this regard the annual releases of liquid are given in Table 11.1-2 and Table 2.4-1. Item (2) (ii)

requests similar information. However, this time it relates to gases, halides and particulates expected to be released.

This material is given in Table 11.1-5.

Item 3 requires a general description of the provisions for packaging, storage and shippment off-site of solid wastes containing radioactive material resulting from treatment of gaseous and liquid effluents and from other sources.

This information is contained in the application in Section 11.1.2.3, found on page 11-12, and in Section 11.1.1.4, Item D (as in David) found on page 11-9.

Additional information is given in Table 11.1-2, which is found on page 11.1-7.

Further information can be found in response to a staff question identified as 11.6, sub-part B (as in Baker) and D (as in David), can be found on page 11.6-1.

In our Safety Evaluation in Section 8.2.4 of page 58, our overall conclusions regarding these radwaste treatment systems includes that relating to the solid system.

END#9

MR. ENGELHARDT: Mr. Chairman, that completes the correction that we desire to make.

CHAIRMAN SKALLERUP: Thank you, Mr. Engelhardt.

The Board during the luncheon break had an opportunity and did examine those sections of the PSAR, the Staff safety analysis and the regulation of the Commission and the Board is ready to rule on the motion which the Coalition on the 21st of January 1971 moved the Board to reconsider its earlier ruling pertaining to paragraph 32 of the Coalition's amended petition to intervene so as to allow the contention raised in said paragraph to be fully litigated and to require these Applicants to provide certain information required of Applicants generally for construction licenses pursuant to newly enacted Section 50.34(a) of the Commission's regulations.

Argument on the motion was postponed until January 27, 1971 at the request of the Coalition.

The Board has heard and considered the arguments on the motion made by parties to this proceeding. The Board notes that the information required by Section 50.34(a) is provided by the Applicant in a response to an earlier request of the Commission and these data are contained in Section 11 of the PSAR and discussed in Section 8 of the AEC Staff safety evaluation.

The Board also notes that Section 32 of the Coalition's

amended petition for intervention dated December 5, 1970 was determined by the Board on December 10 to be not relevant because it is not an issue in this proceeding. In that respect see transcript page 385.

Accordingly the Board concludes that the Intervenor Coalition for Safe Nuclear Power has not shown good cause and its motion is denied.

Mr. Baron yesterday informed me that he would not be here today. He said he would review today's transcript and that for his purposes will be satisfactory notice of this order of the Board.

We are now ready to resume hearing from the witness, Dr. Sternglass, and Dr. Sternglass will testify on behalf of Mr. Lau. Doctor, before you begin, may I ask you if the Witness Houston is present? Mr. Houston?

I note that no one responds to Mr. Houston, so would you proceed, Dr. Sternglass?

Whereupon,

DR. ERNEST STERNGLASS

was called as a witness on behalf of Mr. Glenn Lau and, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

THE WITNESS: Yes, sir.

I have previously been sworn in and have given my

qualifications so I can proceed in behalf of the petition of Mr. Glenn Lau as Docket No. 50-346, in the matter of the Davis-Besse plant.

The points that I would like to bring out in my testimony, therefore, relate primarily to the problems regarding the points raised in the petition which are primarily addressed to such questions as the possibility that the releases of gas wastes will endanger the petitioner, that the exclusion zones both for the various zones called for by 10 CFR 100 are adequate and that the entire problem of evaluating the consequences of an accidental release which are implied in the development of the guidelines for siting need to be reexamined and may be invalid in the light of further evidence on the effects of radiation or a given amount of release on the population in the various zones surrounding the nuclear facility.

Now, I would like to, in this matter, recall that the evidence, the thrust of my testimony has been, so far, that as a result of the newly developed information on the greater sensitivity of the embryo and fetus and the young infant, that as a result of this growing evidence, that we must also examine the consequences that this has for the question of deciding on siting of nuclear reactors. That is really the main question at issue in this matter.

In particular, it is my view, after examining the

matter of siting suggestions as set forth in TID-14844, calculation of distance factors for power reactor sites, March 23, 1962. This document being based on a limit of 300 rads to the population zone, to the total thyroid given by the release of iodine, the iodine release and the thyroid dose being critical in this situation, that the values arrived at for the various radii for the inner circle, the next zone, that is the exclusionary area, the low population zone and the population center distance, need to be reexamined and revised in the light of this new information.

In particular, I refer you to my testimony as set forth in item five as submitted by the LIFE Intervenors, that our studies for the likely dose required to double the incidence of leukemia, when fresh fission products are released and the thyroid dose as a matter of 3 rads, that we are dealing there with a doubling dose of 3 rads, 100 times less than the 300 rads which is regarded as an acceptable single emergency planning dose on the basis of which a plant can be designed.

Now, assuming for the moment that this 3 rad dose to an infant thyroid now appears to result in a doubling of the chance of leukemia and cancer but other effects, as I mentioned, congenital defects, fetal and infant mortality, then it would appear that a design which calls for a release under accidental conditions such that individuals are exposed

to 300 rads could no longer in the light of present scientific evidence be regarded as sufficiently prudent in order to form the basis for these calculations.

It seems to me that in view of the recent evidence as set forth here with regard to our knowledge of what happened to the Marshall Islanders in a paper entitled "Thyroid Neoplasia and Late Effect of Exposure to Radioactive Iodine and Fallout" in the Journal of the American Medical Association, dated October 12, 1970, Volume 214, No. 2, page 316, by Robert A. Conard, MD, Brown M. Dobyns, MD, and Matatu W. Sutow that in view of the doses set forth on page 321 as experienced by the Marshallees, which led to both benign thyroid lesions and malignant lesions, that in view of these doses which I will now cite these values of 300 rad appears to be excessive as an engineering design base for the design of a nuclear plant.

MR. CHARNOFF: Dr. Sternglass, pardon me.

Mr. Chairman, in the absence of Mr. Lau I am not going to object in the sense that I would move that this witness not continue with this material. I would, however, like to note for the record that Mr. Lau's contention as we understood it was whether or not the AEC and the Applicant have properly applied the AEC's siting criteria in 10 CFR Part 100 and the reference document there in TID-14844.

I did not understand Mr. Lau to be challenging the

validity of 10 CFR Part 100 and the testimony so far offered goes to the question as to whether 10 CFR Part 100 is a prudent rule or not.

End #19

CHAIRMAN SKALLERUP: Dr. Sternglass, did you understand the gist of Mr. Charnoff's comment?

THE WITNESS: I think I do. I am not an attorney, I'm not absolutely sure that I understand that language.

My eye was caught by this second paragraph here on the second -- the last paragraph on the second page, where it said that there may be -- the specifications may be meaningless, or obsolete, or subject to being disregarded.

So I happened to interpret this as a possibility that not only are the existing guides possibly misinterpreted under present radiation standards, which is something I am prepared to argue in any case, but I felt this also raised the question of a possibility that this entire document may just, in the light of the previous testimony, also have to be reexamined.

I am not an attorney, and I can't tell whether or not this is admissible.

CHAIRMAN SKALLERUP: Well, if you have no testimony to give us relating to the compliance by the Applicant with Part 20, and your testimony continues--and we are prepared to let you continue-- and it relates solely to the validity of the Part 20 standards -- excuse me, Part 100, I meant to say, 10 CFR 100--

THE WITNESS: Yes.

CHAIRMAN SKALLERUP: -- that if it relates to the

validity of the Part 100 criteria, it is subject to a motion to strike. And in that event, there is the possibility that the testimony would not be considered part of the evidence.

THE WITNESS: I will try to separate my testimony in such a way that it may become clear which part may be subject to being stricken and which part addresses itself to what is spelled out here.

CHAIRMAN SKALLERUP: All right.

THE WITNESS: For the moment let me continue on the line of the subject I was pursuing with regard to the possibility that the 10 CFR 100 standards may have to be revised, and then I will come to an end.

May I just finish by saying that in this article just referred to in the Journal of the American Medical Association, the doses to the Marshall Islanders, at which significant percentages of thyroid lesions and malignant lesions occur range as low as 14 rads of radioactive iodine to the thyroid, to typically as high as 1400, with many of the doses in the range of 55 to a few hundred rads.

I believe that this evidence is reflected in the recent report of the National Council for Radiation Protection, dated January 15, which I have in front of me, page 16, "Radiation Exposure Conditions from Fallout," and I read in paragraph 46,.

"Radioiodine is of special importance because

of its high yield efficient volatility with the accompanying ease of transport and strong localization within the human body, the thyroid gland, radioiodine may present a special problem to children due to their small thyroid mass and greater sensitivity."

In pursuing this line, one would have to say that if one recalculates the dose, the radii, for instance, for the population center distances for a dose 1/10 of what one had permitted previously, like 30 rads to the thyroid or a ten-fold reduction, as suggested in the case of pregnant women working in the AEC facility, then the radii, instead of being closer to the typical 18 miles, begin to increase by a factor of about slightly under 5 -- between 80 and 90 miles.

This raises, then, the possibility which I think needs to be considered and needs to be examined in the future siting -- even in the present siting -- of nuclear power plants, that the nearest cities are then Detroit, Cleveland, Toledo, that they are included in a zone that ought not to contain under present 10 CFR 100 regulations populations greater than 25,000 people. In other words, the entire philosophy of siting would have to be reexamined unless very major engineering steps can be taken, such as underground siting, et cetera, and coolant containment of a higher degree than a half percent per day presently used in this type of plant, I believe, and most plants of the "at the present time"

type where the containment is allowed to leak a half percent a day. This, then, would reflect greatly on the siting problem which is cited by Mr. Plum.

I would like now to return, and get away from this part of my testimony, which is subject to question in view of what was just said, and address myself to the questions that possibly I did not fully appreciate, namely, that the question is being raised as to the actual safety of the existing regulations, assuming that the 300 rad and the doses to the adult are not challenged.

Even under this condition, number one, I would like to point out the following problems:

Number one, the 300 rad dose, as specified in 100 10 CFR is not called for for the most critical member of the population. Therefore, under present 10 CFR 100, an infant would receive something like 10 times that dose, or 3,000; and under present 10 CFR 100, the fetus could receive as much as 30,000 rads to the thyroid from such a similar situation, where the adult only receives 300.

This has been long established. In fact, the fact that the fetus concentrates this was well known before this report was formulated.

Before March of 1962 Dr. Eisenbud and others had made measurements and a number of people had made measurements on the fetal concentration of thyroid long before March 23,

1962. So I contend that it would seem that the present 10 CFR 100, even without any further changes in standards, would not provide adequate protection for the most critical members of the population in the case of an accident.

