application in terms of date and in terms of stage of growth of the weeds.

e. If treated water may be used for irrigation, then tests must be made on the highest concentration of the product in water which will not cause injury to crops or desirable vegetation. This level is to be considered as the highest at which the treated water may be used for irrigation.

f. Tests must be made in *in-use* situations to establish the concentrations of the product in water as a result of application as proposed, and the decline of that concentration with time and/or distance of flow. It must be shown that the use of treated water can be controlled during the time and/or distance of flow needed for the concentration of the product in the treated water to decline to non-phytotoxic levels. Appropriate statistical analyses of the data and development of depletion curves are essential.

SUMMARY AND CONCLUSIONS

There may be other tests required before the product is registered. After the product is registered, it may be marketed in interstate commerce. Of course, the buyer must comply with the various state laws.

The present federal pesticide act does not regulate the actual use of the product. It is expected that the user will comply with the directions. EPA does investigate accidents or incidents involving pesticides. If our investigation or investigations find that there are abuses to the environment by the product, it is possible to suspend or propose the cancellation of the registration of the product.

Briefly, we can say that it requires a great deal of effort to get a herbicide ready for sale. It is fairly easy to purchase the product. In order to assure the availability of the product for continual use, the label should be read and the product used strictly in accordance with the directions.

Pesticides In The Aquatic Environment, 1972

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INTRODUCTION

This organization (Hyacinth Control Society) exercises a major impact on the total ecology of Florida. This presentation is directed toward your action and the impact on man. One million people drinking surface water are oblivious to the magnitude of chemicals which are intentionally and indirectly added to their drinking water. This fact coupled with the lack of a program of State surveillance of residues of herbicides or any other agricultural chemicals in Florida waters are the two points to be discussed. We will consider families of poisonous chemicals under the heading "Economic Poisons." Unlike chemicals which may be added in processing foods, these economic poisons are used and are effective in their proposed uses because they are poisonous to the insect or organism which adversely affects the production of food, feed, or fish. The margin of safety between the recommended effective use level and the level which may be harmful to man or his beneficial animals and plants is, in some cases, small. Our consideration will be focused on surveillance activities in Florida. This is an important part of the total effort for environmental management for mankind.

DISCUSSION

The key to any intelligent or responsible control program must be the availability of tools needed to do the job. To apply herbicides, one must have a delivery system. Whether this be a hand pack sprayer, an outfitted air boat, or a crop dusting plane or helicopter makes no difference, except one of degree. The continued use of pesticide chemicals in the environment of mankind must be based on the application of the analytical surveillance of residues which result from the intentional use of pesticides. Incidentally, the unintentional or indirect residues which occur in the environment are also an important consideration. In the 1960's, these "indirect food additive" situations were the subject of at least two National Academy of Science studies. While those deliberations dealt primarily with the chlorinated hydrocarbon or persistent chemicals, other agricultural chemicals, in their degradation, leave breakdown products which in turn must be considered as to their potential hazard to man and his environment.

Turning our attention to the analysis of water for pesticide residues, let us look at some of the surface water sources in Florida. In the beginning, the analytical service capability and support came from the Communicable Disease Laboratory pesticides facility, Atlanta. It was subsequently moved to Athens, Georgia. Carbon Chloroform Extract (CCE) analyses were provided as far back as 1962 and continued through 1971. The new analytical sensitivity to organic chemicals brought by the gas chromatograph had been applied to smaller sample sizes by 1963. Sophistication in the use of this and other analytical tools has made it possible to detect small amounts of contaminants in water.

At this time, the Tampa water plant and the Brevard

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County Health Department Laboratory have operational gas chromatograph equipment. The Tampa laboratory, set up for (2,4-dichlorophenoxy) acetic acid (2,4-D) analysis in 1967, was the pioneer in Florida.

The Winter Haven laboratory, now under the Department of Pollution Control, began to gear up for pesticide analysis capability in 1968.

To illustrate what has been done in Florida, let us review a few of the pesticide surveillance programs which have been carried out in the State. Three major surface water resource areas are discussed here.

CALOOSAHATCHEE RIVER (Lee County Water Supply)

The possibility of this river being used as a source of public water supply prompted the Florida State Division of Health to obtain reference background data as to pesticide content or absence. Sampling was done at Olga Dam site upstream from Fort Myers in 1962. In 1965, CCE values on the Caloosahatchee River were reported as 0.325 to 0.397 ppm. The recommended limit is 0.200 ppm. No pesticide was identified at that time and place. In 1966, the Corps of Engineers considered using 2,4-D to correct an aquatic weed problem. This chemical was not applied due to the use of the Caloosahatchee as a drinking water supply source.

