

P R O C E E D I N G S

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T E C H N I C A L A D V I S O R Y C O M M I T T E E O N T H E
F L U O R I N A T I O N O F W A T E R S U P P L I E S

April 24, 1944
80 Centre Street
New York, N.Y.

A Meeting of the Technical Advisory Committee on the Fluorination of Water Supplies convened at 2 o'clock on Monday afternoon, April 24, 1944, at 80 Centre Street, New York, Dr. Harold C. Hodge, Assistant Professor, Biochemistry and Pharmacology, University of Rochester, Rochester, New York, presiding.

The following were present:

- Dr. Katherine Bain, Director, Division of Research in Child Development, Children's Bureau, Department of Labor, Washington, D.C.
- Dr. John Caffey, Attending Roentgenologist, Babies' Hospital, New York City
- Dr. William J. Gies, Professor of Biological Chemistry, Columbia University, New York City
- Dr. Harold C. Hodge, Assistant Professor, Biochemistry & Pharmacology, University of Rochester, Rochester, N.Y.
- Dr. Philip Jay, Assistant Professor of Oral Pathology, University of Michigan, Ann Arbor, Michigan
- Dr. Samuel Z. Levine, Pediatrician-in-Chief, New York Hospital, New York City
- Dr. Maurice Pomeranz, Attending Roentgenologist, Hospital for Joint Diseases, New York City

Guest:

Dr. H. Trendley Dean, Senior Dental Surgeon, National Institute of Health, U.S.P.H.S., Bethesda, Md.

Departmental Working Committee:

Dr. Edward S. Rogers, Assistant Commissioner, Medical Administration

Dr. Harry L. Chant, District State Health Officer, Middletown

Dr. B.F. Mattison, Acting District State Health Officer, Kingston

Mr. F.W.Gilcreas, Associate Sanitary Cehmist,
Division of Laboratories and Research

Mr. Charles A. Cox, Chief, Bureau of Water Supply,
Division of Sanitation

Dr. David B. Ast, Assistant Director for Oral
Hygiene, Division Maternity, Infancy and Child
Hygiene

Dr. Sidney B. Finn, Senior Dentist, Division
Maternity, Infancy & Child Hygiene

Miss Sheerar, Statistician

Dr. Babalke *representing Dr. Perkins*

DR. AST: With your permission, we will open this conference. I think, perhaps, the proper procedure would be to advise you why we called this conference and what we hope to accomplish thereby, after which we will really have some very interesting discussion of our problems which, without doubt, will be many.

We hope through this conference and through the Technical Advisory Committee on the Fluorination of Water Supplies, which was appointed by Dr. Godfrey, to have the benefit of expert advice in proceeding with a plan which I think, perhaps, is revolutionary in its nature, and which, if it proves successful, will really give us our first opportunity to prevent the onset of dental caries.

Perhaps before going into our problems it might be a good plan to introduce all of the folks who are here so everybody knows who is sitting ^{opposite or} next to ^{him or her} them and who is sitting opposite to them.)

... Each person who is listed as present was presented in turn to the group, with a statement of his or her connection ...

DR. AST: With your permission, I would like to ask Dr. Hodge to act as Chairman for this meeting. If Dr. Hodge is willing to give the time necessary, and if the members of the Technical Advisory Committee are so inclined, we would like to have Dr. Hodge act as Chairman for this Committee at subsequent meetings when we get together and discuss our problems during the year.

CHAIRMAN HODGE: Perhaps I had better start by asking the Committee whether that arrangement is going to be a satisfactory one.

DR. BAIN: There are no dissenting voices.

DR. AST: On the agenda we have indicated as our first step a brief history of the caries-fluorine hypothesis. I doubt whether we need to spend any time on that since practically everybody here is familiar with it. For the benefit of the few who may not have spent very much time on the problem, suffice it to say that there have been many studies of a very satisfactory nature, control studies, in the Mid West and the West and perhaps other areas of this country where fluorine is found naturally in the communal water supplies. In those areas there has been a very definite correlation of a diminished incidence of dental caries when compared with the child populations of

Fluorine free

similar communities. I think that hypothesis is well established and does not need any further discussion. What we hope to do now is to take a natural phenomenon and try to apply it artificially.

We know that sodium fluoride found naturally in water supplies will diminish the incidence of caries. With the proposed study in this state sodium fluoride is to be added to a communal water supply to bring it up to the concentration of 0.8 to 1 part per million. In those areas where fluorine ^{was} (is) found naturally in the water supply when found in excess of one part per million mottled enamel was evident, and the degree of mottling was in relation to the concentration of fluorine. However at one part per million we do not find this mottling of enamel.

In the study area, the City of Newburgh, we do find 0.12 parts per million of fluorine naturally in the water supply, and we propose to add approximately 0.8 parts per million, which will bring it below one part per million, yet to a concentration which we expect will diminish the onset of dental disease.

The demonstration, as it has been outlined, calls for the addition of sodium fluoride to the communal water supply, and then thorough examinations annually for ten years, which is the expected duration of this demonstration. These examinations are to be dental and pediatric. The dental examinations are to be for the entire five to twelve year old child population; the

pediatric examinations are to be made for a very substantial sample of this child population; also there are to be x-rays of the long bones^x centers of ossification for a sample of the population; urine analyses and salivary analyses also for a sample of the population. These will be on an annual basis.

Similar examinations will be made in the control area, which is the City of Kingston. Both cities are comparable in as many factors as we could find, and I think the control city is ^{admirably suited} (suitably fixed) for its purposes. Fortunately, we have been able to get the consent of the officials of both the study (area) and the control area:

The problems were discussed with the Newburgh Bay Medical Society and the Newburgh Dental Society, and they have unanimously endorsed the program.

The problem which, of course, will interest us most is the question of toxicology. In those areas of endemic fluorosis which have been studied there have been no observed defects other than mottled enamel.

There are at the present time about one million persons living in communities in the United States where there is a natural fluorine^{content} in excess of one part per million in the communal water supply. It is true there have not been ^{sufficient} studies made of any defects other than mottled enamel; however, I think it reasonably safe to say that if there had been any serious defects they would have come to our attention. That does not, of

course, mean that we need overlook that factor entirely. It is with reasonable assurances of safety that this plan has been proposed, and I think we ought to throw this question of toxicology out on the floor for some discussion, along with any other problems which you people here feel ought to be discussed.

DR. CAFFEY: What is the spread between dental fluorosis in its non-poisonous and its poisonous effects? When do you expect the poisonous effects to arise from fluorine, in what concentration?

DR. AST: It has been found in concentrations as low as 1.2 and 1.5 parts per million.

DR. CAFFEY: What are the manifestations of the intoxication in the early stages of dental fluorosis?

DR. AST: A chalky white spot on the teeth.

DR. CAFFEY: I mean in other parts of the body than the teeth?

DR. AST: There have been no other manifestations reported.

DR. CAFFEY: Have there been any urinary changes reported in children from fluorine intoxication?

DR. AST: Not to my knowledge, but Dr. Dean may be able to answer that.

DR. DEAN: We have looked at nothing but teeth. As to other effects, those would depend upon a complete physical examination of the children of known continuity of exposure.

DR. CAFFEY: Fluorine intoxication in adults has been pretty well studied, and the kind of bone reactions resulting therefrom. In the studies in Denmark were any children involved in the poisonous reactions to fluorosis?

DR. AST: They have found mottled enamel among children who were not in the cryolite mines, and they thought the intoxication was transmitted either through the placenta or the mammary glands.

DR. CAFFEY: What is the concentration in milk excreted by a mother?

DR. AST: I dare say that would be dependent on the intoxication to which the mother was subjected. We know something about the excretion of fluorine in urine. We know that up to one part per million in the community water supply or up to the ingestion of one to one and one-half milligrams per day in an adult the excretion in feces and urine equals the intake. We have a very fine study on that ^{d.} gone by Largent^{out} at the Kettering Laboratory. In excess of one and one-half ^{mg per day} (parts per million) there is some storage. Largent^{out} is still continuing his experiment, and he is now taking as much as six milligrams per day orally in addition to what he gets in any of his food or water.

