Need broader based, more independent study. Dwight Ink B-64 #20

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UNITED STATES GOVERNMENT

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File 129 84

TO : D. A. Ink, Assistant General Manager
THRU: J. A. Erlewine, Assistant General Manager for Operations
FROM : Gordon M. Dunning, Acting Director, Division of Operational Safety

DATE: August 27, 1965

Gordon M. Dunning B-64

SUBJECT: PHS STUDIES IN UTAH

OS:DIR:GMD

In your capacity as liaison between the AEC and PHS, I think you should be aware of a situation that is developing in regard to proposed studies by the Public Health Service in southern Utah.

As you may recall, the PHS initiated some studies in Utah a few years ago which were expanded in 1963 to include studies of possible thyroid cancer. It is my understanding that these have been essentially only paper studies.

On June 1, 1965 Mr. Edward Weiss of PHS sent me a copy of a proposed study, "Environmental and Genetic Factors in the Oral Dental and Medical Characteristics of Utah School Children" (Attachment 1). This was a proposal by personnel at the National Institutes of Health to their Clinical Research Committee. There were so many fallacies in the bases for their proposal that I discussed the problem with Dr. Dunham to see what we should do about it. It was concluded that, on balance, it might do more harm than good to the Commission to try and stop PHS. Therefore, in lieu of sending my reply (Attachment 2), I discussed the fallacies informally with Mr. Weiss over the telephone and suggested that other reasons for performing the studies were more valid than fallout.

On August 23, 1965 I received from Dr. Dunham a copy of a proposed article, "Leukemia Mortality in Southwest Utah" by Mr. Edward Weiss (Attachment 3). Many of the data used by Mr. Weiss and much of what I consider unwarranted conclusions drawn by him had been used by the NIH people for preparing their studies in Southern Utah. Attachment 4 prepared by Mr. Tommy F. McCraw presents his comments on Mr. Weiss' proposed article. In addition to Mr. McCraw's comments I have added two of my own (Attachment 5).

On August 24th we learned that PHS was proposing to put out a press announcement concerning the studies to be conducted in southern Utah (Attachment 6).

In summary - (1) there are real and significant bases to challenge the interpretations of the statistics made by the NIH and Mr. Weiss; (2) the studies proposed by NIH undoubtedly will be accompanied by much fanfare

and publicity in Utah. Probably several doctors from Washington will appear on the local scene in southern Utah, establish a headquarters, and use local school facilities to examine 2,000 public school students. All of these will be done under the banner of fallout from the Nevada tests. Whereas, it might not be wise to attempt to stop the PHS studies, perhaps we should consider the technical staff indicating more formally the fallacies upon which the studies are being based. Hopefully there might be a chance of averting a potential fallout scare by placing the purpose of the studies in proper context.

Attachments:
1. "Environmental and Genetic Factors in the Oral Dental and Medical Characteristics of Utah School Children"
2. Dr. Dunning's draft reply to Mr. Weiss (not sent)
3. "Leukemia Mortality in Southwest Utah"
4. Tommy F. McCraw's comments
5. Comments by Dr. Dunning
6. Proposed PHS press announcement

cc: Director, MA w/attach.
Director, PNE "
Director, PI "
Director, BM "
Manager, NV "
Officer in Charge, USPHS, NV w/attach.

DRAFT 4/28/65

Clinical Project Number_____

Date_____

TO: Chairman, Clinical Research Committee

Recommended by: Carl J. Witkop, Jr., D.D.S., Chief
Human Genetics Branch, NIDR
Edward J. Driscoll, D.D.S., Clinical Director, ~~NIDR~~

Project Title: Environmental and genetic factors in the oral dental and medical characteristics of Utah School Children.