I would like to address this question as follows, to the problem of both minor and major accidents, and their potential consequences in the light of what we know.

According to the present, it is said that the low population zone distance is two miles, and the population center is 21 miles, according to the November 20, 1970 reactor licensing statement regarding this reactor.

end 11

Now, I have examined these plots in here, and without any further detailed justification for making changes that are due to some unknown engineering design considerations, it would appear that for a reactor of this size, as large as 2800 megawatt thermal output, the actual zone to the low population zone should be such that when one considers the population distance, it would be 24 miles, which in this case would clearly involve an area containing cities such as Toledo and would encompass a population significantly closer to 1 million people, which I believe would not be within the spirit of the existing 10 CFR 100, whose aim is clearly to limit the total population at risk from either a minor or a major accident.

I believe the seriousness of such an accident under present 10 CFR 100 is further underestimated as follows:

As called for now, it only involves a consideration of the two-hour does from inhalation experienced by someone who is thereafter assumed to be able to either remove themselves from that area in that time, or in the event that somehow the cloud directly passes him in a period of less than that.

Such a situation might not arise in the case of a period of very low winds and in a period in which heavy snows prevent people from leaving this relatively confined area where large amounts of snow under certain conditions could indeed prevent evacuation in these periods.

So, even assuming 300 rads is an acceptable dose in the thyroid, it would appear that the present siting of this plant in this area close to these regions, which often are difficult to leave on account of heavy snows and meteorological conditions, that this would not be within the letter or the spirit of 10 CFR 100.

Now, the important point about this whole problem is that we must realize that at the moment the releases from plants, even in the case of small accident, are by no means small. Even suppose we were permitted 300 rads; then, in view of everything that we know now to the thyroid, this would allow, in effect, with the best judgment that we have now, typically a hundredfold increase in leukemia among infants at the time in utero.

It would seem to me that a revision of the engineering specifications of a plant is needed if an engineering design failure such as the break of a pipe or the falling of a control rod or the dropping of a fuel assembly, could lead to the gradual release of doses of a half-percent a day of whatever escapes through the containment vessel in such a way that individuals near the zone of exclusion would receive 300 rads in a matter of only two hours.

It does not seem to be a kind of acceptable engineering design to have a design that would be -- that would allow in that sense a significant and what must now be regarded

as a serious health effect on the individuals and, therefore, would call for a revision of the specifications on the releases to be permitted, in view of, if one cannot change the location of the plant --

In other words, the argument is simply as follows:

We have had growing evidence that there are critical members of the society who might be exposed. We have had increasing evidence that there are concentration effects like iodine in the thyroid that are serious and can lead to both rumors, benign and others.

We now, therefore, see if we want to have reactors located still at these close distances which seem to be below those originally visualized; then we must demonstrate far greater engineering capability of limiting the conceguences of even a fairly serious accident.

I am not talking about a major explosion or a major boiler explosion or anything of this sort. I am talking about the kind of engineering accidents spelled out in the Safety Analysis Report, such as the breaking of a pipe or the dropping of a fuel cell assembly.

I believe in the light that we now know and the possibilities that we have these serious defects, a half-percent release rate from the containment vessel is no longer an acceptable release rate any more than the large normal releases discussed under 10 CFR 20, if, for instance these emissions

are indeed correlated with the change in infant mortality as we believe, and this, then is the substance of the argument that I believe needs to be re-examined.

CHAIRMAN SKALLERUP: Thank you.

The time has come for cross-examination.

MR. CHARNOFF: Let me start out at the outset: I am not going to cross-examine Dr. Sternglass on behalf of his testimony for Mr. Lau. I believe it comes back to the same "hot soup" and none of it really is with regard to Mr. Lau's contentions.

My questions now will be addressed to Dr. Sternglass in connection with his testimony this morning on behalf of LIFE.

DR. JORDAN: The Chairman asked if I agreed 100 percent with your statement, and I said it could be argued, and so we thought it would be good to get into the record and perhaps it is something that should be argued when we have a chance for counsel on behalf of Mr. Lau.

MR. CHARNOFF: Is it clear that Mrs. Bleicher is not acting on behalf of Mr. Lau?

MRS. BLEICHER: I will make a statement with respect to that.

I am not representing Mr. Lau.

MR. CHARNOFF: I didn't think so. And on that basis I am not asking for striking of the testimony.

MR. ENGELHARDT: Mr. Chairman, may I suggest an approach?

May we cross-examine Dr. Sternglass with regard to his testimony on behalf of Mr. Lau and then maybe have an opportunity to review the transcript of this proceeding to make sure it relates to this issue and then at that stage, may we have an opportunity, if appropriate, to move for certain sections of that testimony to be stricken from the record with regard to this matter that we feel is outside the scope of Mr. Lau's contentions.

CHAIRMAN SKALLERUP: Let's have a bench conference.

END#12 (Discussion off the record.)

CHAIRMAN SKALLERUP: Will the hearing come to order?

As a consequence of the conference it is agreed that Mr. Charnoff will commence cross-examination of Dr. Sternglass with respect to the testimony provided this morning on behalf of LIFE.

XXX CROSS-EXAMINATION

BY MR. CHARNOFF:

Q Dr. Sternglass, this morning you characterized the data you presented on behalf of LIFE and I believe the words were "As a possible statistical association but not proof of causation of relationship between infant mortality and low doses of radiation;" is that correct?

MRS. BLEICHER: Excuse me. We cannot afford to have a copy of the transcript. I have no way of knowing whether the words he is quoting are correct words or not.

May we borrow a copy?

CHAIRMAN SKALLERUP: Yes.

MRS. BLEICHER: What page were you referring to?

MR. CHARNOFF: I didn't have benefit of the transcript when I developed these questions either.

Let me ask Dr. Sternglass if the basic drift of what you were saying was that the data you were researching demonstrated a possible statistical association between infant mortality and low doses of radiation but you are not

claiming this was proof of causation between low doses of radiation and infant mortality?

THE WITNESS: The kind of data that I submitted and which exists in all this type of -- in these kinds of cases -- can never be regarded as 100 percent proof of causation, but can only be regarded as a probability that the hypothesis is correct, that there may well be a causal relationship and all one can do is increase the probability of that hypothesis.

BY MR. CHARNOFF:

Q I think that is right and I just wanted to be sure of what you were saying.

In this connection, and I am certainly not a statistician or physicist, but I would like to call your attention to figure 1 of LIFE Exhibit 2, I think that is the document entitled "Infant Mortality and Nuclear Power Generation," dated October 18, 1970.

Do you have that chart?

A Figure 2?

Q Figure 1, Exhibit 2.

A Is that entitled "Infant mortality rates per 1000 live births for Illinois and New York"?

Q No.

Are we looking at the same document, namely "Infant Mortality and Nuclear Power Generation," dated October 18, 1970?

A Yes, I am, and you asked me to look at figure 1?

Q Yes.

A Well, it may be mixed up. Can we straighten this out?

Q I would hope so.

(Counsel and witness confer.)

BY MR. CHARNOFF:

Q Figure 1 has on it curves related to infant mortality in Illinois and New York. It also has a curve showing Dresden radioactive gas discharge; is that correct?

A That is correct.

Q Now, as I said, I am not a statistician but is it true looking at this chart that the peak for infant mortality in Illinois precedes the peak of the Dresden radioactive gas discharge?

A I am afraid it is not correct. When you look again very carefully you will find that there is a declining base line --

Q Would you just tell me when the peak is defined or what year the peak is defined for on that chart for infant mortality in Illinois in terms of time of the year, the highest peak point?

A Okay.

When a correlation is carried out, the reference line is not a horizontal line. For a horizontal base line,

the peak would occur in 1965. For a declining base line the peak occurs in '66. This is a subtle difference which I am afraid may well escape someone not trained in mathematical or statistical analysis.

Now, we have carried out the same analyses and I have with me a copy of a curve for the State of Ohio where we have done this subtraction from the declining base line and there indeed the peak of emission occurs at the same time -- that is the peak in infant mortality occurs one year later because it refers to a declining base line.

Q The chart itself doesn't say that in those terms, does it? If I misread the chart, as I said I am not a statistician, I simply compared the peak and the peak point I note for Illinois exceeds the peak, but if I am misreading it why don't we go on?

A Yes.

Q With respect to the Illinois infant mortality figures, did you inquire as to the specific causes of the infant mortality or did you use gross infant mortality data?

A I certainly did examine the question of the causes of infant mortality and examined it in some detail as reported by the official Illinois Vital Statistics which was sent to me by a statistician at the Illinois Department of Health.

Q Are you aware that there was an outbreak of

rubella and rubiola in Illinois during 1963 and 1965 or through 1965 and also during 1957 and 1958 which preceded Dresden startup, both of which outbreaks were associated with interruptions in the long term declining infant mortality rate in Illinois?

A Yes, I have been made aware of this and it in no way contradicts my findings, since the nature of the cause of death is a decline in ability to resist infections, not any gross changes of congenital defects or leukemia and cancer --

MR. CHARNOFF: Mr. Chairman, could we have the cross proceed directly with our responses to the question?

THE WITNESS: The answer is I am aware of it and it in no way contradicts my findings.

BY MR. CHARNOFF:

Q In responding to Dr. Winters' questions with respect to the New York data and the Indian Point reactor, is the Indian Point reactor for which you gave the release data and pressurized water reactor?

A As indicated in --

Q All you have to do is answer whether it was pressurized water reactor or boiling water reactor? There are short ways to answer questions, I am sure.

MRS. HILDRUM: I think that you owe Dr. Sternglass the courtesy of giving him an opportunity to try to answer

your questions. I think he has indicated that he is sincerely attempting to do so. If he is going to cite the course of his information, I think there is no harm in that. He wants to give you good information on how he answered.

CHAIRMAN SKALLERUP: I will ask the Reporter to repeat the question.

(The Reporter read the question as requested.)

THE WITNESS: To the best of my knowledge, yes.

BY MR. CHARNOFF:

Q I asked whether it is a PWR or BWR; is the answer yes?

A The answer is yes, it is a pressurized water reactor.

Q Is the Dresden plant a boiling water reactor or pressurized water reactor?

A It is listed as a boiling water reactor.

Q Is the Davis Besse plant a pressurized water reactor or a boiling water reactor?

A It is a pressurized water reactor.

Q Thank you.

Did you yesterday, Dr. STernglass, say that a factor -- that the emissions should be reduced by at least a factor of 1,000 to be safe, based upon the Dresden situation? I am referring to page 1305 of the transcript?

