UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

403480

TO : Dr. Melvin W. Carter
Director

DATE: July 22, 1969

Refer to: RMC:EvdS

FROM : Chief, Radiation Medicine
Southwestern Radiological Health Laboratory

SUBJECT: "Evidence for Low-Level Radiation Effects on the Human Embryo and Fetus," a paper by Dr. E. J. Sternglass (Dept. of Radiology, U. of Pittsburgh)

July 10, 1969, the LAS VEGAS SUN printed an article by Joyce Egginton entitled "Life Ends a Generation After Bomb, Doctor Says" datelined New York. Other newspapers have carried similar articles. This paper by Dr. Sternglass has been presented, at least its basic aspects, several times by Dr. Sternglass over the past year.

The basic thesis for the newspaper headlines is: (a) present fallout has caused a marked increase in fetal, and neonatal mortality, and a decrease in birth weights; therefore, (b) the fallout from a nuclear war would be many orders of magnitude greater, consequently the fetal and neonatal mortality would increase proportionately and effectively eliminate the next generation.

The material referred to in this article was, in part, presented by Dr. Sternglass at the Ninth Annual Hanford Biology Symposium, May 5-8, 1969.(1) This paper engendered considerable heated discussion and rebuttal.

Dr. Sternglass first started his work on this theory by a study of the Troy-Albany area following a "rainout" of fallout material in 1953. He was primarily interested in leukemia at that time and reported a "dramatic" increase in leukemia following the fallout (several years later) as compared with pre-fallout cases. Much of the discussion at the Ninth Annual Hanford Biology Symposium refuted the conclusions of Dr. Sternglass, and Dr. Sternglass did not make too serious an attempt at rebuttal of this refutation. The other data (discussed below) could not be refuted at the time and, I believe, should receive a high priority for investigation.

Dr. Sternglass did a statistical study of health department reports of fetal, neonatal and postnatal mortality rates for each state of the United States and several foreign countries. Analysis was made of mortality rates during the period immediately prior to the TRINITY shot (1945), the period between the TRINITY shot and subsequent atmospheric testing, and the mortality rates during and after the period of atmospheric testing. Pre-1945 rates were considered the base line.

"Fallout" deposited in the various areas was evaluated and estimated primarily from milk data, although a few other sources were used. Attempts were made to correlate increases in ^{90}Sr with mortality rate increases.

The article quotes Dr. Sternglass as saying, "We found that five years after the first New Mexico test in 1945, there was a narrow band of states -- Texas, Arkansas, Louisiana, Mississippi, South Carolina, and North Carolina -- in a direct path under the fallout cloud where the infant mortality rate had shot up by as much as 40 to 50 percent."

At the Biology Symposium he said that the increase was not as great in Texas as in the other states. He postulated the fallout cloud was still quite narrow in Texas and did not cover as much of the state as it covered in other states, and since he used state totals for mortality rates the percent of the population affected would be less in Texas than in other states and thus would show less of a total state increase. I believe this could be quickly checked by doing a county-by-county mortality rate survey of Texas and see if only the counties under the cloud trajectory were affected. North Dakota had an anomalous rise at this time that Dr. Sternglass did not explain.

Following the Pacific tests, according to Dr. Sternglass, there was an increase in the mortality rates in the Western States; and when atmospheric testing was carried out in Nevada, the mortality rate increased throughout the United States. This latter increase, according to Dr. Sternglass, was averaging 25 to 30 percent above the normal expected figure.

In addition to this work of Dr. Sternglass, there have been similar studies (Grahn and Kratchman (2); Solon, et al (3); Lichty, et al (4); and Greim (5)) which taken together are inconclusive. Most papers presented at the Ninth Annual Hanford Biology Symposium (May 5-8, 1969, Richland, Washington) indicated the fetus to be very susceptible to low levels of irradiation. (Throughout this memo I shall frequently refer to discussions and papers at this Symposium.)

On July 16, 1969 (at 1:00 p.m.), Miss Mary Manning, a reporter for the LAS VEGAS SUN, interviewed me on my reactions to the Sternglass paper. Mrs. Douglas was with us during the interview.

I made several points in this interview. (I am giving a resume in this paragraph, and the following paragraphs have more detail.)

1. Dr. Sternglass presented a similar paper at the Ninth Annual Hanford Biology Symposium. This engendered considerable discussion.

2. The part of the paper relating to the Troy-Albany incident and leukemia is so full of mistakes that it undermines the creditability of other studies by Dr. Sternglass.

