

make these figures that are now questioned, whether they are good enough even to rely on? Who made the charts and how were they collected?

Dr. WEINBERGER. I would want to comment on that.

Mr. DADDARIO. I think you should.

Dr. WEINBERGER. It is one point that I think is quite important that again we indicate.

The work in developing the cause-effect relationship has been pursued for many years. There are two Federal laboratories that were authorized by the Congress in 1962 specifically for the purpose of carrying out the necessary research to determine water-quality requirements.

One of these laboratories is at Duluth and the other is at Narragansett in Rhode Island. Both of these laboratories will be developing increased information on these cause-and-effect relationships. The information that is available, Mr. Fulton, is information which has been carried out in our laboratories, laboratories of other Federal agencies, State agencies, universities, by competent scientists all over the country and, indeed, all over the world.

This information is, if you will, summarized in the report of this national advisory committee. The technical information has been accumulated in laboratories all over this country, in Federal laboratories, university laboratories, industrial laboratories, on the basis of field and laboratory studies.

Mr. FULTON. Are they narrow or broad figures? Are they figures with a history or are they just current figures?

Dr. WEINBERGER. Some of them are figures with a history.

Mr. FULTON. I wish you would put a statement in the record on that.

Dr. WEINBERGER. I would be happy to do that.

(The information requested is as follows:)

The use of charts 2 and 3 was meant to serve the purpose of illustrating concepts rather than to convey any types of precise quantitative relationships.

Figure 2 refers to a relationship between the concentration of a pollutant and the time of exposure of that pollutant to the water use. Degrees of damage or effect upon the water use produce a family of curves. For certain pollutants these effects are fairly well known and such a curve could be delineated with accuracy. Figures 2A and 2B are examples of the bases for these curves. For most pollutants, however, these cause and effect relationships are not well understood and a great deal of the further work must be done. This is true especially when two or more pollutants act together and the result produces a synergistic or antagonistic effect. Also, a pollutant exhibits varying effects in water of different physical and chemical characteristics. The relationship shown in Figure 2 could be more accurately presented as bands rather than as distinct lines. Here again, the qualitative concept and not a quantitative relationship is implied.

Shown in Figure 3 is an attempt to demonstrate the conceptual relationship between cost and removal effectiveness. The intent of the chart is to convey qualitative and not quantitative information although quantitative information is certainly readily available for certain pollutants, e.g. organic matter, phosphates, inorganic matter, color, etc. Examples of these BOD and COD removal are illustrated in Figures 3A and 3B. The concept is that in order to achieve lower and lower final concentrations, greater and greater costs are required for each unit of concentration removed. Treatment costs are also dependent upon the initial pollutant concentration in the untreated water, thereby producing a family of curves as shown.