DR. CAFFEY: With a nursing infant you must consider that it is getting fluorine in the breast milk and fluorine in the water. Therefore, the fluorine in the amount of water you gave the infant would not indicate the total fluorine intake because

there is an excretion of fluorine in the breast milk as well.

Another question is: What about the cumulative poison? You mentioned the level. The level for how long? That is, is it the ingestion of fluorine over one year, or are we going to run into a five-year or a ten-year program?

DR. AST: That is really the crux of this whole problem of toxicology of fluorine as it is pointed out in this study. We have searched the literature pretty thoroughly, and the only thing of real interest so far as human studies having been made is the study made by Hodge, ^FFarred, (another ^{Rugg}roentgenologist), and ^VChadnoff, at the University of Chicago. They studied two communities in Illinois where there had been in excess of three parts per million in the water. They studied adults who had been subjected to this fluorine for varying periods up to about sixty or sixty-eight years. They found no evidence of sclerosis in the skeleton. They studied the pelvis. They studied the long bones. Their conclusion was that if we expected to find sclerosis of the skeleton from fluorine intoxication we would have to look for concentrations in excess of three parts per million. This was ^wa group of about 75 adults.

DR. CAFFEY: One other point is that yearly intervals for examination are pretty long intervals during which to detect poisons under conditions where you are not sure of the time factor for the onset of manifestations. In children, a small group examined every three months would be a much safer factor, than

larger groups at yearly intervals, it would seem to me. Hematuria and skeletal manifestations would appear very late in the crude method of detecting poisons.

DR. AST: One of the points we wanted to take up in our discussion today was the question of the types of examinations to be made, and if you feel you want to discuss that now very well.

DR. DEAN: In connection with that University of Chicago report that you mentioned, there is one thing that must be considered. Although in that report it states that one individual was exposed up to sixty years, I believe they have only had the present water supply for about forty years in that community, and the chemical analyses are based upon samples taken as of the time of the examination, but those were not the two wells in use at the time. The first well was put in use about 1910, and maybe the second well for eight or ten years, and then both were abandoned at some subsequent period. The chemistry that you are speaking of there is in relation to wells three and four, so you don't know what the exposure was, say, the first twenty years of the forty. According to Bulletin No. 21 of the Illinois Water Survey there was no public water supply there sixty years ago.

DR. AST: I did not know that. I based my information on the published data of these physicians.

DR. DEAN: I think to study any possible toxicity we

have got to begin with a known constant, that is the public water supply of a specified number of years of continuous use, thirty, forty, or fifty, without any physical changes in that community water supply involving the installation of new wells or the abandonment of old wells.

DR. JAY: Do you have any record of an analysis of the public water supply for, say, thirty years?

DR. DEAN: No, but you find very little change in deep wells with respect to fluorine, providing you could find a place where they had been using this particular well or group of wells for thirty or forty years. For instance, we have been checking the Galesburg supply for over ten years, and it is right within the range of experimental error of the method. The same way with the one at Colorado Springs. I am just bringing out the question of abandoning wells, so you do not know what they had at the start.

DR. CAFFEY: I should think, in view of the fact that we don't know what we are going to look for in these children, they had better be examined very frequently because you ought to put every possible safeguard around this thing, the more the better. What do you think about that, Dr. Levine?

DR. LEVINE: It seems to me that is a perfectly reasonable thesis.

DR. CAFFEY: A year is a pretty long interval for a checkup examination.

DR. LEVINE: Was there any statement to the effect that the pediatric examination would only be made annually?

DR. AST: Yes.

DR. LEVINE: I think it would be preferable to shorten that period to a maximum of six months, and if feasible, depending upon your assistants, to as short as three month intervals. I think six months is probably a safe interval, because with that dosage, even in young babies receiving a multiple supply from the breast, which I presume would be very small, very low -- would you not say so?

DR. CAFFEY: Yes.

DR. LEVINE (Continuing): No acute cases would develop, and that it would be a cumulative rather than an acute manifestation of the poison that would become evident.

DR. CAFFEY: Renal irritation could be looked for very easily.

DR. BAIN: My understanding was that you were going to do the pediatric examination on the school age children. Are you going back to do the infants?

DR. AST: We plan to include the infants and pre-school age children as well.

I think it is of interest to point out what McClure has given us recently on the amount of fluorine which may be ingested by varying age groups if they were to have community water supplies containing one part per million of fluorine

in the water: At age 1 to 3, with a body weight of 8 to 16 kilograms, the child would be getting anywhere from 0.390 to 0.560 milligrams of fluorine from the water, and from food 0.027 to 0.265 milligrams, a total daily intake of 0.417 to 0.825 milligrams. That increases at the different age ^{levels} groups, and he gives one age group three to six, another seven to nine, and another ten to twelve. In the ten to twelve year old group the total intake would be 0.866 to 1.725 milligrams. ^{daily}.

If any of you are interested in looking this particular reference up, it was published in the --

DR. DEAN: American Journal of Diseases of Children.

DR. AST: It was by F.J. McClure, and I think it was published in the issue of September of last year or October. Is that correct?

DR. DEAN: Somewhere along there. It was of that time.

DR. AST: Of 1943. I am sorry I don't have that reference on this chart.

Of course, we have a great deal of evidence on fluorine intoxication as it relates to animal experimentation. Roh^{son} has done perhaps the most intensive work on fluorine intoxication. It is comparatively recent in origin, and I think was published in 1937 or 1938. He found that in his animal experimentation 1 milligram per kilogram of body weight in rats was sufficient to produce mottling of the enamel. It took five

times that quantity to produce any bony changes. Ten to fifteen milligrams per kilogram of body weight produced the first effects ^{on} of the general condition. Twenty to twenty-five milligrams per kilogram of body weight per day produced severe influence on the general condition or organ degeneration. From fifty to one hundred milligrams per kilogram of body weight per day produced death in one or a few weeks. Of course, that is in animal experimentation. How well we can apply that to human experimentation is questionable.

DR. CAFFEY: Are those growing animals or adult animals?

DR. AST: I don't recall. Do you recall, Dr. Finn, what they are?

DR. FINN: I should think they would be growing animals.

DR. POMERANZ: Does Hodges deal with children too or only with adults?

DR. AST: He did two studies. In the first one they were from age 1 up to about age 60. In the second, in Kempton, Illinois, they were from 7-1/2 to 71 years of age, and in ^{Bureau} (Burrow) Illinois, they ran from 18 to 78 years of age. According to his reprint, in Kempton they were exposed from 0 to 61 years, and in ^{Bureau} (Burrow) from 18 to 68 years; but Dr. Dean has given us some other information which, perhaps, makes this read a little differently.

Bureau
(Burrow) DR. DEAN: You have three or four breaks in that water supply too.

DR. POMERANZ: There was a study too which found that where there was excess ammonium there is greater fixation in the bones even in minute quantities.

DR. AST: I am not familiar with that. Was it animal experimental work?

DR. POMERANZ: Yes.

DR. AST: Are you familiar with that, Dr. Hodge?

CHAIRMAN HODGE: No.

DR. POMERANZ: I think Jacob did some work on that about five years ago.

DR. CAFFEY: If the pediatrician were doing serial examinations what would he look for in the way of early intoxication? What do you propose to examine by way of laboratory work and clinical examinations?

DR. AST: We had hoped we would get that information at this conference, what to look for and how to set up this pediatric examination.

DR. CAFFEY: That is a very important point. I am sure no pediatrician knows because they are not familiar with fluorine poisoning.

CHAIRMAN HODGE: Dr. Dean, can you give us any information on that?

DR. DEAN: I don't think I can. While you are

discussing this point though, there are two things to consider: One, the children; second, the population past middle age. While the fluorine may be excreted in the urine in children and younger adults in accordance with the intake, in the older age groups when you are beginning to get renal impairment or metabolic changes that may not be so, and it is a point that has to be considered; in other words, there the fluorine intake and output may not be balanced.

DR. AST: What was that reference we discussed recently about changes in the metabolic rate?

DR. FINN: Apparently with rat investigation they have not found any changes in the basal metabolic rate.

DR. DEAN: I was thinking if you give them a certain amount of fluorine at age 15 and the same amount at age 50, it may have a different effect. For instance, is the excretion of that fluorine intake going to be comparable at the older age groups with the younger age groups or are we apt to get storage in our higher age groups?