MRS. BLEICHER: Are you cross-examining him on the testimony he has presented today?

MR. CHARNOFF: Yes, I am providing a basis for the relationship of the discussion held this morning on boiling water reactors and pressurized water reactors.

MRS. BLEICHER: I am not sure what he said yesterday in relation to another contention should be brought up at this point.

MR. CHARNOFF: I don't think it was in relation to another contention so much as what he said today and what I am trying to establish is that yesterday afternoon in discussing the Dresden situation Dr. Sternglass called for a 1,000-fold reduction from the Dresden data and what I am trying to establish is that pressurized water reactor have releases that are lower by at least 1,000 from boiling water reactors and in characterizing Dr. Sternglass' testimony.

MRS. BLEICHER: I don't think there is any necessity for you to go into that argument.

MR. CHARNOFF: It is very difficult to say which of Dr. Sternglass' statements relate to one contention or another since they have the same thread throughout.

CHAIRMAN SHALLERUP: I would think it is immaterial when and where Dr. Sternglass made the statement. If he made it in a publication or during the course of a speech, we ought to be able to ask a question about it and get an answer and then compare it with another statement.

THE WITNESS: As I recall, to the best of my

knowledge, I called for at least a factor of 1,000 times reduction in gas releases and I did not specify the particular year in which I referred to it because there were large differences between emissions from Dresden in 1961 say to 1969.

A thousandfold may be the very minimum that one could possibly accept as a safety measure but I believe more is possible and desireable.

CHAIRMAN SKALLERUP: Pardon this one additional interjection.

If you have a page number could you give it to us so we will be sure Mrs. Bleicher has a copy of the transcript?

MR. CHARNOFF: Yes, page 1305.

THE WITNESS: Thank you.

BY MR. CHARNOFF:

Q The basic discussion begins on line 3 and goes virtually to the end of the page?

A Yes.

Q Did you there say, Dr. Sternglass, "First of all," in looking at line 3, "we, in examining the Dresden situation and the situation at the Big Rock plant, and at the NFS plant in New York, we find that the release is on the order of hundreds of thousands of curies per year. We find that if these changes in infant mortality are in effect, or should be causally related, then one would have to reduce these effects

by at least the effect of 100, at least, to not have detectable effects on infant mortality.

"I would say a factor of 1000 is not only necessary but feasible in view of the fact that equipment exists for trapping these gases to such a degree.

"So this factor of 1000 has the origin in the assumption -- the conservative Public Health assumption -- that these changes fround in all these different plants may indeed be causally related to these releases, so that we should reduce our emissions by at least that much in order to be safe; and say that even if Dr. Sternglass is wrong, but maybe he is right, then if we have a thousand-fold reduction we can sleep reasonably well at night because we may be all right in not being able to detect any further changes in infant mortality."

Did I read that correctly?

A I believe you did.

Q Thank you.

Now, you refarred yesterday and this morning, Doctor, to a document entitled "Radioactive Waste Discharges to the Environment from Nuclear Power Facilities," BNL/DER 70-2, which has a Table 8 on page 15. It shows annual gaseous waste discharge from PWR, namely, pressurized water reactor and boiling water reactor?

A That is correct. I have it in front of me.

Q Would you say by examining that table that the gaseous releases from pressurized water reactors are a factor of at least 1,000 less than the releases from the boiling water reactor?

A I wish it were true. There are many years when, for instance, the Big Rock Point emitted only as typically, like for instance 1962 and '63, a boiling water reactor emitting 25.6 curies in --

Q Was that the startup year, Dr. Sternglass?

A I am sorry, just a second.

I am saying that boiling water reactors under certain conditions can emit very low levels of radiation and indeed sometimes as little as 25 curies per year.

Now, there have been times when the difference is as much as 100 million times and there are sometimes when the difference is as much as a factor of just barely 2.

Q Was your data that we were talking about yesterday related and based upon the releases in '62 or '63 before Big Rock was even a tower or were you talking about Big Rock and Dresden in terms of the last half of the decade when the releases there as shown on that table begin at 132,000 curies, 735,000 curies, 264,000 curies and 232,000 curies?

A I find that with the statistics available in that area, it is only possible to see clear effects during the period when the releases were as high as they were in '65

to '69.

Q That is the period, Doctor, that you were examining and you would ask for, on page 1305, a reduction of these figures by a factor of 1,000 so that you may sleep well at night; isn't that correct?

A Yes, but the present reactor here is scheduled to emit 27,00 which is hardly a thousand times less than 132,000.

Q Doctor, first of all, the reactor you are referring to, the 27,000 curies is based upon certain maximum assumptions and you would have to compare those assumptions with the maximum assumptions for these other plants.

But let us talk about the practical actual experience of PWRs, pressurized water reactors versus boiling water reactors. Would you say that based upon the experience shown in that chart that pressurized water reactors released gaseous wastes by a factor of a thousand, when they are operating, less than the gaseous releases from boiling water reactors when they are operating?

A Not at all times.

Q Well, I will let the Board make the judgment as to whether you are correct or not.

CHAIRMAN SHALLERUP: I don't think that table has been produced as an exhibit, has it?

MR. CHARNOFF: In document BRH/DER 70-2?

CHAIRMAN SKALLERUP: No. Dr. Sternglass referred to it but I don't believe it was an exhibit.

MR. CHARNOFF: I am sorry, we will make copies of this document available to the Board as an exhibit when we present rebuttal testimony.

End #13 CHAIRMAN SKALLERUP: Thank you.

Q Do you have a copy of this morning's testimony, Dr. Sternglass?

MRS. BLEICHER: Yes, I think we do. Going back to what we were discussing, did you say you would want to produce that as an exhibit?

MR. CHARNOFF: I said we could do that when we offer rebuttal testimony, and copies will be made available to you.

BY MR. CHARNOFF:

Q Dr. Sternglass, referring to the bottom of 1342 and the top of 1343, you were referring there to an article by Dr. Alice Stewart, and you say,

". . . involving her review of some 19 million children . . ."

do you recall where I am?

A Yes, I do see it.

Q Was this the paper that was produced in the "Lancet" on June 6, 1970?

A I believe in the Lancet on June 6 or 7, 1970, right.

Q May I read a sentence to you under the topic titled "Method?"

"This inquiry was based on 15,298 children who were born between 1943 and 1965."

A Let me clarify that, may I?

It is a little complicated, again, a statistical

question. The 13,000 or 15,000 number refers to the number of leukemia and cancer cases that actually developed. The 19 million children refers to the total number born during this period, which was roughly 100,000 developed cancer.

So there is no conflict between those two numbers.

Q Thank you.

May I also ask you, keeping the page open, to page 1343, would you also turn to page 1269 of yesterday's transcript?

A Yes.

Q Do you have that page?

A Yes, I do.

Q On page 1269 did we discuss there your assertion that for plants such as this, that it called for an exposure of about 5 millirads per year from external gammas and gases to the average person in the population?

A Yes, I see that statement.

Q Now, Dr. Stewart's data, as interpreted by you, suggests that at least for the early fetus -- I am looking on page 1343 -- for the early fetus, presumably we are talking about the first three months or the first trimester of pregnancy?

A Right.

Q -- required only -- I am looking at line 16 -- only about 1200 millirads in the first three months of

pregnancy, in order to indicate a significant increase or doubling of cancer and leukemia?

A I may have mis-stated it. I should say a doubling occurred therefore, that means a 100 percent increase. Therefore, a 5 mr increase, if that were the dose to the fetus -- if that were the dose -- would represent a fraction of 5/80 of 100 percent, or something like 1/40, or something like a five percent increase -- something of that order.

Q Well, let me ask you if another way of stating this is that if we are concerned with 80 millirads in the first trimester of pregnancy, would it be accurate mathematically -- and I remember the difficulty we had in our math yesterday with regard to salamanders -- but would it be accurate to say, assuming the 5 millirad figure as the average population dose, that a pregnant woman would have to, in the first -- would have to remain in the area where she would get this 5 millirads during the first 3 months of her pregnancy in order to get 80 millirads, that she may have to stay there 16 years?

DR. JORDAN: Mr. Charnoff, may I interrupt this for a moment? I believe LIPE's contention is that the 10 CFR 20 standard is inadequate, and there they are talking about 170 millirads. So I believe that is really the thing that is under contention, and it is not particularly at the moment whether the Davis-Besse plant is living within those, or how much lower they are.

MR. CHARNOFF: All right, I would accept that.

DR. JORDAN: Very well.

BY MR. CHARNOFF:

Q Most of the data that you referred to, or perhaps all of it I take it, has been published or offered -- well, most of it has been published, and it is probably available to experts in the field; is that correct?

A That is correct, or it is in the process of publication.

Q Can we turn now to the NCRP document, Number 39, which is the new document just released early this week, and you referred to that as the news clipping you had before you yesterday?

A Yes.

Q Do you have a copy of the entire document, or just a xerox of 1 or 2 pages of it?

A I have only seen the xerox of 1 or 2 pages at this time.

Q I see. Because I had provided a copy of this document to Mrs. Bleicher the other day for a short period of time.

A Yes.

MRS. BLEICHER: Yes, and you told me you would let me take a peek at it and then took it back.

MR. CHARNOFF: That's right.

BY MR. CHARNOFF:

Q Could I see the clipping that you referred to?

A Yes.

(Handing document to Mr. Charnoff.)

end 14

BY MR. CHARNOFF:

Q My assumption is that most of this data is not based upon readings and this is with due apologies generally to the press who are present here but my assumption is that all of your data is quoted from scientific articles except for this article?

A Yes, that is all the information I have on the subject matter.

Q I have before you, Dr. Sternglass, NCRP Report No. 39 entitled "Basic Radiation Protection Criteria," which was released to the public on Tuesday, January 16, 1971, which apparently was the subject of this newspaper article.

In this regard to my next question, the newspaper article was not incorrect. It said specifically the NCRP recommended keeping the guidelines established in 1964 that set the average safe amount of exposure.

Are you aware, and perhaps you haven't seen this document, but are you aware that this document recommends that the maximum dose levels of 500 millirem and 170 millirem, the individual and average doses, now reflects Part 20 as maximum dosage be retained for the general population?

A I am sorry, I have not read the document in detail.

Q Let me read paragraph 245, the entire paragraph.

"The dose limit for the critical organs whole body of an individual not occupationally exposed shall be 0.5

rems in any one year in addition to natural radiation and medical and dental exposure."

Does that conform with the 500 millirem figure that is set forth in Part 20?

MRS. BLEICHER: May we see that document that you are reading from, please?