Principal Investigator: Kenneth S. Brown, M.D.
Human Genetics Branch, NIDR

Associate Investigators: Drs. J. D. Niswander, C. W. Trygstad
Human Genetics Branch, NIDR
Drs. A. L. Russell, N. Littleton, L. Mills
Epidemiology and Biometry Branch, NIDR
Dr. W. T. London
Epidemiology and Biometry Branch, NIAMD

Collaborating Units: Division of Radiological Health, B.S.S., U.S.P.H.S.
Utah Department of Health

Estimated Duration of Study: 1 year

Number of Patients or Volunteers Needed: 2,000 + control group to be determined later

Kind of Subjects: Volunteers 2,000 + Control Group - see text, page 4
Age Range 10 to 20 years
Sex: Male 50% Female 50%
Other Requirements: Residents of Washington County, Utah, or other selected area

Introduction:

In the interval from 1951 to 1962, the United States conducted above ground atomic tests in Nevada. During this interval, nearby Washington County, Utah, population 10,500, was found to have received increased external gamma dose from fallout on several occasions. The town of St. George, population 4,562, on one occasion recorded "the highest 24 hour average concentration of fallout ever measured in a populated area."[1] The average was 1.3 microcuries of fission products per cubic meter of air.

Measurements of fallout material in the air at St. George, Utah, on May 19, 1953, show that for that particular exposure the airborne concentration was localized within a 24 hour period,[2] and during the first four hour period of fallout an average adult would be expected to inhale 15 μ curies of fallout material of which 3 μ curies would be retained in the body.[3]

In March 1955 the populated part of Washington County received two acute fallout exposures from testing. On March 1 the highest recorded average air concentration for 24 hours was 4×10^{-2} μ curies per cubic meter at St. George. The maximum effective biological dose on this occasion was 177 mr at Santa Clara, 5 miles west of St. George.[4] On March 7, 1955, the Turk detonation caused an activity substantially above background in the communities of Toquerville and Rockville in Washington County, but only 11 mr and 3 mr respectively were reported.[5]

On May 15, 1955, several areas in the county received external gamma doses which ranged from 20 mr effective biological dose in Santa Clara to 110 mr in Washington with St. George getting 76 mr.[6]

The accumulated gamma exposure estimated for all tests up through September 1955 was 3 Roentgens for St. George.[7] In this same interval nearly half of Washington County including most of its populated area accumulated from 2 to 4 R and a narrow strip bisecting the county in an east-west direction accumulated between 4 and 10 R[8] included in which was the town of Hurricane, population 1,271, with an estimated accumulated dose of 4.2 R.[7] Eleven of the thirty-eight communities in Utah that received over 0.2 R gamma in this interval are in Washington County including the six with the highest exposures of 3 R or more.[7] These doses are significant in that a whole population including young and unborn children was exposed to the possibility of radiation damage.[9]

It has been estimated by one group that the 700 children residing in Washington County who were less than two years of age during the peak exposure period received, in 1953 alone, between 120 and 440 rads to their thyroid from I^{131} in milk.[10] Lower doses were also received during other periods of fallout. These exposures from ingested I^{131} were also of an acute nature lasting only a period of two weeks or less.

Subsequent to these incidents the Research Branch, Division of Radiological Health of the Bureau of Environmental Health, Bureau of State Services, U.S.P.H.S., has engaged in a series of studies to evaluate any possible effects of the fallout exposure that had occurred. In 1963 the Utah-Nevada population study program was started in collaboration with the Public Health Department of Utah and Nevada. It includes epidemiological studies of selected causes of morbidity and mortality potentially related to radiation exposure.

The study director of the Utah-Nevada population study has contacted the Human Genetics Branch, NIDR, to inquire whether any of the techniques available in this Branch would be of use in carrying out the mission of the study. He suggested that a collaborative study of the population of 3,405 children in public schools in Washington County would prove useful for genetic or epidemiologic studies of interest to our program. Such a collaborative project would be of significance for the Utah-Nevada population study and would be funded through the Division of Radiological Health, Bureau of State Services.

Purposes of the Project:

The several purposes of this project are related, to the individual interests of the investigators participating in the study, through the utilization of this population of children as a data source, and through the application of the skills of several investigators. Of prime interest to the Utah-Nevada Population Study is the detection of possible somatic damage to the developing tissues of young children exposed to fallout. The Human Genetics Branch of NIDR is interested in genetic and environmental factors controlling the growth of the face and dentition, and in the development of genetic marker characteristics that can be of use in human genetics generally. The Epidemiology and Biometry Branch of NIDR is studying the epidemiological aspects of all factors in the environment known to influence dentition. The Epidemiology and Biometry Branch of NIAMD has been concerned recently with epidemiological factors affecting goiter production.