DR. ROGERS: What about those studies you reported upon, did they cover a spread of age groups?

DR. AST: That was done by Largen^x, and he used himself as the subject. Although he had some other adult subjects, the work that he reported upon was mostly work where he was the subject.

DR. FINN: I think we are assuming here that less

than one part per million is toxic, but I do not believe we have any proof that that is actually toxic. Therefore, I cannot see how we are going to look for the symptoms when we don't even know whether it is toxic or not in less than one part per million.

DR. LEVINE: There are a number of facets to this problem. If the water supply is universally set at one part per million that would mean that animals would get that as well as humans. Infants receive a larger proportion of fluid intake than adults, in the neighborhood of 130 or 150 cc. per kilogram; in addition to the excretion of fluorine in breast milk the question would come up what is the excretion in cow's milk because that provides a large proportion of the fluid intake in infants. They might proportionately get more per unit of body weight than adults would be getting with cow's milk and water being their main sources of fluid intake. I don't know what the excretion of fluorine in the human or cow's milk is. I would guess it is very low in both instances.

DR. DEAN: Very low in cows. I think it is about 0.1 to 0.2, and even if you give them very high supplemental feedings one or two parts per million you cannot drive it over two-tenths per million in the milk. The University of Arizona did that study two or three years ago.

DR. AST: Didn't McClure report on that also on the amount of fluorine in cow's milk?

DR. DEAN: Yes, and it is pretty low.

CHAIRMAN HODGE: There is one report in the literature about the excretion in goat's milk.

DR. DEAN: Yes, from a group of Italian workers.

CHAIRMAN HODGE: And there it is of the same order that you report.

DR. LEVINE: How many communities are there in which the fluorine content of the natural water supply is appreciably higher than one part per million?

DR. AST: Perhaps Dr. Dean will take the ball there?

DR. DEAN: Not over 400.

DR. LEVINE: Has anybody ever reported any toxic manifestations from the use of that water supply in any of those 400 communities?

DR. DEAN: In one isolated case in the Journal of Radiology, but I think we have to remember that we think of long, continuous exposure to that specific water, while as a matter of fact populations are moving and shifting an awful lot. You would have to pin down a rather small fraction of your population to find that portion of the adult population with, we will say, twenty years' continuous exposure immediately preceding the time of your survey.

DR. AST: I would like to answer your question with a categorical no.

DR. LEVINE: Furthermore, even if that reservation

were made, this project is not inflexible. It is subject to change. If in a period of six months or a year any manifestations appear certainly the ten-year project is going to be abandoned or revised. It would seem to me that in view of the existing evidence in the literature it is a perfectly proper procedure to conduct at the onset certainly, with the understanding that careful observation will determine whether the project will continue for the ten years or not.

Would you agree with that, that as a start the project as contemplated is a perfectly safe procedure from a public health point of view?

DR. DEAN: I don't think so. I think that when material is available in the country that they should be thoroughly examined to see if there are any untoward effects.

DR. LEVINE: That has not been done yet?

DR. DEAN: We have started some of it, but as I see it we have to continue it further.

DR. AST: Do you have any reason to believe, Dr. Dean, from your present studies that we may find some toxic effects at low concentrations?

DR. DEAN: We don't know what we will find even in the low concentrations. We have found some bony changes in eight.

DR. AST: Eight parts per million?

DR. DEAN: Yes. Now we will have to keep on going

down further to see where the thing runs out.

DR. CAFFEY: What bony changes do you find at eight?

DR. DEAN: We found some bone changes, and it is possible there is a higher incidence of cataracts. That is going to involve rather extensive study of a large number of people of known continuous exposure.

DR. ROGERS: Have the bone changes had any clinical significance?

DR. DEAN: Certainly no functional impairment. We just noticed them starting in the same old place that Rohsm spoke of in the lumbar region and pelvis. I have Dr. Hawkins' report which I can read in that connection: "The most characteristic bony abnormality in fluorosis is an increase in the density of the lower vertebrae, sacrum and adjacent pelvis. Various degrees of increased density in the spine and pelvis were observed in 13 of the individuals x-rayed from Bartlett." It was possible to get 111 people with over twenty years' exposure out of a population of about 1700 or 1800 from a house-to-house enumeration down there.

DR. ROGERS: And you found 13 with bone changes out of those 111?

DR. DEAN: Yes.

DR. ROGERS: And what about your controls in that respect?

DR. DEAN: I don't think they found any in the controls. No, there was nothing in the control area.

DR. POMERANZ: Were there any blood changes in the positive cases?

DR. DEAN: Yes, a little. There was some. "In those patients who had osteosclerosis the hemoglobin values averaged two grams less per person than in those which did not have evidence of osteosclerosis. However, the average level of hemoglobin in Cameron and Bartlett were nearly identical." Cameron was the control place. "It would appear, therefore, that if fluorine affects the hemoglobin, it does so indirectly through the mechanism of producing accretional bony changes which encroach on the marrow cavity (osteosclerosis) rather than by a direct toxic effect on the hemoglobin-producing system."

DR. JAY: Did he find any evidence of impaired hearing due to sclerosis?

DR. DEAN: He did not report any. He tested hearing.

DR. JAY: He did test hearing?

DR. DEAN: Yes.

DR. ROGERS: This was at eight parts per million?

DR. DEAN: Yes.

DR. ROGERS: In animals you showed that the animal evidence of bone sclerosis (^{started} stopped) at what?

DR. AST: Started at 5 milligrams per kilogram

of body weight.

DR. ROGERS: But the mottled enamel started at over one part per million of fluorine?

DR. AST: Not in rats. In parts per million it was at fourteen parts per million that we found the first evidence of change in the tooth structure.

DR. ROGERS: And in the same animals your bone sclerosis started at a higher or a lower level?

DR. AST: At a higher level, a much higher level. I don't know the exact figure, but it was at a very much higher level.

DR. ROGERS: Is there any sense in making an analogy in that situation, Dr. Dean?

DR. DEAN: I would not go too far in making an analogy of humans with rats as long as we have the human populations to study.

DR. LEVINE: May I ask Dr. Dean two questions: One is, in those who did not show gross cataract, was vision tested, and was there any diminution in the fluorine group if it was tested? The second is, in those that showed a reduction in hemoglobin, did they also show a leukopenia, a reduction in white count?

DR. DEAN: I don't know. That has been very quickly tabulated rather recently. We have not completed it. I would have to look that up.

CHAIRMAN HODGE: Do you have data on the incidence of cataract in the two populations?

DR. DEAN: This data is not very good because there was not a high enough age group in our control. In our control area in the fifty and older age group we had 26 individuals. One had moderate cataract. In the fluoride area there were 49 individuals, and we found 8.

DR. ROGERS: Eight with cataracts?

DR. DEAN: Eight, moderate and severe.

DR. ROGERS: In 49 individuals?

DR. DEAN: Yes, 49 individuals.

Then we just checked the eyes out of Brittain and King Hill, one in South Dakota and the other in Idaho, and again we found what seems like a relatively high incidence. Brittain has 7 parts per million, and in the age group of 50 and over, with 59 individuals with over twenty years' exposure, there were 18 with moderate and severe.

DR. ROGERS: And there were only 26 in the control group?

DR. DEAN: Only 30 in the control group.

DR. ROGERS: And they had none?

DR. DEAN: One moderate. So we have got to go out and get a larger sample in the higher age group, but it does seem like a rather high incidence down there in the fluoride areas. The fact that you leave Bartlett, Texas, and go up to

South Dakota, and pick up another place that has been using it for forty years, and they show that high incidence, and then you go across the range out to King Hill where they have about 14 parts per million, and see it again, at least indicates that you must go into it a lot further to see what kind of a curve we have got. That curve may tail off at 4, or 5, or somewhere in there, and we would then be fairly safe, but we would like to know which way it is going.

CHAIRMAN HODGE: In your opinion is dental fluorosis the most sensitive indicator of the fluorine effect in the human?