MR. CHARNOFF: Yes, I will show it to you.

I would also ask you to examine the paragraph on page 296 with regard to the 170 millirem figure and that is paragraph 247, and, Mr. Chairman, we will produce this document as an exhibit when we have another one for longer than a peek.

CHAIRMAN SHALLENUP: Mr.Charnoff, while counsel is consulting with Dr. Sternglass, your description of the document was a bit on the cryptic side; c an you amplify precisely what the document is about?

MR. CHARNOFF: When I get another peek I will be glad to, yes.

MRS. BLEICHER: Would you repeat the question, please?

MR. CHARNOFF: I asked whether the NCRP in this current bulletin just released this week, and that is the National Council on Radiation Protection -- did their recommendations, and those are the two that I called to your attention on pages 295 and 296, do their recommendations still retain

the 500 millirem general population individual dose and the 170 millirem average population dose as the maximum level for radiation for the general population?

THE WITNESS: To the best of my believability here to scan these two pages, I would say this appears to be the case but this was not the thrust of my contention.

BY MR. CHARNOFF:

Q But you were referring to the NCRP in the news clipping, let me now refer you to page 92. I don't have the paragraph reference there. You have said, I believe this morning, that the NCRP has reduced the occupational dose to pregant women by a factor of 10?

A Yes.

Q I think that was based upon this newspaper article?

A Right.

Q Would you tell me whether -- I believe it is the paragraph beginning at the bottom on the left and I think -- does it say there and perhaps you ought to read the paragraph.

A Yes, I just did and I believe there is no conflict. I believe the newspaper article had been correct.

Q Let me just ask you to read it and when you read it would you be clear to read what the dose to the fetus should be as distinguished from the dose to the mother? Could you just read that?

A It says exposure of the fetus during the entire

gestation period the maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother should not exceed a half a rem.

Do you want me to read the comments on this?

Q Please do.

A The need to minimize exposure of the embryo fetus is paramount and becomes a controlling factor in the occupational exposure for the women. In effect this applies that such women should be employed only if situations where the annual dose accumulations are not to exceed two or three rems and is acquired at a more or less steady rate.

Q Two or three rems; is that correct, to the mother per year and 500 millirems to the fetus; is that correct?

A I guess so. It goes on that such cases the probability of the dose to a fetus exceeding half a rem before pregnancy is recognized as negligible.

Q Thank you.

Now, if that is correct, then the recommended reduction in exposure to the pregnant woman from 5 rem to 2 to 3 rem is in the order of a factor of 2 and not a factor of 10; is that correct?

A I really could not give you a meaningful --

Q I am just asking if that is correct, not an explanation.

A I am only saying I have not read this entire thing

in its context, all I can say is that it appears on the surface that at this point only a reduction of 2 or 3 is recommended.

Q About two?

A Yes.

Q If I may have another peek at that book I will describe the book and then close my cross-examination.

I think the record should show this book belongs to Dr. Goldman and he allows nobody to have it except for peaks.

(Laughter.)

This document is entitled NCRP Report No. 39 entitled "Basic Radiation Protection Criteria," recommendations of the National Council on Radiation Protection and Measurement, issued on January 15, 1971.

The NCRP is not affiliated with the Atomic Energy Commission in any way, it is charged by the United States Congress. It is one of the -- it is the domestic standards recommending controls in this country and compared to the International Commission on Radiation Protection which is the international group that has recommended standards in the past and continues to do so, it is these recommendations that are taken into account by the Federal Radiation Council and the Atomic Energy Commission.

We will produce this document as soon as we get another copy as an exhibit and make it available to everybody.

DR. JORDAN: Could I ask a question of either Dr. Goldman or perhaps Dr. Sternglass?

This is the NCRP document and is there an ICRP document which will contain the same information, does it come out previously or later?

I see Dr. Sternglass shaking his head. Can someone just enlighten me on this? It is not important to this case.

THE WITNESS: Well, only to the extent I would say I am not aware of the ICRP having recently prepared an equivalent document.

DR. JORDAN: Okay.

DR. GOLDMAN: The only comment I would make, Dr. Jordan, is just about a year ago the ICRP did issue publication number 14 which was an updating of the biological data available to that time and in that document indicated no need for any change in the standards that had been issued prior to that.

MR. CHARNOFF: I have no further cross-examination. Dr. Goldman has taken back his book.

CHAIRMAN SKALLERUP: We will take a 10-minute break.

End #15 (Recess.)

CHAIRMAN SKALLERUP: Will the hearing please come to order?

At this time Mr. Engelhardt will cross-examine Dr. Sternglass regarding his testimony given on behalf of LIFD.

Before the testimony begins, I will ask again if Mr. Houston is in the audience, the witness for Mr. Lau? Is Mr. Houston here?

(No response.)

I hear no response.

BY MR. ENGELHARDT:

Q Dr. Sternglass, I would like to refer you to transcript page 1341. That is this morning's transcript. You referred on that page to certain diagnostic studies, Xray studies of pregnant women by Dr. Stewart.

Can you tell me what the dose rate of those exposures were that were administered in the course of that study?

A Typically Xrays are given in a matter of a 10th of a second, or half of a second. Therefore we are dealing with dose rates in the order of typically -- well, in a second, a half a rad, quarter of a rad per second -- of that order.

Q Would you characterize that as large quantities in a short period of time?

A Half a rad per second, not particularly. But certainly it is more than the dose rate -- the dose rate is

much greater than that of cosmic rays or fallout or other type of radiation.

Q Including such emissions as might be released from a nuclear power reactor?

A Generally speaking, yes; except in an accident.

Q Then may I ask this question, Doctor:

What is then the significance of the Xray -- the diagnostic studies of Xrays working on pregnant women in relation to essentially routine low-level quantities released from a nuclear power reactor?

A I'm glad you asked that. I believe I did not explain that adequately.

This is the situation. Whenever there is a direct line relationship or linear relationship, as Dr. Stewart testified to in her paper, then the dose rate or the time during which the dosage is administered plays a very minor if any role at all.

If one gets a half rad in one second, or in one minute or one day, as far as the developing fetus is concerned or the early embryo developing extremely rapidly, this appears to make little if any difference at all.

This is quite a different situation from the case of the adult where a dose given like 500 rads in one second would be much more lethal than a dose of 500 rads given in a period of a year or half a year, or even a month.

Therefore, dose rate effects are important in situations where healing can take place, but they are not important when there is a direct linear relationship and the total doses are very small, so that one is dealing with what Dr. Lewis called essentially a genetic type of effect, or a single hit type of theory.

Q But isn't there a dose rate effect?

A That is precisely what I was saying. There is no apparent dose rate effect when there is no apparent healing. That has been pointed out by Dr. E. B. Lewis and Dr. Stewart herself, that this implies essentially a single hit, irreversible kind of damage effect, which in the case of the embryo, tissue seems to be quite different than for the adult, for which we do know that dose rate effects and healing take place.

Q Dr. Sternglass, on that same page of the transcript you cited another researcher, Dr. MacMann, who had performed similar studies, diagnostic Xray studies.

Are there other people in the field who have performed similar studies?

A Yes, there have been a series of such studies, and these have been reviewed by Dr. MacMann in the course both of his testimony before the Joint Committee on Atomic Energy, and a later article published in the journal, "Cancer," an international journal relating to cancer, presented, I believe, at a cancer congress in Moscow during which he examined all

the other experiments that had been carried out up to that time, all the other statistical studies, and concluded by a careful statistical analysis that even those that had not found such an effect--and there were a few--had not found such an effect because of the small size of the sample. In those other studies he showed conclusively, I believe, that all the studies,when combined, taken together, do not contradict the findings that he and Dr. Stewart had arrived at.

Q Dr. Sternglass, do you know approximately how many of these other studies have been made?

A There were, altogether -- I don't recall the exact number but there are something in the neighborhood of 10 studies in which 2 or 3 had not found an effect carried out with relatively small samples of children.

Q Dr. Sternglass, could you give us a reference to where those studies might be found? In other words, is there a document in your possession, for example, that would cite the 10 studies that you refer to?

A I can refer you only to the -- the best place would be the hearings of the Joint Committee on Atomic Energy, August of 1963, where Dr. MacMann, I believe, referred to his own analysis of all the other studies available.

The other, I believe, is a later Journal, and I don't have it here. But this kind of analysis has been presented by Dr. MacMann himself, who at that time pointed out

that although it had been argued that some of the studies did not show it, he could show that they were all consistent with his and Dr. Stewart's findings.

Q Dr. Sternglass, are there any of these reports, to your knowledge, at least, as of now, that were released or issued or published subsequent to 1963?

A Yes, I know of 1 or 2 other studies that involve a search of diagnostic Xray effects on the early fetus, the embryo and the postnatal infant.

There is, for instance, a study of Dr. Saxon Graham and his co-workers at Rosslyn Park Memorial Hospital, published a few years later, which also found an increase in leukemia for exposures prior to, during and after pregnancy, especially when multiple sites were irradiated; finding, when multiple sites were involved there was a higher degree of incidence than when a single exposure took place; and when there was a prior pregnancy combined, there was a higher incidence.

And there was a second paper published in the New England Journal of Medicine in which they found when the mothers had a previous miscarriage, and in addition had an Xray, and the child has an Xray, the combination of factors was much greater in its effect than Xrays alone.

The same was true for virus diseases, and the same was true for other conditions that appeared to increase

or enhance the effect of a single Xray, leading to some sort of synergistic effect.

To the best of my knowledge those studies were the only ones that I am aware of at this moment that invclved carefully controlled large-scale statistical studies of diagnostic Xrays given to mothers under known conditions of dose, where the records are clearly available in hospitals.

Q Thank you, Doctor.

I would like to refer you now to page 1367 of the transcript, on approximately line 19 -- or I should say in that paragraph -- at any rate, beginning on line 13, you indicated that certain radiation effect studies at low doses were difficult to perform because of the large number of laboratory animals that might be required for use.

In other words, what you said was that the point is that laboratory studies can only be carried out on a relatively small number of animals at a time; is that true, sir? You did say that?

A I did say it, but there is a qualification.

Q All right. I merely wanted to ask you a question with respect to that statement. I wanted to ask you whether you were aware of the work that is being done by the Russells at the Oak Ridge laboratories on radiation effects, low dose rate radiation effects?

A I am familiar with some of the work. I am not certain I am familiar with the particular paper you may have

in mind.

Q I wanted to ask whether you were familiar or knew as to the number of animals that were used in that laboratory experiment?