Morphological and physiological changes in dentition are possible types of effects of fallout which have not been examined in this population. A systematic examination of thyroid morphology by physical examination has not previously been attempted although the thyroid is recognized as being one of the body organs most at risk in the fallout exposed group.

This study would propose to survey the children of this county and to compare oral and tooth morphology, enamel structure and carious teeth of the children who were at risk of radiation damage during various stages of development with the teeth and oral structure of their siblings and other children in the community who were not at the same developmental stages during the radiation exposure period and, therefore, were not at risk. A thyroid examination will be performed in a systematic manner in order to compare the thyroid morphology of the exposed group with suitable controls. This will be used as a baseline for future follow-up studies and as a data source for current epidemiological research. Examination of other specific characteristics of genetic and possible somatic relationship to radiation exposure will be carried out concurrently. The data regarding these characteristics will be used in testing hypotheses about the somatic effects of radiation and also in testing and developing genetic hypotheses independent of possible radiation effects observed.

Protocol:

Of the 3,400 children in school in Washington County, about 1,500 were alive in 1953. This group is now attending junior and senior high school. It contains 753 sibships which contain 536 independent sib pairs. There are an additional 500± children in 5th and 6th grades who would be expected to have erupted their permanent anterior teeth and first molars, but who were born after the period of major fallout exposure. There is also a local junior college at which an additional school age population who had developed dentition prior to fallout exposure could be studied.

The 1,500 junior and senior high school students in this community will be the subjects of this study. The addition of the 500 upper primary school children will be considered depending on the progress of the study and the evaluation of the workers in the field. A field team of four dentists and four physicians with supporting technical personnel will plan to complete the field study in ten working days of two school weeks. It is anticipated that some of the supporting personnel can be recruited in the local junior college.

The question of controls in this study must necessarily be left open. There are several types of control included in the study of the 1,500 junior and senior high school students alone. There are controls within the individual due to the sequential development of teeth, there are sibling controls, and there are controls of children of different exposure history in relationship to development. The size of any of these control groups is small, however, and it may be necessary to turn for controls to the large longitudinal studies being carried out in other parts of the country. To use these would introduce problems regarding possible genetic differences and differences in environmental factors other than the one of major concern. A specially selected control group should be located in a socio-economically similar semi-rural county of similar environmental type most probably in eastern California or Oregon or western Arizona (west of the test site) in an area with no history of fallout exposure. The control group will be of similar number, sex, age, and ethnic classification to the study group. It is entirely possible that controls for one part of the study will not be suitable for another part.

Two general types of tissues might *a priori* be expected to show somatic effects from any toxic process. The first group is the tissues that tend to have high exposure to the toxin, either by direct exposure, as in the case of skin and contact dermatitis, by concentration as in the case of the thyroid and Iodine, or by deposition as in the case of bone and strontium. Although bone is turning over its salts, the effect is that of deposition.

The second group of tissues that might be expected to show effects of toxins are those in which the structure of the tissue results from a limited number of cells and in which a defect in one cell or a few cells would be apparent as a change in the appearance of the tissue. The teeth and the iris are two examples of structures that are changed by changes in small groups of cells during development. They have also the desirable properties that they are visible for examination without trauma and with economy of time in the examination.

- ORAL AND DENTAL STUDY -

The formation of the 10 primary tooth primordia are from localized areas in the oral epithelium. Subsequent tooth buds form from the germinal

buds except for the permanent molars which develop directly from epithelium. The tooth buds develop in three waves, the primary teeth start at the 5th month in utero and the enamel is largely formed by birth. The permanent anterior teeth and the first molars are beginning to develop enamel at birth and are continuing to develop enamel up to about the 4th year. (Table 1). The permanent lateral incisors do not start to form until the tenth month post partum. At about one andone half years the bicuspids develop and permanent molars begin between one and a half and three years. The third molars are beginning to form at age 7 to 10 years. The upper teeth generally are somewhat ahead of the lower teeth at a given age. (Table 1).[11]

From this brief synopsis of dental development it can be seen that in a population of children who had been exposed to a possibly toxic event it might be possible to predict which specific teeth would be expected to show any effect from the toxic event or events. This would apply to comparisons of individual teeth within a given child and also to different teeth in children of different ages at the time of the supposed toxic event or events (shown in Table 1).