DR. DEAN: I have only studied dental fluorosis. Actually we have not studied much of anything else in connection with this problem other than the objective evidence of dental fluorosis. You can see it is quite a problem to screen out of an adult population those people middle age or over with over twenty years' continuous exposure to this specific condition. It is absolutely necessary in order to make a good survey, and if they have been moving around of course the examination of them is meaningless.

DR. GIES: Are there any public health reports that have been correlated with the fluorine conditions in districts in which there is apparently complete prevention of decay of the teeth? I am thinking of such diseases as arthritis. Is it less or more common in such districts? Are there any public reports that are accessible on that phase?

DR. DEAN: Not that I know of, Dr. Gies.

DR. AST: May I follow that question by asking you if in animal experimentation have you found that dental fluorosis was the first evidence of fluorine intoxication?

CHAIRMAN HODGE: We have done no complete toxicological studies. As far as I know the literature is rather limited especially on long term complete studies in which autopsies have been performed and each organ has been gone over histologically carefully.

DR. JAY: In respect to cataract the incidence of cataract seems to be unusually high in India. How does that stack up with fluorosis? In India why do they have so much cataract?

DR. LEVINE: Do they have a lot of mottled enamel in those districts in India where the incidence of cataract is high?

DR. JAY: Yes, there are areas where they do have.

DR. DEAN: Around Madras and up in the Punjab.

DR. LEVINE: In the cases you cite showing these various conditions of cataract and anemia, did they occur in any patients who did not have mottled enamel?

DR. DEAN: Most of these people would not have mottled enamel because they are thirty, or forty, or fifty years of age, and they may have not moved into the community until they were fifteen or twenty years of age.

DR. CAFFEY: At what age does dental fluorosis become manifest in a child as determined by these studies?

DR. AST: That would depend upon the concentration of fluorine and whether or not the child was born in the area and lived continuously in that area, but evidences of dental fluorosis have been reported on deciduous teeth as well as permanent teeth.

DR. CAFFEY: Do you find it in children a year or two years of age, or must you wait until five or six? My point is that if you are going to use this as an index, how sensitive an index is it?

DR. AST: It has only been found in the deciduous teeth when the concentration of the fluorine in the water has been very high. At low concentrations where mottled enamel has affected permanent teeth, it has not been manifest in the deciduous teeth.

DR. JAY: I would say about six or seven years old in the lower concentrations.

DR. CAFFEY: Then dental examinations prior to the seventh year are going to be useless as far as detecting fluorosis, is that a fair statement?

DR. JAY: That is a possibility with a low concentration.

DR. DEAN: I would not say you would see it before twelve or fourteen. The first molars and the centrals you know

have a great habit of missing it in these lower concentrations, and the bicuspid and second molars is where it was largely found. Eighty-seven or 93 per cent of all of the teeth that showed any evidence of fluorosis were on the bicuspid and second molars, so if we had gone in at an earlier age than twelve or fourteen I would say it would have not been detected.

DR. JAY: I was thinking of Amarillo. I thought we saw something of that there at an earlier age.

DR. DEAN: That is around five, and you do get it on the centrals there, but the anterior teeth and first molars are practically all free.

DR. CAFFEY: Then it would be a waste of time to examine children's teeth at the pre-school level?

DR. AST: In connection with the dental examinations we intend making those on the school children, ^{starting} around the fifth grade. *year.*

DR. CAFFEY: But, as I understand it, there are going to be examinations of pre-school children?

DR. AST: For pediatrics.

CHAIRMAN HODGE: It is my impression that at about one part per million the incidence of mottling in teeth is low. Children do not uniformly have mottled teeth. My impression is -- and I got this from your papers, and would like to check on it -- that something of the order of 10 per cent of the population would show a mild mottling at a level of 1 part per million.

Is that right?

DR. DEAN: That is right. But that is a very conservative figure because if even two out of the average of 24 teeth were just slightly affected, they were counted, and the person was put in the affected figure. Therefore, when you put it on a tooth population basis it drops down to 4 or 5 per cent.

DR. AST: That 10 per cent is on a child population basis?

DR. DEAN: Yes.

CHAIRMAN HODGE: I wondered for a long time ever since I ran across that figure what was it about those two teeth that caused them to become affected. What are the factors that make those two teeth in the 10 per cent of children vulnerable to mottling? Are there any leads on that at all?

DR. DEAN: None that I know of.

CHAIRMAN HODGE: Of course we could say that was natural biological variation.

DR. DEAN: That is the easiest way out of it. It is so insignificant that you have to hunt like the mischief before you can see it. If you take a bicuspid tooth, for instance, in the low concentration areas you have to hunt for that white ^{spot} right on the tip of the cusp. That is about the only place you can find it. The rest of the tooth is perfectly normal. It is just the faintest signs of fluorosis that is usual-

ly seen, and often it completely passes the eyes of the local dentist. Then, again, you see you have to screen out quite a portion of that population. There would only be about 25 or 30 per cent that would have been continuously exposed to that condition. If you take 10 per cent of that 25 per cent, you can readily understand why the local practitioners will tell you that there are not any signs of dental fluorosis in that area.

DR. LEVINE: In view of what has been said, would it be necessary if this project is going to be undertaken to revise some of the procedures? In saying that I am thinking particularly in terms of adult examinations, especially visual testing for signs of early cataract in the adult population.

DR. AST: Would that not depend on long exposure? If we were to revise the procedure it would not necessarily mean it should be in the early part of the demonstration, but rather at the end of the ten year period of exposure.

DR. LEVINE: That is not safeguarding the observation then, is it? If a disproportionate number of that population develop cataract after ten years, and they had signs of it at the beginning of the demonstration, as a Department of Health you may be regarded as having been negligent in not catching that at the start. I don't know whether such a contingency might or might not happen, but in view of what has been said I should think you would have to adopt some prophylactic procedure rather than a purely observational one.

DR. DEAN: We ran into another finding that I might comment upon as rather unusual with respect to nails. "From 10 to 20 per cent of the younger individuals examined in Bartlett, Britton, and King Hill had a rather unusual type of nail structure, the most characteristic aspect being transverse white blotches within and completely across the nail, usually symmetrical on all the nails, there frequently being from 3 to 5 of these per nail." It was rather characteristic, and we had some color pictures made of them. "The incidence of this finding decreased with age, the oldest patient being 57. Nails tend to be somewhat more brittle and thin, and were occasionally curled, making it difficult to keep them presentable. Such individuals had frequently bitten their nails very close. In the control area of Croeur Dalene of the 139 high school students examined none showed transverse striations." This change in the nails that we saw in the fluorine areas was quite different than that observed in the control population.

DR. BAIN: Is there any basis for the statement that I believe I have seen in the literature that in high concentration fluorine areas the deciduous teeth are slow in erupting, that there is a delay?

DR. DEAN: We just finished a study on that of about three or four thousand children under two. We took a number of cities. We had Elmhurst, Galesburg, Aurora, and so forth. Under two there is apparently no difference. Up in

Colorado, where it goes to two and one-half, apparently there is a little delay, so both statements have been made in the literature. It is probable when you are dealing with the higher fluoride areas there may be a slight delay, but in the lower fluoride areas none. At best it is very slight, only ten-tenths of a tooth a year or one-tenth of a tooth, something like that. We were checking it in order to get the comparability of tooth life exposure to see if that would influence the rate. It is insignificant from that point, but there is a little difference.

DR. POMERANZ: Do you not think it would be interesting in this type of experiment where you have that finding of delayed eruption to take radiographs of the centers of ossification?

DR. CAFFEY: But any bone change would be possible to detect by gross measurement only at about the end point of intoxication. For instance, if you used lead lines from lead poisoning, you would only pick up long ^{w-g} standard severe poisons. Slight degrees of sclerosis are very difficult to estimate; that is, if you are going to pick up early signs, I don't think we should rely on a crutch as weak as yearly examinations.

DR. AST: The investigators who have reported to date all seem to feel that the tooth shows the first evidences of intoxication through the mottled enamel, and that the bones were next; that the teeth and bones acted as store houses for fluorine.

DR. CAFFEY: If you do not see any toxic manifestation in an individual except after six years dental fluorosis must be one of the late signs.

DR. AST: Not in animal experimentation. Those that have reported have indicated that dental fluorosis was the first evidence. Most of that work was done with rats with continuously erupting incisors, so they could get changes very early.