A As far as I know, any one laboratory experiment involved hundreds or thousands of mice, but they were not looking for induction of leukemia in the offspring or the cancers produced, nor were they looking for what I now regard as one of the more important problems, namely, fetal or infant mortality among the mice.

I think the large-scale experiments that were carried out, to my knowledge, involved subtle genetic changes which in my case do not apply to what I believe is the main action of the fallout on the fetus.

Q Were you aware that the number of animals used in that experiment were on the order of five million?

A There were not five million animals irradiated at one time, nor do these studies relate to the question I am raising; namely, I am raising the possibility which appears to be indicated by our data that the effect is not so much on the genes of the parents -- that is the gonads, the male and female reproductive cells -- but on the early developing embryo and to the best of my knowledge the Russell experiments were not designed to detect the effects of radiation on the developing mouse embryo.

Q Were you aware of the Russell's conclusion that the genetic effects of radiation are less than that thought at the time the standards in 10 CFR Part 20 were established?

A I am aware of their opinion on this matter, but I do not regard this as having a direct bearing on the findings we have in the case of man, especially since all our indications are that we are not dealing primarily with a genetic effect at all, but one that acts on the early developing embryo of the fetus.

Q Dr. Sternglass, with respect to the studies you have made regarding the Dresden plant, were there other non-quantitative data, or non-radiological environmental contaminants considered in the course of that study?

In other words, did you only look at radiation?

A No, by the choice of the method of analysis we attempted to eliminate the other environmental agents, and I would like to explain this as follows:

We take counties for control counties which were directly to the northwest of very similar socio-economic and rural characteristics, with populations about the same size and same population density in areas that did not involve large city and urban pollution problems. Therefore, by comparing two areas very similar in socio-economic and other pollution factors, we believe that to the best of our ability under these conditions we were able to eliminate the difference -- that is,

we eliminated the effect of whatever other pollutants may exist in rural areas.

end #16

Q Dr. Sternglass, in conducting the study, we will call it a cause and effect study, such as you have performed here, is it customary not to look at other sources of contamination or other possible bases or reasons for what has happened?

A Not at all. As a matter of fact, the design of the way we look at it is an attempt to ensure that the other factors were kept constant so that the only difference was in these two areas, the difference due to the emissions from these plants. It does not by any means imply that both counties could not be affected by this DDT, that both counties could not be affected by local pollutants and local fallout.

There are numerous other factors which, however, by the choice of controls would tend to eliminate anything but this one different factor, namely, the emission of large quantities of radioactive gases.

Furthermore, by the fact that we found a decline of the incidence of infant mortality changing with increasing distances away from the center of this plant, generally, in all directions, but naturally, not quite uniformly, we feel that the other factors -- that any other factor would not tend to decrease with distance in all directions from the plant.

Furthermore, we found the same thing at these other locations.

As I indicated, both at the area around the

Charlevoix Reactor, there too we picked counties that were relatively the same in all the other factors except different in the one factor which is radioactive releases, and the same is true in the plant around the New York County of the Nuclear Fuel Services Plant.

Q Do you have any quantitative data with respect to these other considerations?

A Yes. In fact, I have discussed this whole matter with Dr. Lapp at the Carnegie-Mellon University, who just published in Science an article in which he showed other pollutants also produce changes in mortality.

The article appeared in the past year and shows very clearly that such other factors, as differences in such factors as SO-2? concentrations, concentrations in particulate materials, effect infant mortality.

I compared the percent changes for a given percent change in these other pollutants and found they were roughly 10 times weaker in their effect than radiation.

Q So, Doctor, you have no quantitative date but what you have referred to and cited, other quantitative data from other researchers?

A Yes, by Dr. Lapp at Carnegie-Mellon University.

Q Now, let me refer you to page 1374 of this morning's transcript. You state at lines 15 through 18 that New York State appears to have been used as a control in your

work. Could you tell me why you selected New York State as a control in the Dresden work?

A Yes. I can.

We tried to compare an area of comparable socio-economics and comparable socio-economic problems as the six and a half million people who were living within the area largely of Cook County and adjacent areas, similar in their general make-up and latitude, location, geographically, as well as in other respects with regard to health care and other matters, roughly similar -- namely, Chicago and New York.

However, that was not our only comparison. We also made a comparison with nearby Ohio, where we then took the difference between Ohio and Illinois, and found a similar correlation between the difference using Ohio as a baseline.

Furthermore, we referred to other states and found that with regard to other states such as Indiana and other states such as North Dakota, we did indeed find all these states having lower values of infant mortality during that period; so they all appeared to be relatively equivalent in their usefulness as, shall we say, control states.

Q You have not used the State of Missouri, for example, as a control state?

A No. That is because Illinois, for instance, has in that area within 50 miles a very highly urban character. In fact, the majority of people were in the 50-mile radius live

in city-type areas. In fact, Cook County is the dominant number of people accounting for the population of Illinois. Therefore, it would be quite inappropriate to use a comparison with a largely rural, quite different socio-economic and medical care area such as Missouri.

Q Now, Doctor, I would like to refer you to two citations to the transcript this morning, although you needn't necessarily look at them because I think you will recall what was stated. I would cite page 1383 and 1392 in which you refer to work that is underway at Hanford and work underway at Peach Bottom.

A Right.

Q I wanted to determine whether the work which you have indicated on those two pages of the transcript has been completed as yet?

A As I said, the work is not quite completed, but we have it now. In fact I just located it --

Q Have you drawn conclusions from that work?

A Yes.

Q You have drawn conclusion?

A I have drawn conclusions but the report is not yet finished in writing.

My conclusions are indeed that the pattern around the Hanford Reactor for the period '43 to '45, before and after onset of operations, is very similar in behavior to the pattern

around the Nuclear Fuel Services Plant in New York where also plutonium is separated chemically from the uranium fuel and radioactive gases are discharged through the stack.

Q Dr. Sternglass, have you performed any studies which you have not yet identified which did not indicate or show the cause and effect, such as the study you have made and discussed?

A Yes.

Indeed we have looked at, of course, the area around Pittsburgh. Pittsburgh is downwind from the Shippingport plant and we have found at this time, as yet, and I am not prepared to say this is final, no significant changes associated with emissions from construction of an onset of operation from the Shippingport plant.

Q Now, let me refer you to page 1363 of the transcript. At the bottom of that page you indicated that certain studies in New Mexico had been performed and you referred to the material in Exhibit 5 that we have not yet seen, dealing with a survey of White males 75 to 84 years of age in the New Mexico area.

A I'm sorry. That is a mistake. It is not what I intended to say if that is the impression.

The figures for 75 to 84 year-old males refer to the entire population of the United States, not just to New Mexico.

A I see, fine.

Let me ask you, Dr. Sternglass, isn't that a rather abnormal group to study with regard to concerns on infant mortality or am I mistaken in my understanding?

A No. I am sorry. As I indicated, although my primary concern in our studies has been to search for defects on the fetus and infant, we have also examined the other end of the scale, namely, the elderly, who are more sensitive again to the induction of various cancers and leukemia.

We have not merely looked at that one age group. I believe I indicated we look at all age groups as reported by the National Center for Health Statistics and in a report published in the early 1960's in which drastic changes in mortality patterns of all respiratory diseases and many other diseases -- and in fact a total change in the declining mortality in general were suggested by Dr. Moryama as having possibly been associated with radioactive contamination of the environment. And it was not restricted to merely one age group.

I am using this as a specific example, and Dr. Moryama's papers contain the same changes for population group after population group.

Q Thank you, Doctor.

Let me refer you now to page 1370, line 4. The sentence I am referring to begins,

"So this idea that immunity is really something" --

-- and so forth. I would like to direct your attention to the use of the word "immunity" as you use it in your testimony.

Can you tell me to what kind of "immunity" you are referring?

A Yes. I would be glad to cite you the precise paragraph and read it to you so there can be no question as to what I have in mind.

Now, this particular immunity refers to communicable diseases as discussed in the article by Paul Jacobs in The Atlantic issue of February of 1971, citing an Atomic Energy report which he had obtained and viewed in 1957 and compared with the final version of this report as later released. And the missing portions which he refers to reads as follows:

"In future tests within such areas blood changes in man might be demonstrable if systematic observations are made. It is possible, also, that the immunities of the population might be sufficiently reduced that measurable increased incidence of selected communicable diseases would be discerned by epidemiological investigations. The long-term implications of yearly exposure of a cross-section of the population to levels in excess of those considered to be maximum permissible for occupational workers certainly justified continued observation and

maintenance of radiation health records, even though specific consequences cannot be foreseen at this moment."

Q Dr. Sternglass, are you reading from the article written by this Mr. Jacobs, is that correct? This is reflecting opinions of somebody we don't know, is that correct?

A I'm sorry. It is not an opinion, this is a citation of an AEC document which is referred to and explained on page 49. I could identify this further if you like.

Q I think if you just identify the document?

A All right.

In August of 1970 I asked the Atomic Energy Commission Public Information Offices at the AEC Headquarters in Germantown, Maryland, for several documents including the report which I first obtained in 1957. Now, it is now declassified together with reports on monitoring and earlier weapons test programs, and was readily available.

I have kept the original all these years and now I read them side-by-side.

Now, this has obviously to do with a report which Paul Jacobs obtained relating to the possible health effects of testing of nuclear weapons in Nevada --

Q I think you have identified this, Doctor. I think we know what you are referring to.

I would still like to go back to my question: Do

you consider the term "immunity" to be innate or acquired immunity?

A As you perhaps know, immuni ' to diseases is very often provided by genetic factors. These genetic factors can be influenced by any mutagen such as radiation.

We are therefore talking about an innate immunity which presumably the normal infant when born full-term has to some degree, and which could be affected by radiation during the period in utero.

Now, it does not exclude the possibility that an acquired immunity or immunity developing in the first few years of live could also be affected by radiation and lead to increased susceptibility to communicable diseases or to that matter, the development of cancer for all we know at this m moment, the ability to resist virus later on in life.

It is this particular mechanism (f indirect action axial radiation which I feel is so important in explaining the kind of phenomena we are now observing and which, apparently, were of concern to someone in the AEC way back in 1957.

MR. ENGELHARDT: If I may have just a moment, I have onemore question in this area and I want to be sure I understand that the question is.

D # 17 CHAIRMAN SKALLERUP: Very well.

BY MR. ENGELHARDT:

Q One last question with regard to your testimony for LIFE, Doctor.

It has to do with the response made this afternoon in connection with a question by the Applicant counsel and I just want to be sure that I understand something you indicated.

Did I understand you to say there were thyroid malignancies in the children exposed?