3. If one assumes the basic data (i.e., amount and deposition pattern of fallout, mortality rates, etc.) are correct, and also assumes that

the changes in mortality rates and birth weights are due to one cause, then the evidence is quite persuasive that radiation caused the changes. However, we do not believe these assumptions to be valid.

4. I believe the study is of sufficient interest that a follow up should be done to either confirm or deny the conclusions.

5. I told Miss Manning that PHS had done similar studies, but related to leukemia and thyroid disease, in Utah and Nevada, since 1957 and had found no significant changes from pre-testing data.

   I also told her that we had planned a more detailed evaluation of the vital statistics of Utah and Nevada, as related to all parameters for which a radiation etiology had been suggested, but due to budgetary restrictions funds were not available for the studies.

6. I discussed similar studies, and the papers at the Ninth Annual Hanford Biology Symposium, in relation to the Sternglass paper. About 50% would support the Sternglass position, and an equal number refuted the conclusions of Dr. Sternglass.

Following Dr. Sternglass' paper at the Biology Symposium there was considerable discussion, both as formal papers and as informal discussion.

Most comments were on the Troy-Albany part of the Sternglass paper. This is the aspect about which the Deputy Commissioner of Health of New York State was "quite incensed with the half-truths presented." The general concensus of the Symposium was that Sternglass misrepresented some facts, misinterpreted others, and that he ignored other facts in the study. Records showed four cases of leukemia in 1946 and nine in 1965, but no account was taken of the comparable increase in Troy-Albany population for the same period. Sternglass used raw data rather than rates per 100,000 population. If rates are used, there is no significant increase in leukemia. Several of the 1965 leukemia cases were not resident, nor were their parents resident in the Troy-Albany area at the time of the 1953 fallout.

Almost all persons at the Hanford Biology Symposium had very serious doubts of the validity of the Troy-Albany data, and the way of presentation. This caused them to also have doubts about the other data of Dr. Sternglass.

That there is correlation between irradiation and leukemia incidence is accepted by most investigators. However, the predominant feeling is that the "doubling dose" for leukemia in children is not the 0.1 R reported by Sternglass, but a much larger dosage.

Dr. Alice Stewart (who a few years back reported an increased incidence of leukemia in England following irradiation for ankylosing spondylitis) said that she now believes that the increased incidence of childhood leukemia is indirectly due to antibiotics. She reasons this way: children now dying of leukemia, would have died of infections before living long enough to

develop leukemia in the pre-antibiotic days. With the use of antibiotics, these children did not die of infection but lived long enough to die of leukemia. Her belief is that the children would have died either way, but by preventing death by infection more children lived longer to die of leukemia. (6)

No one at the Biology Symposium commented for the official minutes about the mortality rates and "small baby syndrome" of the Sternglass report. Later several comments were made privately that they did not believe or trust the Sternglass paper.

While listening to Dr. Sternglass' paper, I was impressed by two facts: (a) if one accepted his data as correct, and also assumed a single cause for the changes in mortality rates and birth rate, then Dr. Sternglass had an "airtight" case against fallout radiation; and (b) the fallout patterns as used by Dr. Sternglass did not match the fallout trajectories I knew occurred from Nevada testing and the predominant Continental United States wind patterns.

Dr. Sternglass said his "fallout deposition quantities" were based upon data of ^{90}Sr in milk as reported by the PHS and other milk networks. I do not believe the United States was adequately covered with milk networks in 1945-1960 to give any indication of fallout in all the states.

I was not familiar with the fallout pattern of the TRINITY shot (1945), so I asked Mrs. Douglas to get what information she could on the shot. Information was obtained from NVOO, Sandia, Los Alamos and "Reach to the Unknown -- The Trinity Story" (LASL publication, 1965) (7). The 19-Kt TRINITY shot was on a day with "rain, an overcast sky, and light and variable winds, and the lack of any fallout problem." (LASL, 1965). Dr. Payne Harris (July 16, 1969) (8) recalled the day as having "local winds generally from the southwest and that close in fallout was toward the northeast." Dr. Tom Shipman (July 16, 1969) (9) said that fallout data such as Dr. Sternglass needed for his predictions did not exist.

Based on the above, and known patterns and distribution from comparable sized atmospheric shots, it would be practically impossible for fallout, of the magnitude Dr. Sternglass used in his calculations, to extend over Texas, Arkansas, Louisiana, Mississippi, South Carolina, and North Carolina.

Radiation cannot be the only cause of increased mortality rates and decreased birth rates as other entities are already known to medical science to be etiological agents.