The tooth enamel is produced by ameloblast cells in a specifically localized pattern in which each ameloblast produces a rod of enamel that forms a column from the dentin out to the surface of the tooth. The length of the column of dentin and, therefore, the thickness of enamel, is a function of the metabolic activity and life span of the particular ameloblast cell which produces a given enamel rod. These cells are active in temporal and spatial sequence from the start of the enamel at the tip of the tooth towards the root.

Tosix effects, such as tetracycline therapy of the mother while a fetus is developing primary teeth,[12] are known to affect the developing dentin in a highly specific way. Experimental studies in animals have shown that a variety of maternal traumas can affect the development of fetal teeth.[13-17] Even variations in metabolism of more physiologic types, such as birth and the various stages of infancy, produce rings in the enamel. These rings are related to the severity of the environmental changes and they appear, as expected, on the teeth or parts of teeth being formed at the time of the trauma.[13] Careful examination of enamel will be carried out by observers standardized against each other so as to provide reliable data on any possible dental changes.

The gross morphology of the teeth are apparently less sensitive to environmental affects. However, it is well known that systemic disease, particularly syphilis, can affect the morphodifferentiation of teeth producing peg teeth, and other variations in the general size and shape of specific teeth or tooth structures. It has also been shown that large

acute doses of radiation affect the general size and shape of teeth.[19] For this reason measurements of specific tooth dimensions will be carried out. These same measurements are to be used as a basis of a study of the hereditary aspects of tooth size.

If radiation has any overt effect on teeth it will probably follow damage to the tooth bud in early morphodifferentiation or to the specific ameloblast cells that are active at the time of exposure. The enamel when formed is stable. The group at risk is those children who were developing teeth, either in the morphodifferentiation stage or in the enamel forming period. From Table 1 it can be seen that these are the children from ages 10 to 16 years old at the present time.

The specific changes that may be observed as evidence of effects of radiation or other toxic factors on dental morphology are the appearance in the group at risk of an increased proportion of small or peg shaped teeth. Since peg laterals, in particular, tend to have a familial distribution, the occurrence of any morphological changes will have to be controlled by family study of siblings, and if necessary parents or other relatives as indicated.

The effects of toxins on ameloblasts are to cause hypoplasias of enamel. In Japan there was reported increased incidence of hypoplasia observed in the radiated group of children.[20] The occurrence of such hypoplasias in the children at highest risk would be evaluated for the distribution of the hypoplastic areas within a tooth and among the teeth of the given individual in relation to the time of exposure and would be controlled against the dental status of siblings and also of non siblings of the same and different ages. Hereditary amelogenesis imperfecta is clinically distinguishable from the condition expected here. High concentration of ingested fluoride ion might present a difficulty in diagnosis, but the major water sources in the area are well below the concentrations that would be expected to introduce this problem.

Since increased dental caries might result from the effects of normal cariogenic processes on enamel that was defective in microscopic degree not otherwise detectable, the dental caries score for the group at risk may prove to be different from the expected scores as extrapolated from the observed scores of older and younger siblings. A difference in caries rate was found in Japan between the exposed and control groups.[20] For this reason the classical DMF and def scores will be recorded. These scores will also be used in connection with the PTC taster score to extend the data that suggests a relationship between caries predisposition and the ability to taste this compound.[21]

The Japanese children in Hiroshima and Nagasaki who were exposed to direct radiation and fallout are reported to have had delayed eruption of both first and second molars compared with the controls.[20] This finding suggests that the eruption time of teeth developing at the time of exposure could be delayed. Eruption time will be evaluated in this population and compared with suitable controls.

Occlusion of the teeth is a rather precise phenomenon depending on size relationships of various structures as well as timing of a number of growth processes. Therefore, external insults affecting, even minimally, growth and development of the dento-facial complex might be reflected in the final occlusal relationships of the teeth. Malocclusion will be assessed using a variety of criteria and the results related to radiation history. Comparisons with siblings will serve both as a control for radiation study and as an independent assessment of genetic factors involved.