A I believe this is the gist of the paper that I referred to by Dr. Robert Conard et al.

Q You are not aware of a possibility of what appears to be a fact that there were no thyroid cancers detected in these children?

A Well, I will read you this table on page 321. "Thyroid Lesions," March of 1969. The table reads Rongelap, 175 rads, age of exposure say less than 10 years old, 500 to 1,400 rad, 9.5 percent had thyroid lesions and there is a separate column for malignant lesions called 5.3 percent. Then in the next line it says Rongelap, greater than 10 years old, just over 10, dose 160 rads, thyroid lesions 0.0 percent, 5.9 percent malignant lesions and to my knowledge malignant means cancer.

MR. ENGELHARDT: Mr. chairman, that concludes our cross-examination of Dr. Sternglass with respect to the

testimony he presented on behalf of Intervenor LIFE.

I would like to request a short recess to permit me to coordinate a few questions that are in the process of being prepared with regard to Dr. Sternglass' testimony on behalf of Mr. Lau.

We have several questions that we would like to ask him to that and I would like an opportunity to consult to make sure I have the questions in proper order.

CHAIRMAN SKALLERUP: Will 10 minutes be sufficient time?

MR. ENGLEHARDT: I am sure it would be.

CHAIRMAN SKALLERUP: We will take a 10-minute break.

End #18 (Recess.)

CHAIRMAN SKALLERUP: It turns out Mr. Engelhardt did not need the full ten minutes, so we are going to resume.

Mr. Engelhardt?

MR. ENGELHARDT: Mr. Chairman, we have determined to deal with the matter of Dr. Sternglass' testimony on behalf of Mr. Lau in rebuttal testimony, and we will not need to further cross-examine Dr. Sternglass.

THE WITNESS: May I make a few comments on the --

MRS. BLEICHER: This is redirect.

THE WITNESS: That's right.

REDIRECT EXAMINATION

XX

THE WITNESS: One comment made by the Applicant is that rubella outbreak may have had a part in it. I have explained since then that we do indeed have indications that immunities to such diseases may be affected by radiation, so there is no contradiction between rises in rubella and the effects of radiation.

Next, I wanted to clarify the matter of comparison between pressurized and boiling water reactors.

Peach Bottom is unfortunately neither one of these two reactors, and it only emitted apparently a total of 100 curies in one year at the height, as reported in the Bureau of Radiological Health publication which we have referred to, the same one that lists all the reactors. Since we do not yet fully understand all the mechanisms and the composition

of the isotopes, for instance, 100 curies, if they are largely composed of iodine, are far more serious than 100 curies composed primarily of krypton-85.

In the absence of a full detailed analysis, month by month, of a composition of the isotopes coming out, it would be foolish indeed or hazardous, or unwise, to judge or compare 100,000 of one with 10,000 of another.

But it is important to point out that in the absence of full understanding of all the mechanisms, caution requires that we do whatever we can in the reduction of emissions, and this must be done to the best of the capability of each of the systems. And even when we are dealing with emissions that are only 10 or 100 curies, it appears that we may have cause for concern.

Therefore, to say merely that a boiling water reactor is always worse by 1000 may not be the whole story. It depends to a large degree on the mix of isotopes, and it depends to a large degree on the particular mechanisms of transport that are involved in all of these situations.

Now, another point that I wanted to spend a few minutes on is the question as to the National Committee on Radiation Protection. I would like to point out that, number one, it is not necessary for the purpose of the argument that I presented that the National Council of Radiation Protection has agreed to a particular amount of reduction, say by a

factor of 4 in the exposure of women exposed in an atomic energy industry, occupationally.

The crux of my argument was really the following:

It was that if there is a finding that there is reason to be more cautious than in the past in the manner of giving doses to women during pregnancy in an occupational situation, then I would think prudence in public health should dictate at least a similar or possibly even a larger reduction for the general population as a whole.

Therefore, the mere fact that the National Committee of Radiation Protection chooses to reduce only the dose to those working within the atomic energy industry may express a very commendable concern for their employees, but not an equally great concern for those who live outside the boundaries.

Now, with regard to the question of the NCRP and its final determinations, it should be pointed out that the National Academy of Sciences is at present carefully reviewing all these radiation standards on the question of low-level effects on various segments of the population.

At this point, the NCRP findings are only one input into what the government agency or the environmental protection agency must use in arriving at determinations which then would have to be approved by Congress.

We are, therefore, far from having the last word in this NCRP publication, and I think it is important to point

out that the president of this organization has been with this organization almost since its inception, that a great many of the members of this early organization have early decisions to defend, and it is only human to regard that past decisions have not been in error.

I would also add that with regard to the International Commission for Radiation Protection, the NCRP and the people who are the United Nations Scientific Commission on Radiation, that there is what you might call a significant overlap involving in many cases large numbers of present or past Atomic Energy Commission employees on the staff of these various committees.

In particular, my examination of the composition of the United Nations Scientific Committee on Radiation, the delegation to that group as sent by the United States, contains a majority of individuals who have been and are still associated with various radiation protection questions, or radiation protection groups within the Atomic Energy Commission.

Therefore, we cannot, although we would like to, say that at the moment there is no clear indication that radiation standards, even set by supposedly independent international commissions and U.N. commissions, are indeed as independent of undue influence from individuals who have past decisions and mistakes and lack of knowledge in their background in areas which unfortunately involve large numbers of

human beings, and are therefore sensitive and difficult to dissassociate from human emotions.

This is the real problem that we are dealing with, the whole matter of radiation standards, that there are almost no people at all who have had sufficient background and knowledge in this area who have not been at one time or another intimately associated with the Atomic Energy program.

I believe that this would then conclude my comments on this testimony.

CHAIRMAN SKALLERUP: Is Dr. Houston or Mr. Houston present?

(No response.)

CHAIRMAN SKALLERUP: There appears to be no response.

We are ready for LIPE to begin cross-examination.

MR. CHARNOFF: Mr. Chairman, I believe the statement was made by Mr. Lau that Colonel Gadler was due in Wednesday night and would be here today.

I may be wrong, but I believe he said that.

MR. ENGELHARDT: In a telephone conversation with Mr. Lau last evening, he informed me that Colonel Gadler was not intending to arrive this week, but would likely or could be available on Monday of next week.

That is from Mr. Lau.

CHAIRMAN SKALLERUP: Thank you.

MRS. BLEICHER: May we have a five-minute recess, and then we will go into the cross-examination?

CHAIRMAN SKALLERUP: Yes.

(Recess.)

end #19

CHAIRMAN SKALLERUP: Will the hearing please come to order.

Mrs. Bleicher will begin her cross-examination.

Are you going to begin with the applicant or the Commission Staff?

MRS. BLEICHER: We would like to begin with the applicant as the applicant has indicated he would like us to go forward with him first. However, we do have this Exhibit 5 prepared.

Would you like to accept Exhibit 5 from this morning's testimony at this time?

CHAIRMAN SKALLERUP: Miss Evans, would you hand those to the reporter, please?

(The document referred to was marked LIFE Exhibit No. 5 for identification and was received in evidence.)

MR. CHARNOFF: I take it that is the documennt referred to be Dr. Sternglass?

MRS. BLEICHER: That is right.

CHAIRMAN SKALLERUP: Has the applicant a copy?

MR. CHARNOFF: No, we haven't.

CHAIRMAN SKALLERUP: What arrangements are going to be made to get a copy for the applicant?

MR. CHARNOFF: Did you give one to the staff?

xxxx

MR. ENGELHARDT: The staff has a copy.

MR. CHARNOFF: If the staff has one and will lend it to us, we will reproduce it.

CHAIRMAN SKALLERUP: Do you expect to get anything back, because this will go to the Public Reading Room in Washington. Do you have a copy yourself?

MRS. BLEICHER: No.

MR. CHARNOFF: We will be glad to reproduce two copies.

MRS. BLEICHER: Thank you.

CHAIRMAN SKALLERUP: This is LIPE's Exhibit 5.

MRS. BLEICHER: That is correct.

We would like to ask the applicant the following question.

Whereupon,

LOWELL D. ROE

MORTON I. GOLDMAN

having been previously duly sworn, resumed the stand on behalf of the Applicant, and were further examined and testified as follows:

CROSS-EXAMINATION

BY MRS. BLEICHER:

Q In order to evaluate the dangers to the public resulting from emissions under 10 CFR Part 20 standards at the Davis-Besse, at what percentage of maximum AEC limits in 10 CFR 20 will Davis-Besse be operated?

A (Mr. Roe) I believe the various tables that were referred to by the staff just this afternoon to the Board do list the complete isotopic content of any of the releases and these can be compared to the 10 CFR 20 standards.

Q Have you done this comparison in terms of percentages?

MR. CHARNOFF: May I ask a question with regard to the question?

Before, when I was asking Dr. Sternglass a question with regard to the 5 millirad figure that he had used yesterday as being the average population does and comparing that with the figures that have been offered by Dr. Sternglass that he attributes to Dr. Stewart, I believe Dr. Jordan indicated that he didn't understand how that was related to the intervenor's challenge to 10 CFR Part 20.

I would think that the same question applies to this particular question by the intervenor and I would like to seek a ruling from the Board on this point.

CHAIRMAN SKALLERUP: Would you explain your rationale on that?

MRS. BISCHOFF: I would attempt in a series of questions to tie these things up so that we will have some

kind of information about the danger to the population of operating under the 10 CFR Part 20 limits.

If, at the end of my questions, it is determined that they are irrelevant, you could take care of it at that point.

MR. CHARNOFF: I think the issue that has to be defined is -- I think there having been any number of cases that we expect to operate at small percents of Part 20, but I take it from Dr. Jordan's remark that the Board understood what is at issue in LIFE's intervention is the validity of the maximum limits in 10 CFR Part 20.

DR. JORDAN: That is right. We do understand that but I would be willing to let her go ahead and ask the questions and do the best you can with them, and we will undertake to recognize which ones are pertinent and which ones are not.

MR. CHARNOFF: Well, let us answer the question, but I think we ought to recognize, depending upon how long they go and the line it takes, it might be that the questions are irrelevant.

DR. JORDAN: Very well. You can bring it up again, but let's see how they go towards tying it in.

WITNESS ROE: The 10 CFR 20 standards are based upon the activity of the liquids being released.

The specific activities of any of the liquids being released are given, I believe, in Table 11-2.4 or in question

11.2 of the PSAR.

The assumptions used in preparing this table were, first of all, that the reactor would be operating at equilibrium cycle for a full year with one percent failed fuel cladding, which is the mechanism where you would get these isotopes into the primary system.