Studies have shown that mothers who smoke cigarettes have smaller weight babies than do mothers who do not smoke. Malnutrition is another cause of small babies. Many chemicals have been associated with the induction

of leukemia. There is some circumstantial evidence to suggest that pesticides and spermatocides affect the mortality of subsequent offspring of parents so exposed. In animal and plant studies genetic changes have been produced by pesticides.

The increased use of tobacco by women, malnutrition, and general exposure to pesticides, toxic chemicals, other pollutants and spermatocides all have an effect on increasing the mortality rates and decreasing birth weight. Unfortunately the exact contribution of each is not know, and if radiation is also a factor, we do not know its dose effect.

Because the emotionally packed question has been raised, and since we have no firm indication of its magnitude, I believe an intensive effort should be made to confirm or deny the allegations of Dr. Sternglass. As recommended by Radiation Medicine during the past year, a start should be made by reviewing the vital statistics for Nevada and Utah for the period 1940 to present. Also the survey of vital statistics should include other diseases and abnormalities of radiation interest (e.g., leukemia, congenital abnormalities, etc.) in addition to infant mortality and birth weight. Birth weight should be the easiest to determine from birth records.

In 1957 I looked into the incidence of leukemia in Nevada and Utah. This was the result of the allegation by some people in the Off-Site area that the boy died of radiation induced leukemia. My explanation at the time was that no one case could be singled out as being due, or not due, to radiation. Radiation induction of leukemia could only be detected by a statistical increase in the total number of leukemias. In 1957 we found no significant increase in either leukemias or congenital abnormalities.

For several years following 1957 I kept a "general outlook" for any unusual changes in either leukemia or congenital anomaly rates. In 1959-60 it was reported to me that St. George, Utah, had had three cases of leukemia in one year. This was about seven years after the 1953 "dirty shots." Investigation of the vital statistics of Utah through the State Health Department showed no significant increase in leukemia for Utah as a whole, or for the Cedar City area in particular. For the preceding several years St. George had averaged one case of leukemia every other year, then one year with three cases, followed by several years of only a case every other year. Statistical evaluation by Mr. Ed Weiss indicated the three cases to be within NORMAL deviation; if there would have been four cases, it would have been a significant change. At the same time we were looking at leukemia we also took a brief look at congenital anomalies, but found no significant change. We did not look at fetal, neonatal or prenatal mortality rates or at birth weights.

I believe that if significant changes in vital statistics do occur due to "fallout" or chronic low-level irradiation, they should be first apparent in the area surrounding the Nevada Test Site, i.e., Nevada, Utah, Idaho, Arizona, and Colorado.

I would suggest a pilot study of the vital statistics of Nevada and Utah. Such a study would review the vital statistics records for radiation related entities, and plot their incidence for the period between 1940 and the present. Such a study should not take more than one man-year. The study should be done in cooperation with the State Health Officers and Regional Representatives. Birth weights and congenital anomalies would be recorded from birth certificates; death certificates should indicate cause of death and also indicate neonatal deaths. The increase in non-fatal radiation related disease entities can not be determined through use of health department birth and death records. The Cancer Registry in Reno, for a nominal fee, would be able to retrieve pertinent information from their files.

Several papers at the Ninth Annual Biology Symposium (May 5-8, 1969) had some bearing on the Sternglass paper. Several discussants found many defects in the conduct and interpretation of the Troy-Albany aspect of the Sternglass paper.

Greim (5) reported on a study where over 1,000 children were irradiated in utero (1.5 to 3.0 rads via X-ray pelvimetry) in 1948 and the incidence of abnormalities and leukemia were compared with a similar, but non-irradiated group from 1947 and 1949. At 15 and 20 years after irradiation there were no increases in leukemia. There were increases in hemangiomas and certain other diseases associated with the heart and blood vessels. Greim intends to follow the offspring of these children who were irradiated in utero.

Animal studies reported (10) from Davis, California, showed that beagle dogs on a chronic ^{90}Sr diet developed leukemia, rather than the expected bone tumors.

Nilsson (Sweden) reported (11) that ^{90}Sr has a strong affinity for the testes, and produces a stronger aspermatogonia effect than does an equivalent dosage of x rays. This report may give some support to the theories of Dr. Sternglass.

Other reports that might lend support to the theories of Dr. Sternglass have been questioned. Gentry (New York) (12) reported a correlation between increased congenital abnormalities and increased "background" radiation. This study is quite doubtful in its conduct and conclusions, and very few currently accept his conclusions.