- THYROID STUDY -

The clinical examination of the thyroid gland is subject to the individual variations of observers. In order to get a reproducible clinical examination which would have a significance for future examinations of the group as well as a significance for the present status of the thyroid, a systematic independent examination by three physicians, a pediatrician, a general physician, and an endocrinologist is planned. These will be done independently and blind as part of this study.

The protocol for the thyroid examination follows the method of Crooks et al.[22] The neck of the subject is observed in a good light during three swallows of water, once from each side and once from the front. A thyroid gland is determined to be "visible" if a mass is seen in the neck that rises on swallowing. The neck is then palpated from behind and a mass that rises in swallowing is determined "palpable." If one or more nodules are felt the gland is determined "nodular." Each subject is examined independently by 3 observers. The highest on which all 3 observers agree is the accepted score. Thus all three observers would have to find a subject's thyroid to be visible, palpable and nodular in order for it to be declared "enlarged and nodular." The grading of thyroid observations is:

0 - not enlarged (may be visible or palpable, but not both)

1 - enlarged (both visible and palpable on swallowing)

2 - enlarged and nodular

On the basis of this scale, 200 individuals have been examined and the ability of this scheme to detect differences among individuals has been demonstrated. Reproducibility testing of this scheme is being undertaken, and additional reproducibility testing can be included as part of the control in this project.

- IRIS STUDY -

The occurrence of segmentary heterochromia of the iris has been reported to be increased about 15 times by intra-uterine exposure of the fetus to diagnostic radiation.[23] In other studies this finding has not been confirmed.[24] The examination of the iris for segmentary heterochromia does not inconvenience the child and can be done rapidly by experienced observers in good light and is, therefore, an ideal population test. The 300 children in this population who were in utero during the fallout exposure periods can be compared with the remainder of the population for their frequency of this trait. In particular, since this condition can also be due to genetic factors, they can be compared with their siblings. During the course of the iris examination the iris structure and color will be recorded according to the classification of Waardenburg[25] for use in genetic analysis.

- TASTE AND SMELL STUDY -

The ability to taste or smell specific chemicals has been known for many years to be under genetic control.[26-27] The ability to taste the compound phenylthiourea is one of the characteristics that is frequently used in schools to demonstrate genetic principles because of its inocuous and quick testing properties. It has been shown, however, that the ability to taste this compound is related to glaucoma,[28] caries rates in the deciduous teeth,[21] and goiter.[29] The nature of these physiological associations are subjects of current investigation. Because data on two of the traits that have been related to PTU testing form a major source of interest in this study the ability to taste this compound will be tested by the method of Harris and Kalmus.[30]

The ability to smell specific odors may possibly represent a new set of genetic polymorphisms similar to the human blood groups.[31] If this proved to be the case, it would be of great value in the study of human genetics by providing a set of genetic markers that could be tested rapidly and without discomfort to the subjects of the study. The first step in the evaluation of this potential resource is the detection of polymorphism or bimodality in the population in regard to these traits. Then if variations are found the nature of the inheritance mechanisms can be studied

One of the seven basic molecular odor types proposed by Amoore has already been demonstrated to be under genetic control.[27] In this study we propose to screen the population of children for their ability to smell the specific molecular species suggested by Amoore at very low concentrations and to evaluate the results by the sib-pair method if any polymorphisms are detected.

- FOLLOW UP -

The State Department of Public Health will be requested to report any determinations, if of significance to the examined individuals, to the appropriate local physician or dentist. The State Public Health Department will be requested to follow-up the history and eventual outcome of these particular cases at the end of one year. Verification of the "follow-up" will be carried out by the Division of Radiological Health, Bureau of State Services.

- DATA ANALYSIS -

The data resulting from the field examinations will receive analysis in several patterns by the individual investigators according to their needs. The general outline of analysis plans include the following.

The dental data will consist of caries (DMF) scores, occlusal and eruption scores obtained from each child examined. These can be compared by age, sex, history of fallout exposure and family group with the controls. The caries scores of individual teeth which were developing during periods of fallout can be compared with caries of teeth in the same children which were developing at other periods as can eruption pattern. The occlusal scores will also be used for correlation studies of genetic factors in determining degree of occlusion. Abnormalities of tooth structure and hypoplasias of enamel of a discrete type will be data items of lower frequency. They can also be analyzed by radiation history, family, age, and sex both within the population and in terms of specific teeth.