DR. POMERANZ: Were the urine and blood carefully checked there?

DR. AST: There are no changes in the bone marrow and blood in the early stages until you get into the higher concentrations. I think Roh^{alm} has done some rather extensive work in that respect.

DR. POMERANZ: Would that not be divided into two stages, so to speak: One is purely from the toxicological standpoint in which the roentgenologist would only incidentally be interested; but the second phase of that study involves does fluorine produce susceptible bone changes in which the roentgenologist would be primarily interested. That is equally valuable. Either it does produce osteosclerosis or it does not. In that event it would be purely an evidence that it does or does not from the toxicological standpoint, in which roentgenology could have no sphere at all, but it would involve more of a biochemical study.

DR. ROGERS: You can see the situation which faces the Department at the present time. ⁶ it is gradually emerging from this discussion. In order that we may get along, Mr. Chairman, on this thing, I would like to just try if I can to pull that together from our point of view. The study was conceived over a period of years in which Dr. Dean's work, as Dr. Ast indicated, played a great part. Dr. Ast, himself, has been a considerable student of the subject. As you know, public interest in it has been very great through the publicity which was given out before we got into it at all. Quite a number of communities are contemplating or are waiting for somebody at the moment to start undertaking a public health program of this kind. We have gone ahead, and we have been received with a good deal of enthusiasm in the City of Newburgh, and have been cordially received in the control City of Kingston. Everything is set up. Everything is authorized. Everything is ready. However, to date no fluorine has been added to the water supply. Despite that, Dr. Ast told me today they have had several telephone calls in the City of Newburgh Health Department complaining about the effects of the new program upon their digestion; but no damage has been done, as it were. (Laughter)

We are aware of the fact that this is reaching into the future a bit, and I think that Dr. Ast, as the spearhead of this particular thing, is not without some courage. The point that we must be sure of, however, is that we are well advised

in what we contemplate. The time is appropriate, but we must surround the project with all necessary safeguards if we are to undertake it at all. On the other hand we are under no commitment other than that of some embarrassment to continue this study if at this time it seems unwise to continue it. I am not putting any pressure upon your judgment. We don't wish to do that at all. The fact that we have gone so far is totally irrelevant to the consideration at the moment. I think there are certain things to be said in connection with the desirability of going ahead, not the least of which is the fact that communities are getting ready to do it, and if communities are getting ready to do it, it had far better be done under careful control conditions, such as we contemplate, and are far greater than might otherwise prevail. It would then be safe to go ahead on the assumption that we could set up over a period of time sufficient careful observations to control this thing.

There are other elements concerned. Dr. Levine brought out that in due course if Dr. Dean's studies or other studies bring evidence to bear that cumulative effects are serious, we will not acquire cumulative effects for a good many years; however, in the meantime we will have taken advantage of a certain psychological situation.

I am sure if all of you will go back into the large public health procedures and analyze their origin, you will find frequently the validity of the results of such pro-

cedures are difficult of measurement because of the fact that we did not set up control periods early enough. After they are under way a time, and are found to be safe and sound, everybody wants them all at once, and you never know just what you have accomplished by your procedure in the way of comparative results. We have seen that happen time and time again, and I think we must bear that in mind in evaluating the present situation.

I think also we must bear in mind that a certain amount of bony sclerosis could be attributable to certain concentrations of fluorine, and must be offset against what we hope to accomplish. If this thing is worth while, we must offset the advantages that are to be attained against the disadvantages, however slight they may be or great they may be, and do some balancing in our thinking.

The material that Dr. Dean has presented us with today, so far as I know is new to us as it probably is to all of you. I think the cataract situation, Dr. Dean, is the most serious of the things that you have suggested.

We hope to have Dr. Dean come to all of our meetings, but he has not yet told us that he can, in order to make sure that his thoroughgoing studious point of view will be presented to us. There is no greater authority on the subject than he, but I am inclined to think he is a little conservative, in fact, a little discouraging toward our present plans. Therefore, I might address a direct question to Dr.

Dean, not to embarrass him but to precipitate the thing, and then to have it go on for discussion addressed to Dr. Dean from the group: Taking this all in all, and viewing the type of program that we think we can set up, assuming that we can set up as elaborate a program as is necessary, do you feel that we should or should not proceed with this particular study at this time?

DR. DEAN: Personally -- and this is only my personal opinion -- I do not think that we are justified in setting it up at the present time until we have at least made the best effort that we can to find out what condition prevails in these populations exposed to fluoride concentrations much higher than what we are discussing, and who have used it for a long period of time. I say that because I think if we were questioned about the toxicological changes in animals in the higher concentrations or ^{if they ask us} (in the areas, and) does that exist, or does this exist in these higher fluoride areas, and we say we have not studied it, we may be in a sort of dangerous position.

DR. ROGERS: Are you ever going to be able to say after you have studied those areas, Dr. Dean, or is the question really an academic one? That is the thing that bothers me. It seems to me this comes to the situation where we have got to consider the next step to be taken and weigh it against the possibility of an over-conservatism, if I may use the term, which can prevent taking these steps that can be taken now when

they cannot be taken later on, particularly the control type of thing I am referring to. Can you ever really hope to establish the thing you are after? Can you remove from the total forces in that community or population the selective factors that enter into this or will that make your group so small as to render the results practically meaningless? For instance, in your control you would have to take people that had lived in that community for twenty years. You are not going to have very many in a city of several thousand, and if you break that down again into age groups that are comparable and other things that are comparable you are going to have a whale of a time drawing any conclusions that will amount to anything from so small a group.

DR. DEAN: I can well visualize what you say as being true. That is why I think we are going to have to completely switch over into cities of forty or fifty thousand population. What I am particularly interested in now is to drop down on the fluoride concentration scale to cities of about two and one-half parts per million. If we are clear there, why I think we are perfectly justified in going ahead. If we take two cities of approximately two and one-half parts per million, one with higher mineralized water and one with very low mineralized water, and then take another city at 1.2 parts per million, which is the approximate concentration we are interested in, and then run two control cities of fluoride free

one from ground water and one from lake water, all in about the forty or fifty thousand population range, where we may be able to get a study group of three, or four, or maybe five hundred, we should be able to get somewhere on this.

DR. ROGERS: Other factors are going to enter into it as well, such as, your calcium, phosphorus, and your sunshine factor, to mention only a few, which must be taken into account when evaluating changes in bone structure, or calcium deposits, and things of that sort. I have talked too much, Mr. Chairman. I just wanted to throw that on the table because that is the problem that we hope to have discussed thoroughly, and if possible we would like to have formal action on it by this group, perhaps not today if time is too short, but obviously in view of this opinion from as high an authority as Dr. Dean of a conservative nature the Department is placed in a very difficult position if we pursue this study. I will be quite frank, but his report today comes somewhat as a surprise to us though perhaps it should not have, and I think that if you will as a committee take advantage of Dr. Dean's kindness in coming here and explore through and with him these points as you think we should explore them we will be very grateful to you.

DR. DEAN: The alpha and omega of this whole thing, Dr. Rogers, is to get into these larger cities to see if we are getting any lens changes in cataracts. What bony changes we have seen are seemingly not too important even with very high concen-

This was on April 24, 1944

Editorial note

DR. DEAN: On page 38 - Dr. Dean states that it will take at least one year to get this information which is necessary before the public should be subjected to water fluorination even at 1.0 ppm F. But in June 1944, Dean arranged with Grand Rapids, Michigan, to start immediately with water fluorination!

DR. DEAN: Dean did not advise us of this change. I learned about it from the Assistant Dental Director, Michigan State Department of Health at a conference in Ann Arbor, June 1944.

DR. DEAN: In October 1944, Dr. Ast appeared on a program with Dr. Dean in Cleveland and asked him then about his change of heart.

See correspondence Documentary file 11/9/44
Dr. Godfrey to Dr. Parran

DR. DEAN: I cannot definitely say right now.

DR. GIES: To come back to a question I raised a little while ago, and making it a little more specific because I think it bears on this discussion: Are there any public records relating to Deaf Smith County in Texas showing that there is more or less occurrence of such conditions than in other places?