This in fact results in a very pessimistic assumption in that we would never be operating for a full year with one percent failed fuel.

These tables are also based on assumptions that we would release all of the primary water that is processed through these system. This again results in a much larger release than we would ever be doing in actual station operation.

These tables were prepared to show the worst situation under which the station would operate. The various tables are both based on daily and annual releases under these conditions.

Even under these most pessimistic conditions, the comparison with the standards in 10 CFR Part 20, the isotopic content is a factor of 10, or in many cases much greater below the standards of 10 CFR Part 20.

This in itself does not really explain the effect upon the area from these releases, and it is really the effect upon the area taking the releases and reducing them to the effect or dosage to anybody within the area. That is

really the concern --

BY MRS. BLEICHER:

Q You are talking about anybody within which area, the restricted area within the general population?

A (Mr. Roe) Within the area in the site boundary, the area of 50 miles.

There has actually been a study conducted of this effect and Dr. Goldman can speak about this study and the results in a dosage.

Q Are you saying that the maximum will be 10 percent of the 10 CFR Part 20 standards?

A (Mr. Roe) 10 percent or less, yes.

Q Did you cite Table 11-2.4?

A (Mr. Roe) This was an error on my part, it was Table -- a table that appears in Question 2.4 in Volume 4.

It is actually Table 2.4-1. It is in volume 4 of the PSAR.

Releases are also given in the tables in response to question 11.1.

Q Would it be possible to limit your operation at all times at the plant to this level?

A On an annual average the releases will be 10 percent or less of the standard in 10 CFR Part 20 for any liquid that is released. During the course of operation of the station there could be short periods, due to certain things

in the station that might be higher than this figure, but in no case will anything be released higher than the limits of 10 CFR 20.

Q Taking into account normal operations, not large a accidents, but normal operations, at what percent of the Part 20 standards could the plant operate at all times?

A I'm sorry. I'm not sure I understood the question. Would you repeat it, please?

Q Yes.

You did state that your average would be 10 percent. What would be the maximum figure from which you would then derive this average?

A I believe I had said that the maximum would be the standards in 10 CFR Part 20, or maybe a little more specifically, would not exceed that.

Q In other words, there are times when your operations would cause them to go up to the Part 20 standards?

A Generally, no. We do not expect this.

END#20

DR. JORDAN: For my information, the isotope in question, is this tritium that is likely to be 10 percent?

MR. ROE: Tritium is the one possible exception that could be closer to the limits than say the 10 percent of the limits.

MRS. BLEICHER: With respect to which isotopes would you be most closely approaching the 10 CFR Part 20 standards?

MR. ROE: Only in the possible case of tritium.

MRS. BLEICHER: Tritium is the isotope which most closely approaches the Part 20 standards mentioned, correct?

MR. ROE: Correct.

MRS. BLEICHER: What are the other isotopes which are also high?

MR. ROE: All of the other isotopes are in the area of 10 percent or below.

MRS. BLEICHER: What percentage of 10 CFR Part 20 stnadards will -- at what percentage of 10 CFR Part 20 standards will the sensitivity of the leak detection systems be set?

MR. CHAUKOFF: Mr. Chairman, I think I would now raise the question relevant to this question to the contention of LEPG.

CHAIRMAN SHAPIRO: In what way is this relevant to your contention?

MRS. BLEICHER: If we are here asserting and able to convince the Board that the Part 20 standards requiring a revision and that the maximums given are too high, then we have to find out whether the plant will be safe as it is going to operate and new levels, perhaps, a new level for their leak detection system will have to be set. That depends at what level their leak detection system now works and at what level we ultimately conclude it should work.

CHAIRMAN SHALLERUP: Any comment?

MR. CHERNOFF: Yes, I don't remember seeing anything in the contention of LIFE with regard to what level the leak detection system should be set or even the radiation detection system should be set.

As I understood it, the contention was simply it was within the limitations of the Baltimore Gas and Electric, Calvert Cliffs case, that LIFE would content that in effect the rules in 10 CFR Part 20 are in effect an unreasonable exercise of the Commission's discretion. It is difficult for me to understand how the sensitivity of the leak detection system relate to the contention.

CHAIRMAN SHALLERUP: The Board will go off the record.

(Discussion off the record.)

CHAIRMAN SHALLERUP: Will the hearing come to order?

During our conference we had a discussion with respect to the line of cross-examination.

Lnd 21

Mrs. Bleicher will continue.

MRS. BLEICHER: With respect to the reactor components discussed in the PSAR, Section 3, have you built these or are your plans to build these in accordance with Part 20 standards?

MR. CHARNOFF: I am afraid the question with relation to Part 20 standards doesn't set standards for reactor components.

MRS. BLEICHER: Reactor components, I understand, the type you have will be one of the determining factors in the eventual amount of emissions.

MR. CHARNOFF: The Part 20 standards, if you examine those, relate to radiation release standards but it doesn't establish standards for any components.

MRS. BLEICHER: Were your reactor components built so that the eventual emissions from the plant will meet 10 CFR Part 20 standards?

MR. CHARNOFF: Is the question, will the components and the plant be built -- is Mrs. Bleicher looking for information as to whether the Applicant is building this plant so that he will conform with 10 CFR Part 20?

MRS. BLEICHER: Yes.

MR. CHARNOFF: I don't think it is relevant to the issue but we will answer it any way.

MR. ROE: I really believe I have answered it before

and the answer is very definitely yes.

MRS. BLEICHER: May I have five minutes to confer with my client, please?

CHAIRMAN SKALLERUP: Yes, Mrs. Bleicher.

(Recess.)

CHAIRMAN SKALLERUP: Will the hearing please come to order?

At our conference we discussed the course of the cross-examination and Mrs. Bleicher will now cross-examine Commission Staff personnel.

The conference also considered the sequence of witnesses tomorrow and in view of the fact that we have to be out of the Armory tomorrow, we are going to convene at 9 o'clock in the morning. We have to be out of the Armory by 3.

Mrs. Bleicher, you may proceed.

XXXX

Whereupon,

PATRICK W. HOWE

and

ROBERT TEDESCO

were called as witness on behalf of Regulatory Staff and, having been first duly sworn, were examined and testified as follows:

MRS. BLEICHER: This is cross-examination of the AEC Regulatory Staff.

XXIX

CROSS-EXAMINATION

MRS. BLEICHER: On page 20 of the AEC Safety Evaluation by the Division of Reactor Licensing you state with respect to Section 4.6, "Based on our review, we have concluded that the proposed design and fabrication specifications and procedures are acceptable."

By what standard did you determine that these were acceptable?

MR. ENGELHARDT: Mr. Chairman, may I inquire as to the relationship of this question to the contention of the Intervenor LIFE?

Let me mention this, Mr. Chairman, to the extent we can be helpful to provide general information that may be within or outside the scope of the safety evaluation but not relate to the issue here, we will try to be helpful. But I think we would like initially some indication of what the relationship of this line of questioning is to the contention, so that the record at least will show what that connection may be or may not be and we can consider that in appropriate brief at a later date. But to the extent that we can be helpful to provide some information and as long as it is not unreasonable in length, we will attempt to do so.

DR. JORDAN: I appreciate that. I think it might be explained to some of you who are perhaps a little puzzled, possibly even to the Intervenor. Because you have noted

that many questions of course are being objected to. The problem at hand is whether the standards set by the AEC for the release of activity to the environment are set low enough so that people who life in the neighborhood of the reactor are protected.

The Applicant, in this case Toledo Edison, guarantees that the plant they build will put out radioactivity at lower levels, you have heard some talk today about how much lower, they guarantee that the activity they put out will be at lower levels than the standards set by the AEC.

In fact there is no question that they will because they will be monitored by themselves and by the Commission and at any time that they exceed these standards they will be shut down.

So there is no question, really, this plant when it is built, will comply with the AEC standards for release of activity.

Now, LUPE, the Intervenor, has raised the question as to whether that is good enough.

So consequently, therefore, we do not allow LUPE at the moment, this is not one of their contentions, to inquire whether or not they are able to meet the standards or not or how much lower the level is going to be because the guarantee is that they will be below the level.

We will hear a little bit further from the Staff

about how much lower. So, therefore, the question is entirely are the standards themselves safe enough? If they are indeed below the level whether there will be any harm to the people in the neighborhood. So therefore we are insisting that therefore -- we agree this is an important question and Mr. Sternglass' testimony that many of you heard today was directed right to that very important question.

Now, there has been hardly any testimony, I think none at all from the Applicant, a little from the Staff on the standards themselves. So therefore cross-examination to which we are restricted to right at the moment, there is little cross-examination if at all.

This is one of the problems that the Intervenor has. Nevertheless, with this explanation, please go ahead.

MR. ENGELHARDT: Mr. Chairman, I just wanted to preface this line of questioning, that I am going to reserve my right to raise objections to these lines of questions unless they can show relationship to the contention of the Intervenor LIFE.

However, as I indicated, within bounds we are prepared to respond to questions that the Intervenor believes to be helpful, but we do not concede that this question or any of the others have any relation to the issue that LIFE has been permitted to intervene on. We are treating these questions essentially as we would treat any questions that

are raised of the AEC Regulatory Staff in connection with the work it did in evaluating the application of the Applicant. It is in that contention that I will not raise any objections to a few questions with respect to this matter that may be helpful and informative to the members of the public or to LIFE. But I am not conceding that any of this line, at least until it can be related, has any relationship to the relevance of the contention of LIFE.

End #22

MRS. BLEICHER: Since you have just given us an opportunity to ask general questions, there was a time previously, on discovery, when we asked you for certain documents, and you refused to product them. And these documents are still documents which have information in them which my client feels are important to the preparation of their case.

They now ask you where they can obtain copies of them, and whether you can help them in getting a copy?

MR. ENGELHARDT: I think that question is out of order. We are now involved in the cross-examination of witnesses, and I think it is appropriate to commence that.

CHAIRMAN SKALLERUP: Proceed with the cross-examination. You can make such inquiries at the close of the hearing today.

MRS. BLEICHER: What we are trying to do is find out how the Part 20 standards are used. In order to know whether they are adequate or not we have to know exactly how they are used. That is why we are asking you whether Part 20 standards were used to evaluate certain aspects of the plant, or whether some other standard was used?

In all cases where you were dealing with parts of the plant that would control the amount of the radioactive emissions, did you measure whether or not this aspect of the plant was acceptable by reference solely to Part 20?

MR. ENGELHARDT: Mr. Chairman, to the extent we

understand the question, we will try a response which may be helpful.