Examination of the thyroid gland will results in a score for each child examined. These can be tested for correlation with fallout exposure by age and sex and with the ability to taste PTC. Comparison of each type of finding in the Washington County children will be made with appropriate controls. The individual cases of abnormality can be followed clinically or in other ways at the discretion of the individuals involved. The number of cases anticipated in the study is less than 20. The frequency of these cases observed can be compared with data from population surveys as to type and frequency.

Heterochromia of the iris is expected to occur in about 10 children in the subject population. The observed population frequency can be compared with the values observed elsewhere[23-24] and with the frequency in the control population. These will be correlated with iris color and structure and with age of exposure to fallout. In particular the children in utero during high fallout periods will be compared with those developing at other times. This condition will also be evaluated genetically as will the structure and color scores obtained on all children examined.

Phenylthiourea taste threshold scores will be determined for each child. These will be correlated with dental caries scores and with scores for thyroid enlargement. The thresholds for ability to smell various compounds will be recorded. These will be evaluated for bimodal distributions. Correlation of thresholds will be tested and also correlations with PTC Taste score.

TABLE Ia

.e 1

CHRONOLOGY OF GROWTH OF HUMAN TEETH*
(Schour and Massler)

	Tooth	Tooth Germ Formation	Enamel and Dentin Apposition Begins	Crown Completed	Root Completed
PRIMARY	Central incisor	7 w.i.u.*	4–4½ m.i.u.	1½–2½ mos.	1½ yrs.
	Lateral incisor	7 w.i.u.	4½ m.i.u.	2½–3 mos.	1½–2 yrs.
	Cuspid	7½ w.i.u.	5 m.i.u.	9 mos.	3¼ yrs.
	First molar	8 w.i.u.	5 m.i.u.	5½–6 mos.	2½ yrs.
	Second molar	10 w.i.u.	6 m.i.u.	10–11 mos.	3 yrs.
PERMANENT	First molar	3½–4 m.i.u.†	Birth	2½–3 yrs.	9–10 yrs.
	Central incisor	5–5¼ m.i.u.	3–4 mos.	4–5 yrs.	9–10 yrs.
	Lateral incisor	5–5½ m.i.u.	10–12‡ / 3–4 mos.	4–5 yrs.	10–11 yrs.
	Cuspid	5½–6 m.i.u.	4–5 mos.	6–7 yrs.	12–15 yrs.
	First bicuspid	Birth	1½–2 yrs.	5–6 yrs.	12–13 yrs.
	Second bicuspid	7½–8 mos.	2–2½ yrs.	6–7 yrs.	12–14 yrs.
	Second molar	8½–9 mos.	2½–3 yrs.	7–8 yrs.	14–16 yrs.
	Third molar	3½–4 yrs.	7–10 yrs.	12–16 yrs.	18–25 yrs.

* w.i.u. = weeks in utero.
† m.i.u. = months in utero.
‡ When significant differences occur between upper and lower teeth, their chronology is indicated separately.

TABLE 1b

AGE CONVERSION TABLES

Age in 1953	Age in 1965
0	12
1	13
2	14
3	15
4	16
5	17
6	18
7	19
8	20
9	21
10	22

Age in 1955	Age in 1965
0	10
1	11
2	12
3	13
4	14
5	15
6	16
7	17
8	18
9	19
10	20

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ATTACHMENT 2

D R A F T (NOT SENT)
GMD:em 6/2/65

(This was used as a basis for a telephone call to Ed Weiss on June 14, 1965)

Dear Ed:

This is in reply to your letter of June 1, 1965 concerning the proposal for medical and dental teams from the National Institutes of Health to examine all school children in Washington County, Utah.

The fallout data quoted in the proposal is from the 1957 Fallout Hearings. More accurate and up-to-date data are to be found in the 1959 Fallout Hearings, starting on page 2021. The data contained in the 1959 Hearings will answer your question about Southeastern Arizona.