DR. DEAN: You could not find enough people in Deaf Smith County to tabulate a rate. They are all concentrated in Hereford, which has about 2400 or 2500 at best. In Texas between 1920 and 1930 there was quite a flux in its population, so you get some idea of the difficulty.

trations, but we ought to know something of those lens changes I think.

DR. ROGERS: How soon would you be able to find that out?

DR. DEAN: I imagine it would take a year at the very least.

DR. ROGERS: And we could have that information I presume as soon as you acquired it?

DR. DEAN: Yes, I think it would take at least a year or probably a year and a half to get in there and screen out the particular types of population in cities of that size. That is some job.

CHAIRMAN HODGE: Is that study going on in the next year or will the war interfere with it?

DR. DEAN: I cannot definitely say right now.

DR. GIES: To come back to a question I raised a little while ago, and making it a little more specific because I think it bears on this discussion: Are there any public records relating to Deaf Smith County in Texas showing that there is more or less occurrence of such conditions than in other places?

DR. DEAN: You could not find enough people in Deaf Smith County to tabulate a rate. They are all concentrated in Hereford, which has about 2400 or 2500 at best. In Texas between 1920 and 1930 there was quite a flux in its population, so you get some idea of the difficulty.

DR. GIES: I was fishing for something definite in that relation. I know of nothing that is definite, myself.

DR. DEAN: You have a lot of individual windmill wells in the town, so you have not a constant there either.

DR. LEVINE: It seems to me that there are three or more alternatives the Committee might take. One is to approve of this project under certain well understood safeguards which we can outline if the action is approved. The other is to postpone any action on this project until more information is available, either presently available in the literature after a more perfect culling of the literature or until further information is obtained.

My own feeling is that the advantages are greater than the disadvantages, and I would think that even after a year we would not be in a perfect position to approve categorically this action any more than we can do now -- possibly a little bit more but certainly not without reservation -- it may take two or three years. Since there are so many communities in which the natural fluorine content of the water is so much higher than the amount contemplated, it would seem to me that no onus could ever be placed on any department of health if the proper safeguards were introduced in the study; so that for the purpose of bringing out the discussion I move the Committee approve of this project with definite safeguards which will be outlined and presented to the Committee before final action.

DR. GIES: I second the motion, Mr. Chairman.

CHAIRMAN HODGE: Is there further discussion on this motion required?

DR. CAFFEY: Do the local authorities in Newburgh know the possibilities of estimating the moderate effects of fluorine? Do they understand those clearly?

DR. AST: I will try to answer that in this way: I have given to the Newburgh Bay Medical Society and to the Newburgh Dental Society as much information as I have had on this subject. I have appeared before them at their official meetings. I have discussed it with them. I have discussed it with a number of the leading physicians and dentists individually. I have given them all the information that I have had, and I feel that I have culled the literature fairly thoroughly.

DR. LEVINE: Dr. Chant is the District Health Officer of that community. I wonder whether he might discuss that question?

DR. CHANT: I think there is very little I could add to what Dr. Ast has just said, Dr. Levine. I have been with him most of the time when he met these men. I have heard no further comment from any of the men individually since they have had the opportunity to see the literature and summary that Dr. Ast has given them, if that is what you have in mind.

CHAIRMAN HODGE: Dr. Jay, do you have something to add?

DR. JAY: Of course, we had contemplated such an experiment in Michigan, and we have postponed it for that very reason: until further studies might be conducted, particularly in respect to lens changes. The point that Dr. Rogers brought out I think is very important, and that is the time is propitious from a psychological standpoint, and I would hate to lose advantage of that. Furthermore, the study could always be discontinued. I cannot foresee any serious consequences due to the fluorination of water in two years.

DR. GIES: In seconding that motion I kept balancing the advantages against the disadvantages, the doubts against the certainties, and so on. I seconded it because I think the desirabilities outweigh the undesirabilities.

CHAIRMAN HODGE: Dr. Bain, have you something to say?

DR. BAIN: I am in a little bit of a dilemma in relation to this. When I first gave some consideration to this study I felt that there was not perhaps enough data on what might happen. I did not think enough communities had been examined from the standpoint of other than just teeth. However, my agency felt that I was wrong in that, and have O.K.'d it, so I am in the position of being in favor of it officially.

DR. POMERANZ: I am in favor of it for the reasons Dr. Levine has given. Certainly a perceptible interval must elapse between the ingestion of the chemical and the appearance

of the toxic effects. Most of those toxic effects are visible to the naked eye so certainly there would be adequate time to discontinue the whole proposal if and when such toxic symptoms become manifest prior to the expiration of the experimental period. I would be in favor of going along with it and encouraging it as a matter of fact, with proper safeguards as both Dr. Levine and Dr. Caffey have stressed.

DR. CAFFEY: I am very much in favor of it, but I think it would be a good idea to perhaps have Dr. Levine organize a pediatric group to see what examinations would be made. It seems to me the medical end of this is very nebulous as to what the doctors are going to look for. What is really the point in examining children if there are no known effects to detect? I think it would be a waste of time unless there is something to study or some criteria. There is no use doctors just looking at children.

DR. POMERANZ: May I clarify it as regards the mechanics of the proposal? As roentgenologists -- and Dr. Caffey is a roentgenologist as I am--what would be expected of us? Perhaps that may indirectly answer the question posed. For instance, are we to specify the type of examinations, the periods of exposure, the amount of radiation, or the mechanics of the examination itself? The voltage and the time factor are very vital in the taking of roentgenograms. Are we expected to formulate a policy in that regard?

DR. AST: We would like very much to have your advice on the subject, yes.

DR. POMERANZ: Who is going to examine these films, the roentgenologist in Newburgh or a roentgenologist who is, let us say, more experienced in bone and joint work and children's work?

DR. AST: It is hoped that we can get only the best advice both in the examinations and in the diagnosis on this.

DR. POMERANZ: In the area in which it is being done?

DR. AST: Not necessarily.

DR. ROGERS: I think we would lay very much weight upon the advice of this Committee as to just that sort of thing. If it is the opinion of this Committee that this is a technical, difficult procedure, there is no reason why it should be done locally as far as the experimental group is concerned. Perhaps the films would be taken, and they could be read locally, but they could also be brought back to our experimental nuclei and whatever group that existed. We would hope that this Committee would steer us in the formation of such groups.

DR. POMERANZ: The mechanics of it would call for Dr. Levine to specify what the examinations should be clinically?

DR. AST: We hope for that.

DR. LEVINE: I have it down now from what I gathered

today, without any thorough study, but I do think it is important in passing on this action to emphasize that appropriate safeguards be applied, and that the duration of the project be determined periodically rather than to make it an inflexible ten-year project. ✓

DR. POMERANZ: I don't want to talk too much, so I will say this, and then stop. My contact with fluorine has been quite casual. Could we get, for instance, for our reference a list of books to read or articles to read, and then perhaps at a subsequent meeting I may be able, speaking for myself, to be more intelligent in my thinking upon the approach to this.

DR. AST: I would be very glad to make that available to you and to the other members of the Committee.

DR. ROGERS: Would it be possible to let us have a copy of that material you read from, Dr. Dean, as well?

DR. DEAN: I would be very glad to take that up with the Surgeon-General.

DR. ROGERS: It is important information, and it is the only place that it is available.

DR. DEAN: I don't think we ought to talk about this lens business. I think we ought to keep it to ourselves until we get a chance to thoroughly check it on a large number of people.

DR. ROGERS: Even then I am wondering what the position of the State of New York will be with regard to individuals involved. Let us say that this thing does prove to be a

cataract former, and we decide to abandon the study, which I hope will not occur, and which I rather doubt, but nevertheless if such is the case the State of New York I am afraid is going to find itself liable for all the cataracts that develop in that city for some time whether justifiably or not if the thing gets much of any publicity. It is one of those little things the State of New York has got to be worried about. I am not worrying this Committee with it. That will have to be referred to other quarters for decision.

DR. DEAN: I think that should be considered quite confidentially until such time as a large sized control group is run.