CHAIRMAN SKALLERUP: When you begin, give us your understanding of the question.

MR. TEDESCO: Mr. Chairman, we believe that the question relates to the utilization of Part 20 limits, and their applicability with regard to nuclear plants.

On that basis, we again cite that Davis-Besse Nuclear Power Plant, like other nuclear power plants of this type, would be constructed in accordance with Commission regulations, and included would be 10 CFR Part 20, which would be used to establish normal effluent requirements relating to radioactive materials.

These would be in the form of gasses, liquids, or solids.

The Part 20 limit would be applicable for this facility. However, additional requirements with regard to maintaining these releases to levels that may be considered as practical would be imposed.

We would also get reports on the releases from the facilities, assurances would be available on the maintenance and operability of the equipment provided to assure that they are maintained in such a state that they would have releases that would be as low as practicable.

These are all in accord with the Commission's

regulations, and particularly with regard to the December 3rd release.

On December 3rd, the Commission had issued a statement of consideration; in particular 35 FR 18385. This is entitled "Control of Releases of Radioactivity in the Environment."

MRS. BLEICHER: I believe you are referring to the new paragraph (c) of Section 20.1 of 10 CFR Part 20. Is that what you just referred to?

MR. ENGELHARDT: I think Mr. Tedesco was referring to the regulation that he cited, the appended regulation that he cited at the Federal Register page that he noted. This includes amendments of 20.1 of the Commission's regulations, as well as 5034(a), which we discussed earlier today, and 5039(a), and these are the three amendments to Commission regulations that are included in that regulation.

MRS. BLEICHER: With respect to the amendment new paragraph (c), the Section 20.1 of 10 CFR Part 20, in its development part, reads as follows:

"Persons engaged in activities under licenses issued by the Atomic Energy Commission should, in addition to complying with the requirements set forth in this part, make every reasonable effort to maintain radiation exposures and releases of radioactive materials and effluents to unrestricted areas as far

below the limits specified in this part as practicable."

I have a question:

Did you use this standard concerning limitations as far below as practicable in determining whether or not this plant should receive a construction permit, this Davis-Besse plant?

MR. TEDESCO: As I indicated, the plant would be authorized to operate at levels not in excess of 10 CFR Part 20. However, the equipment that would be available in the plant is adequate to assure that releases from the plant would be maintained as low as practicable.

MRS. BLEICHER: With respect to the word "practicable" how do you define that word when you evaluate the plant?

MR. HOWE: May I direct your attention to the section called "Guidance on Low Radiation Dose." Have you found that?

MRS. BLEICHER: No.

MR. HOWE: May I give you the copy that I am working from, if that is permissible?

CHAIRMAN SWALLEROP: Yes.

MR. HOWE: I think the Applicant has one of these.

MR. ENGELHARDT: I think I should note for the record that it is customary for regulatory agencies, including the Atomic Energy Commission, when publishing amended regulations to preface those regulations with a statement that

is essentially referred to, and identified as a statement of consideration, which gives the rationale and the explanation of the agency for the proposed changes or the effect of changes contained therein.

Once these are codified in the Federal Register or in the Code of Federal Regulations, the statement of consideration no longer appears with that amended regulation, and instead, appears only in the initial publication in the Federal Register.

What Mr. Howe has just shown counsel for intervenor LIFE is a statement of consideration which was published in the Federal Register with respect to the rule which Mr. Tedesco identified.

CHAIRMAN SKALLERUP: What was the question that you are asking?

MRS. BLEICHER: I asked how the AEC Regulatory Staff defines the word "practicable." What standard they use to determine whether something is or is not practicable when they are evaluating the plant?

MR. ENGELHARDT: And Mr. Howe was going to show how the Commission has dealt with this matter in the statements of considerations, which precede or preface the amended regulations that Mrs. Bleicher has been referring to.

end #23

MR. HOWE: I can't give you the Funk and Wagnalls' definition of practicable but I can refer you to the guidance set forth in the statement of consideration.

Under the section "Guidance on Low Radiation Doses," about the third paragraph starting with the word "Experience," do you find that?

MRS. BLEICHER: Yes, I have found that.

MR. HOWE: There is a statement where it says "The Commission believes in general releases of radioactivity in effluent from nuclear power reactors now in operation have been within the ranges that may be considered low as practicable."

Now, in order to get at the numerical translation of that, one can go to the testimony before the Joint Committee of Congress, this document has already been placed into evidence I believe by the Applicant and contained in there are the discharge level and percent of MPCs these plants have achieved in '67, '68 and '69 and generally we find the plants are discharging in the range of 1 to 3 percent.

MRS. BLEICHER: Does that mean when a new plant is built so long as it is in the same range as the plant previously operated, it is considered to have been operating as low as practicable within that standard?

MR. HOWE: It is within those ranges of 1 to 3 percent of MPC that I think the definition can be as low

as practicable, but it doesn't mean that the Applicant ceases to attempt to have lower releases.

MRS. BLEICHER: Itis true, isn't it, I am referring to the very language of the regulation itself, it states that "As is practicably achievable taking into account the state of technology and the economics and improvements in relation to the benefit of the public health and safety."

When they are talking about economic improvements, they are referring to the cost of improvements, are they not?

MR. TEDESCO: Yes.

I think it is a desirable goal to have absolutely no releases. But you have to realize nuclear reactor create fission products. In the long run the operation of the plant, with gases, there has to be some release. The equipment provided in the plant is consistent with that which we have reviewed under similar plants.

MRS. BLEICHER: I understand that. I am simply asking you if it is true that 20.1(c) takes cost into account in determining safety?

MR. TEDESCO: In our review we do not consider economics. Our review is involved with the safety of the plant.

MRS. BLEICHER: You did not take into account the guidelines in Section C, taking into account the economics of improvements?

MR. TEDESCO: We have to include this in our review.

MRS. BLEICHER: Did you say you do?

MR. TEDESCO: Yes, we make every reasonable effort to maintain low releases of radioactive material as effluence in unrestricted areas as far below the limits specified as far as is practicable.

MRS. BLEICHER: In other words, you take cost into account to decide whether something is safe or not?

MR. TEDESCO: No.

MRS. BLEICHER: These Part 20 limits are safety standards, are they not?

MR. TEDESCO: Yes.

MRS. BLEICHER: And they are supposed to be set so there will be safety assured to the public?

MR. TEDESCO: Yes.

MRS. BLEICHER: So all I am asking is whether you take cost into account when talking about safety?

MR. ENGELHARDT: I think, Mr. Chairman, this witness is not qualified to deal with that particular question. These are rules of the Commission, I think this witness has indicated that the scope of the review is as discussed here, I think what we are looking at here is a statement on goals that the Commission would hope to achieve and I think the words speak for themselves with respect to that matter.

MRS. BLEICHER: Mr. Engelhardt, do you have with

you any witness who is qualified to talk on what the language of 20.1(c) of 10 CFR Part 20 means?

End #24

MR. ENGELHARDT: Our witnesses who are here today are prepared to discuss the substance of our direct testimony. That testimony is contained in the four corners of the Staff's Safety Evaluation. To the extent that the Safety Evaluation is pertinent to the issue raised in this proceeding, yes, we have witnesses who will be prepared to discuss that matter. To the extent that you desire to go outside the scope of that testimony, as I have indicated before, we do not necessarily have witnesses with us who are prepared to respond.

We have indicated the willingness to provide such information as may be interesting but may be outside the scope of your contention, and to that extent we are prepared to deal with this matter.

Mr. Tedesco did not prepare this rule or regulation; the rule is applicable here and as is indicated in the very terms of the regulations, it is clear what its intent is and to this extent we are applying it.

But, Mr. Tedesco did not draft this rule. They speak for themselves.

MRS. BLEICHER: I understand Mr. Tedesco is simply a person who applies Part 20 and I understand in the Safety Evaluation it indicates in numerous places you have reviewed the application and you consider it to comply with the safety standards required by NRC Regulations.

I am simply asking you whether you have used all

of the Part 20 standards, including that standard which requires you to take cost into account when you are deciding whether or not the plant is safe?

MR. ENGELHARDT: I think probably the answer, to the extent I am in a position to answer it or determine that, I think that the Commission has stated in the statement of considerations that such matters have essentially been taken into account, certainly with those pending applications in those plants which are currently operating.

MRS. BLEICHER: I think it would be better, since we are challenging the regulations themselves, to confine ourselves to the discussions of the regulations.

But you have asked the question. I am just trying to show it is relevant and I conclude my cross-examination of the AEC Staff.

CHAIRMAN SKALLERUP: Is Dr. Houston or Mrs. Houston present?

(No response.)

Have counsel any suggestions prepared for the Board relating to its communication to the AEC regarding its order?

MR. ENGELHARDT: I am going to ask Mr. Wallig, who actively participated in the preparation, to comment on this.

CHAIRMAN SKALLERUP: Well, just pass them up here.

MR. ENGELHARDT: We have discovered some interesting

new information that we would like to convey to the Board just for your information that relates to this matter which we were unaware of at the time we left Washington.

MR. WALLIG: Talking with Washington this afternoon, Mr. Chairman, we have been informed of a decision of the Atomic Safety Licensing Appeal Board which was made on Friday, January 22, 1971.

This decision deals with an appeal in the Shoreham case, one of the many interlocutory appeals in the Shoreham case -- It appears at one time in the Shoreham case the intervenors, Lloyd Harbor Study Group, made a motion to the presiding Atomic Safety and Licensing Board to issue an order directing the applicant, the Long Island Lighting Company, to cease laying concrete underneath the position where the reactor vessel will be.

CHAIRMAN SKALLERUP: Do you have a copy of the decision?

MR. WALLIG: No, sir. We have neither a copy of the decision of the licensing board nor a copy at this time of the appeals board decision. It was read to me over the phone this noon, and I have taken notes on that.

CHAIRMAN SKALLERUP: Well, we would rather see the opinion of the board rather than hear your comments about it.

Thank you.

MR. WALLIG: Okay.

In the meantime, do you still wish the recommendations?

CHAIRMAN SKALLERUP: If you have any suggestions, just deliver them to us.

We will adjourn until 9:00 o'clock tomorrow morning.

MR. CHARNOFF: Should these be marked as exhibits or how would you like to receive them?

CHAIRMAN SKALLERUP: They are informal considerations for consideration of the Board.

We will adjourn until 9:00 o'clock tomorrow.

(Whereupon, at 5:20 p.m., the hearing in the above-entitled matter was adjourned to reconvene at 9:00 a.m., Friday, 29 January 1971.)

ENDEND