The proposal submits as one of its principal arguments that the relatively high concentration of fallout debris in the air constitutes evidence of high radiation exposures to persons. As you know, relationships between concentrations of radioactive debris in the air and that deposited on the ground have not been established. The whole body external dose from the debris while it is suspended in the air is quite minor compared to the potential dose after deposition - at least for the cases in point. Even the lung dose from inhalation of these relatively high concentrations is not great compared with the exposure from natural occurring materials in the air. The proposal states " . . . 3 μ curies would be retained in the body." This is a generalized statement which may lead to false assumptions. The fallout debris from Nevada tests has been found to be very insoluble, at least in the nearby areas, thus the lung would be the critical organ by a large factor. One possible exception to the above statement is the dose to the thyroid resulting from the inhalation of

radioiodines. A specific example would have to be assumed to better delineate the ratio of doses to the lung and to the thyroid. In any event, I think studies on thyroids should go forward as explained below.

By far the larger percentage of fallout that occurred in Southern Utah, since the Nevada Test Site opened, was in 1953. It would seem, therefore, that one should look at the age group of interest in relation to this single year of exposure. If one uses the statistics encompassing the period 1951-1962 (as given in the proposal), it would in effect be "diluting" the key data, i.e. it would be producing an "average" which could conceal significant data. I recognize that there are different latent periods and that limiting the significant exposure to one year will also limit the number of potential cases. In fact, one might argue that the number of cases would be so limited as to produce a statistical unsound study. If so, it is unfortunate, but cannot be ignored. In this connection, it is noted on page 9 of the proposal that even under the present assumptions, the anticipated number of cases is quite small.

On page 2 of the proposal it is stated: "It has been estimated by one group that the 700 children residing in Washington County who were less than two years of age during the peak exposure period received, in 1953 alone, between 120 and 440 rads to their thyroid from I-131 in milk." This estimate was made by one individual whose methods of calculation received a critical appraisal by an Ad Hoc Committee of experts. Another estimate, reported on the same page of reference 10 quoted in the proposal, was 68 rads with an uncertainty factor of 4. This estimate was based on comparisons with relative concentrations of beta activity in the air - another method shown to be quite unreliable.

I am puzzled about relationship of the proposed study and the one that I assumed was already well in progress. As you point out in your letter, the study in Utah and Nevada was announced in August 1963. This was to incorporate studies of thyroid into already existing studies of leukemia, etc. Are the studies on thyroid in the current proposal additional ones, or what?

On page 4 of the proposal there is mentioned that one of the tissues of interest is the bone in relation to strontium. The levels of strontium-90 in the Nevada-Utah environs are among the lowest in the country. It is also noted on page 5 that "Experimental studies in animals have shown that a variety of maternal traumas can affect the development of fetal teeth." With such variables as these, and many, many others, how does one delineate the problem?

I am in favor of the studies on thyroid, principally because of the allegations made concerning production of thyroid cancer from fallout. Because of the nature of the study and the limited population at risk, it is highly unlikely that definitive answers will be obtained, but I agree the study should be done, even in desperation, in the hope of obtaining a better response to the allegations. I have a different feeling about the other studies proposed - admitting quickly that I am not an authority in these areas. The likelihood of obtaining meaningful results are at least as small as for the thyroid studies and perhaps much smaller, nor do I know of any compelling public relations need to undertake the studies as there apparently is for the thyroid work.

As I understand it, some of the other proposed studies are genetically related. You will recall that in 1959 the World Health Organization considered the feasibility of conducting genetic studies in the areas of high background radiation levels - some as much as 15 times higher than the average. Yet after generations of exposures at these elevated levels a Committee of the WHO concluded, "The Committee regards it as rather improbable that the investigation of any of the high-background areas known today, will, by itself, lead to the demonstration of significant genetic effects." It is correct that this Committee went on to say in effect that it would be desirable to obtain meaningful, if imperfect data. I believe, however, that one should honestly state and document that there is a scientific basis for a proposed research study or to say that one is just going "fishing." Or to put it more kindly, if it is a question of taking advantage of a fortunate willingness on the part of highly competent scientists to undertake the additional studies beyond these for the thyroid, as I understand it may be, would it not be more accurate to place the justification for this work on this basis rather than flying under the banner of fallout from the Nevada tests?

Sincerely yours,

Gordon M. Dunning
Deputy Director
Division of Operational Safety