CHAIRMAN HODGE: I would like to emphasize that this is not a committee entrusted with the safety of the health of the nation exactly, but a committee for making a study and reporting thereon. Such a finding, as you say, must have very careful verification, so I think we should be very guarded, each of us, to see to it that we respect Dr. Dean's courtesy in bringing this material from the files of the United States Public Health Service to our attention. It certainly is invaluable to us, and we ought to be very particular to see it goes no further.

I heard a little bit about this some time ago, and I have been very curious about it. It is really unique information that he has imparted. There just is not anything like it available elsewhere, so we are not only respecting Dr. Dean but

we are also respecting quite a few of his colleagues who have done a tremendous job in making such a painstaking and wide study, in keeping this confidential for the time being.

DR. JAY: I am wondering if Dr. Rogers has had an opinion from the Attorney-General in regard to the State's liability to suits due to change in water supply or the addition of any substance to the water?

DR. ROGERS: I don't know that it was worded that way, but, Dr. Ast, you could probably give us some information on that point.

DR. AST: We have asked for an opinion ^{from} (of) the Attorney-General, and I can give you now an informal version of what he said. The formal opinion is probably now on my desk in writing, though it had not been received up to Saturday. There is no legal barrier to the State Department of Health setting up a study such as we have planned here. There is no liability which may devolve later upon the state. The municipality assumes no obligation or special liability in this other than it must follow the directions specified by the State Department of Health in this study. The municipality cannot be held liable unless it can be shown that through negligence higher concentrations of fluorine or of sodium fluoride rather have been added to the water supply than have been specified. That is an informal opinion, and I am giving it to you as it came to me over the telephone. It will be confirmed in writing. It probably is in

writing now on my desk.

DR. CAFFEY: As a matter of interest, how safe is the dilution of water by fluoride? Is that a serious problem?

DR. AST: Mr. Cox, would you like to answer that question?

MR. COX: The apparatus that would feed the sodium fluoride was obviously specially selected for the purpose to provide the safeguard against negligence. The machine that we are contemplating getting would have a capacity between 1/2 lb. to 8 lb. approximately per hour, or in terms of doses and parts per million it would be approximately a little less than one part per million up to eight parts per million. In other words, if gross negligence occurred, the maximum dose for that very small period when it did occur would be eight parts per million. It is impossible to get a machine that would give you the flexibility of one to four that we require actually and not have a flexibility of one to eight, if you see my point. The details are this: that the rate of filtration is varied manually during the night hours when the consumption is less and a corresponding reduction would be made in the dose. If it did not make that reduction, the dose could be through negligence eight times more during the few hours. That is speaking of it from the standpoint of equipment. With a trained chemist, and with men who are experienced through years of practice to change for the dosing of four other chemicals in accordance with changes in the demand for water, we don't

anticipate that we should have any difficulty in making this change correspondingly as well.

DR. AST: May I add to that that one of the points considered in selecting ^{for} the study ^{area the City} of Newburgh was the fact that it has an excellent water filtration plant and a highly trained operator in that plant?

CHAIRMAN HODGE: I believe I will call for a vote on the motion at this time, and we can discuss then matters that arise from the decision on the motion. You have heard the motion. I don't think I can repeat it word for word, but the general idea is that this Committee goes on record as favoring this project, with adequate safeguards, and with periodic review as to its modification or continuance. Is that a proper statement of your motion?

DR. LEVINE: Yes.

CHAIRMAN HODGE: Do you accept that version?

DR. LEVINE: Yes, it is better put than I stated it.

CHAIRMAN HODGE: If you are ready for the question, I will put it. If there is no further discussion, I will call for the vote. All those in favor will please say "Aye"; those opposed, "No."

... There were no dissenting votes ...

CHAIRMAN HODGE: I would like to add one word. Dr. Treadley Dean is not I believe a member of this Committee?

DR. DEAN: That is right.

CHAIRMAN HODGE: I think, Dr. Dean, we all tend to accept the reservations that you have brought up on this project. I believe I can speak for all of us when I say we are very much interested, and even though you did not vote the remarks you have made constitute a strong minority expression.

DR. DEAN: That is quite right.

DR. LEVINE: May I ask whether it would be possible to have Dr. Dean effect arrangements whereby it will be possible for him to attend all meetings of the Advisory Committee because his advice is invaluable, and we may change our minds very quickly at any statement he may make in the future.

CHAIRMAN HODGE: I don't know just to what lengths we might go in order to bring that about.

It seems to me now that the matter we all must attend to is the matter of safeguards. We have had quite a number of them suggested this afternoon. The question has been raised repeatedly as to what constitutes an adequate means of the early identification of intoxication. Do you think that that is a suitable matter for discussion now?

DR. LEVINE: This is purely an informal suggestion and is not in the form of a motion. In so far as children are concerned I believe a general pediatric examination should be given periodically, every three months preferably, and every six months if that should not be found to be possible, in other words,

if a three-month interval is not feasible; two, that in addition to the general medical examination periodic blood counts, complete counts, be run; three, that included in the medical examination vision and hearing tests be performed; fourth, the dental examination of course is included, the x-rays of the bones are included, and if possible -- and I don't know whether it is possible or not -- the eye examinations include slit ^{lamp} (lens) studies and occasionally blood marrow smears to be done, if possible. In so far as adults are concerned I think there ought to be safeguards there too. In addition to the general examination there should also be possibly visual testing, urine examination, x-ray of bones, and history of fractures, as well as hearing tests, and in the medical examination of course inspection of the nails would play a big role. Also, if possible, records should be available to the Committee at intervals of six months or a year regarding these examinations.

DR. ROGERS: How big a sample would you suggest be used? There are 3,000 children roughly?

DR. AST: About 3200 between the ages of 5 and 12.

DR. ROGERS: We would have to go down to the younger ones as well, of course.

DR. LEVINE: How many are there in the younger group, do you know?

DR. AST: I don't know that.

DR. ROGERS: That would be about 2500 I suppose.

DR. AST: Miss Sheerar, could you estimate that in a population of about 32,000 or 35,000?

MISS SHEERAR: I am afraid I cannot make too sound an estimation, but I should say that 2500 would be high and 2000 would be a safer estimate.

DR. AST: That is up to age 5.

MISS SHEERAR: Yes, I think that would be the safer estimate of the two.

DR. CAFFEY: The ideal way would be to take a small group and make a longitudinal study using the same children rather than a composite study involving many people.

DR. BAIN: Your sample has to be fairly large because you are going to lose as you go along.

CHAIRMAN HODGE: This is a subject that Dr. Dean has investigated exhaustively.

DR. DEAN: By shoe leather methods, house-to-house.

CHAIRMAN HODGE: How large a sample do you think would be minimal?

DR. DEAN: You will probably lose 65 per cent of your original sample in ten years.

CHAIRMAN HODGE: What constitutes a statistical sample?

MISS SHEERAR: Those things are conditioned by what you are looking for as well as pulling a number out of a hat. Since that is difficult at this point to say exactly what we

would expect to find, should we find anything, I don't feel that I am competent to say from statistics themselves how large the sample should be.

DR. ROGERS: It would seem to me we would require a certain number of children that had been in the study area continuously, and while it would be desirable to have the same children to study the cumulative toxic effects as well as the dental effects I cannot see any reason why they must be the same children.

DR. CAFFEY: The blood findings vary in children so much that I think it is basic that you do longitudinal studies on the same children, if possible, because there is such a wide variation in hemoglobin in a group of children.

DR. LEVINE: I agree. Even in gross matters like height and weight, a longitudinal study is preferable.

DR. CAFFEY: I would certainly prefer it.

DR. LEVINE: I think it would be desirable if you could have a combination of a larger cross-sectional study and have an intensive longitudinal study. I don't know what personnel is available.

DR. AST: I think that is important.

DR. LEVINE: I would think that as many safeguards as possible are indispensable in the first year or two of the study, after which a lot of the excess baggage might be overthrown later on. To start with every conceivable safeguard

should be employed, and I would think that a combination of a longitudinal study of a fairly small sample in the control as well as in the test area and a larger cross-sectional sample in both areas would be ideal if it could be arranged.

DR. AST: Dr. Dean, if I am not mistaken have not all the studies on mottled enamel or the dental caries fluorine studies been confined to those who have been continuously exposed to fluorine throughout their lives?

DR. DEAN: Yes.