Solon (1960) (3) compared infant mortality rates, birth weights and other parameters between the Mid-West (Indiana, etc.) and the Mountain States (Colorado, Wyoming) where there is a gradient of 50-60 mr over the nine months of fetal life. His conclusion was that although the difference in

radiation exposure might have some influence on the difference in infant mortality and birth weight, there were other factors (hypoxia, economics) just as important, if not more so.

Early in the use of radiation a number of radiologists practiced giving 50 to 200 r to the ovaries of females who were "infertile," and in a number of these cases the females could subsequently become pregnant. In one such series there was no detectable damage to either children or grandchildren of women so irradiated. (12)

Statistical analysis of the Hiroshima and Nagasaki progeny for stillbirths, neonatal deaths, sex-ratio, birth weight and congenital malformations, has shown a significant shift in sex-ratio and an overall early death of progeny. It also suggests some significant radiation effects for other categories of defects.

Sixty children born subsequent to 1954 of exposed parents (Marshallese) show no difference from a similar group born of unexposed parents. Maximum whole-body external gamma ray exposure of these parents was 175 rads, plus a possible 160 rads to the thyroid from ^{131}I. (13)

Although most of us believe that fallout in the United States did not cause increased mortality rates, or decreased birth weights, we have no definite proof to say it did not. Conversely, the "evidence" given by Dr. Sternglass is not sufficient to state that fallout caused the increased mortality rates and decreased birth weights.

Bibliography

The following is a partial list of references pertaining to the basic theory of Dr. Sternglass. A detailed search of the literature will reveal additional studies, which I have not mentioned, that have a bearing on the Sternglass theory.

1. Sternglass, E. J., "Evidence for Low-Level Radiation Effects on the Human Embryo and Fetus," paper presented at Ninth Annual Hanford Biology Symposium, May 5-8, 1969, Richland, Washington.

2. Grahn and Kratchman, "Variation in Neonatal Death Rate and Birth Weight in the United States and Possible Relations to Environmental Radiation, Geology, and Altitude," Am. Jr. Hum. Genet. 15: 329-352 (1963).

3. Solon, et al, "Investigations of Environmental Radiation," Science 131: 903-906 (1960)

4. Lichty, et al, "Studies of Babies Born at High Altitudes," Am. Jr. Dis. Child. 93: 666-678 (1957)

5. Greim, et al, "Effects of Radiation on the Fetus -- Analysis of Children Irradiated in Fetal Life - A Progress Review," paper presented at the Ninth Annual Hanford Biology Symposium, May 5-8, 1969, Richland, Washington.

6. Stewart, Alice---informal discussions at the Ninth Annual Hanford Biology Symposium.

7. REACH TO THE UNKNOWN---THE TRINITY STORY, JULY 16, 1945. The Atom Los Alamos Scientific Laboratory, July 16, 1965. (now out of print) (forword -- "The rain stopped at 4:00 a.m. The decision to proceed with Project Trinity was announced at 5:10." --- p. 20 ... 160 enlisted men were stationed north of the test area to evacuate ranches and towns if necessary.....-p. 23. The rain stopped at 4:00 a.m....at 4:45 a.m.... Winds aloft very light, variable to 40,000 feet, surface calm. Inversion about 17,000 feet. Humidity 12,000 to 18,000 above 80%. Conditions holding for next two hours. Sky now broken becoming scattered. ---p.27 ... cloud... could be followed to a height of 40,000 feet above the ground.--- p. 29 As the sun came up, air currents were created which swept radioactivity trapped in the inversion layer into the valley.--- Geiger counters at S 10,000 began to go wild .... the radioactive air moved away before the danger level was reached. --- p. 31 By late afternoon it was clear that there would be no difficulty with fallout.)

8. Harris, Payne --- telephone conversation July 16, 1969.

9. Shipman, Tom --- telephone conversation July 16, 1969.

10. Paper presented at Ninth Annual Hanford Biology Symposium.

11. Informal discussion by Dr. Nilsson at Ninth Annual Hanford Biology Symposium.

12. Gentry, Parkhurst and Bulin, "An Epidemiological Study of Congenital Malformations in New York State", Am. Jr. Pub. Health 49: 497-513 (1959).

13. Kaplan, I., "Genetic Effects in Children and Grandchildren of Women Treated for Infertility and Sterility by Roentgen Therapy. Report of a study of Thirty-three Years." Radiology 72: 518-521 (1959).

14. Gray, L. H., "Ciba Foundation Symposium on Ionizing Radiation and Cell Metabolism," Little Brown and Co., Boston, 1957 (page 255).

E. van der Smissen, M. D.

E. van der Smissen, M. D.