DR. AST: No studies have been made of those who had had any discontinuity of exposure?

DR. DEAN: Not to amount to anything, because you would not know what to pin down on after you got through.

DR. AST: If we were to take the entire 5 to 12 year old population for dental examination, regardless of the time of exposure, we may get some information as to whether or not it is necessary to be continuously exposed to fluorine in order to get the benefit of the sodium fluoride. We will have some who will have been exposed three years, or four years, or five years, and the differences or lack of difference may give us some worth while information.

DR. LEVINE: I think Dr. Caffey had in mind the younger age group for the longitudinal studies.

DR. CAFFEY: The ten-year studies, if you had 50 children really well studied, that is a large group. Most of the

mass studies are so bad when you get into them they are not worth anything.

DR. LEVINE: Isn't it true -- and Dr. Dean will agree with me on this I think, though I don't know -- that the evidence is definite that fluorine or water containing fluorine does reduce the incidence of dental caries?

DR. DEAN: Yes.

DR. LEVINE: That is acceptable?

DR. DEAN: Between, say, 1.2 and 1.5, It is a difference of about three to one when compared to fluorine-free water.

DR. LEVINE: It seems to me that our problem here as a Committee is to be sure that the toxic effects do not overcome the advantages.

DR. CAFFEY: Is the caries index available for both Newburgh and Kingston?

DR. AST: Careful studies have not been made, but they will be made prior to the introduction of sodium fluoride. That will be done in both communities.

CHAIRMAN HODGE: It is perhaps tacitly understood, but I would like to bring it out and say it. By sad experience I know that it is very important to have as good a pre-examination as any of the examinations during the course of the experiment.

DR. AST: As we have said, no date has been fixed for the introduction of the sodium fluoride into the water supply.

That can be held up until this Committee feels that we have made the necessary examinations on which to base our final results for comparative purposes.

CHAIRMAN HODGE: Would it be in order to suggest this sort of procedure: From now on suppose that we furnish to whoever wishes it bibliographies, or reprints, or photostats, or whatever is necessary to get reading matter into the hands of the Committee; arrange for small groups to confer. For example, Dr. Caffey and Dr. Pomeranz, perhaps would like to confer on the subject of roentgenology, and perhaps they would like to take into their confidence somebody else; Dr. Levine and Dr. Bain might like to arrange a session between themselves or with some other people, in which the pediatric studies would be discussed, after seeing some of the findings in animals and in humans other than what they have had access to at the present time. The minutes of this meeting should be sent around to each of us, and we should make our comments to you, Dr. Ast, in writing, and reconvene with specific safeguards that all of us can think up in the meantime to consider in detail exactly what our continued opinion is going to be. Would you favor that suggestion?

DR. AST: Indeed I would.

CHAIRMAN HODGE: Is that a sound proposition that is going to be workable?

DR. LEVINE: May I ask whether you would be willing to insert an intermediate step: that after the small conclaves are

held that Dr. Ast or the State Department of Health submit prior to the next meeting a detailed outline of the project so that it will be in the hands of the Committee an appreciable period before the meeting in order that we can discuss the program intelligently.

CHAIRMAN HODGE: And perhaps we could even arrange that the results of the deliberations of the small groups could be conveyed to Dr. Ast, and through him back to the Committee as a whole so we would meet all informed as to the ideas of each person.

DR. LEVINE: Might we not add small groups on the pharmacology of fluorine and on the adult aspects of it because apparently there are some potential hazards for the older age groups?

DR. ROGERS: Should we add an ophthalmologist to the Committee?

DR. CAFFEY: I think it is very desirable to have ^{slit lamp} (slight lens) examinations, and an expert ophthalmologist might formulate a more satisfactory eye examination.

CHAIRMAN HODGE: I wonder if it would not be a good idea to add not only an ophthalmologist but perhaps a good internist with general training.

DR. BAIN: With some special training in hematology. He could cover both fields.

DR. LEVINE: May I move that an ophthalmologist

and an internist with a special knowledge of hematology be added to the Committee?

DR. CAFFEY: I second that.

... There being no discussion, the motion was put to a vote, and was unanimously carried ...

DR. AST: May I ask whether this Committee feels that we ought to hold up our dental examinations until we meet again? I have in mind the fact that we will have to get our dental examinations in during the school year. We are in a position to go ahead with those dental examinations almost immediately and get the caries index before the end of this school year. If the Committee does not object, we will proceed along those lines.

DR. GIES: With all attention to the maximum of safeguards.

DR. JAY: Will you be set up to do your bacteriology before school closes?

DR. AST: I think that will be determined by our conference after this meeting when we get you in a corner and find out what we want to do.

CHAIRMAN HODGE: It could be done at the same time the dental examinations are done most conveniently.

Is there anything further that should come up at this time?

DR. ROGERS: We appreciate the attendance of this

Committee. I think it shows the earmarks of being exactly the kind of committee we want. I am deeply gratified at the manner in which you have approached the program.

DR. DEAN: There is one little point that I might bring up when you gentlemen are thinking of your examinations: "The study of bony development as judged by epiphyseal closure in the wrist correlated with age showed no difference in the younger ages at Bartlett and Cameron." That is 8 parts per million as against .4. I think we ought to keep this thing separate. It may be the younger age can handle this fluorine, and that we start getting accumulating effects past middle age. I thought you folks would be interested in that information.

DR. ROGERS: Couldn't some studies on the older people on the intake and output be done rather promptly, or would it be too hard to do?

DR. DEAN: Not if you have some comfortable shoes and can go out and punch door bells.

DR. ROGERS: I meant in a hospital group of some kind. How long do you have to take to set up a study of the possible retention on a chemical basis?

DR. DEAN: I don't know. I would make a broad screening on urinary fluorine after the thing is introduced.

DR. ROGERS: We would not be able to know the intake exactly?

DR. DEAN: No, but you can figure about .3 to .5

milligrams per day from the food, and then you can estimate from the water.

DR. ROGERS: The thing I had in mind was the possibility that there was a greater retention in the older people, and if you are doing it on an approximation basis you would miss a fine amount of retention that might become significant over a period of time. Where it has been shown in these experiments that there was no retention in groups getting as low a quantity as 1 part per million in the community water supply, and that apparently the output equalled the intake, how well was it done?

DR. DEAN: We don't know much about these older age groups.

DR. LEVINE: How difficult is the determination of the fluorine intake and output? Is it a technically difficult procedure?

DR. DEAN: What is it: 80 per cent in the urine, 10 per cent in the feces, and about 10 per cent in the perspiration?

DR. AST: It is quite difficult, as I think Mr. Gilcreas can attest to that.

MR. GILCREAS: It is a micrometric method. We are not too expert at it with what little we have done. It is not easy. It is not as easy, for example, as titration but requires some skill and some experience.

CHAIRMAN HODGE: I have heard the comment made from an experienced man that it is one of the most difficult procedures

he has encountered.

MR. GILCREAS: We have tried to do it ourselves from the literature, and my conclusions were exactly the same as yours, that it was the toughest thing we have attempted yet. It is not easy in water, but it is a much simpler problem to lick the determination of sodium fluoride in water than it is in organic material. The question of digestion is the place where we stubbed our toe.

We have undertaken, as time permits, a survey of the water supplies in the state, both ground and surface, to get a picture of what the fluoride distribution is in the water supplies of the state. We have some nitrates in some of our ground waters, very high chlorides and very high nitrates, especially up near your part of the state, Dr. Hodge. We have run into the difficulty there that we have not been able to get what we consider a satisfactory determination of fluoride where we have a high nitrate.

DR. DEAN: Dr. McClure is doing the urine work for us there instead of Elbow. He has just completed fluorine urine examinations on 1800 or 1900 people in pooled samples about 15 to 20 individuals per sample.

MR. GILCREAS: You pooled the urine from 15 to 18 in the one sample?

DR. DEAN: Yes, and then grab 10 or 15 pooled samples at one place, and the whole thing aggregates about 1800 or 1900

individuals.

CHAIRMAN HODGE: Was there any further discussion that should come up at this time?

... There was no response ...

CHAIRMAN HODGE: If not, I will declare the meeting adjourned.

... The meeting adjourned at 4:15 o'clock, p.m. ...