In March of 1968, at the request of State House Representative Ted Randell, a sampling program was started on the Fort Myers watershed. The allegation proposed that the farm area run-off was contaminating the surface water supply source, i.e. upstream from the dam at Olga. The immediate fear of interested parties was related to the possible 1,1,1-trichloro-2,2-bis (*p*-chlorophenyl) ethane (DDT) levels in water. Sampling stations were selected from Moore Haven, at Lake Okeechobee and downstream to Fort Myers. The unpublished report revealed that nine samples of finished water contained the following economic poisons at the levels indicated: 2,4-D and O,O-diethyl O-*p*-nitrophenyl phosphorothioate (parathion) at greater than 0.1 ppb and DDT, 1,1-dichloro-2-2-bis (*p*-chlorophenyl)ethane (DDD or TDE), 2,2-bis (*p*-methoxyphenyl)-1,1,1-trichloroethane (methoxychlor), 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4 endo-exo-5,8-dimethanonaphthalene (aldrin) and 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo endo 5-8-dimethanonaphthalene (endrin) at less than 0.1 ppb.

HILLSBOROUGH RIVER (Tampa Water Supply)

In Hillsborough County there has been a continuing effort to tie down patterns of contribution of economic poisons to the surface supply which could result from such activities as dairying, citrus groves, and truck farming. The sampling sites were selected in December, 1964. A concerted sampling and analysis program started in 1965. Six sampling points were used. In 1965 and 1966 specific chemicals were identified from the CCE. These ranged from 0.04 ppb of benzene hexachloride (BHC) to 0.6 ppm of organic phosphorus compounds in raw water samples. The latter value is six times greater than the allowable level for drinking water. One finished water sample was determined to contain 0.01 ppb of BHC in 1966. All of this laboratory support was provided by Federal Water Quality Laboratory in Georgia. As a result of the proposed use of the herbicide 2,4-D in the Hillsborough River (1966), the interested parties in Tampa provided the Tampa water plant with the necessary equipment to test for this chemical in their water supply. In 1967, the laboratory had become operational. With the exception of one sample from the Blackwater Creek sampling station in 1968, all water samples analyzed revealed "no" detectable residues.[2]

As of 1972, the personnel at the Tampa water plant are continuing the surveillance for pesticide chemicals in their raw and finished water. Their detection limit for 2,4-D is 0.001 ppm. The proposed limit, as seen in Table I, is 100 ppb (or 0.1 ppm). The highest value detected at the Tampa plant was 0.359 ppm in March, 1972. Their sampling program is scheduled in cooperation with the local spray teams. Thus sampling follows the scheduled application 2,4-D. No chlorinated hydrocarbons or organic phosphorus compounds were detected in the last 2 years which would be considered near the allowable limit.

CLEAR LAKE AND LAKE MANGONIA (West Palm Beach Supply)

Another surface water supply reaching out from our largest freshwater lake is that for West Palm Beach. In cooperation with the Southeast Water Laboratory, a pesticide surveillance program was in operation for the years 1962 to 1964. CCE's were determined and the extract was analyzed for pesticides. The CCE values exceeded the

[2] Anon., August 12, 1969, Pesticide Surveillance of Hillsborough River 1965-1968, Division of Health, Bureau of Sanitary Engineering, Water Supply Section, Memorandum.

TABLE I. PUBLIC WATER SUPPLIES RAW WATER QUALITY

Chemical[a]	Maximum permissible concentration (ppm)[b]
Endrin	0.001
Chlordane	0.003
Toxaphene	0.005
Aldrin Dieldrin	0.017
Heptachlor Heptachlor Epoxide	0.018
Methoxychlor	0.035
DDT	0.042
Lindane	0.056
Total Organic Phosphorus and Carbamate Compounds[c]	0.100
Silvex (2,4,5-TP), 2,4,5-T or 2,4-D (individual or combined)[d]	0.100

[a] Chemical names not mentioned in the text are: Mixture of 60% octachloro-4,7-methanotetrahydroindane and 40% related compounds (chlordane); chlorinated camphene with 67-69% chlorine (toxaphene); 1,2,3,4,5,6-hexachloro cyclohexane containing at least 99% gamma isomer (lindane); (2,4,5-trichlorophenoxy)propionic acid (silvex) or (2,4,5-TP); (2,4,5-trichlorophenoxy)acetic acid (2,4,5-T).

[b] For long term exposure.

[c] Expressed in terms of parathion equivalent cholinesterase inhibition.

[d] Short period limit only: 2 to 3 days, no more than once or twice a year.

standards for raw water and most finished water sampling points i.e. the 0.2 ppm level. Now as to the specific pesticides, positive values were reported at at least one sampling point for each of the years tests were conducted. The last detectable residue in finished water was in May, 1963. The overall picture of pesticide residues reported in this area is as follows: chlorinated hydrocarbons, undetectable by analytical methods sensitive to 0.1 ppb as lindane; and for organic phosphorus compounds, reported as parathion, these were present at a detection level of 0.045 ppb. This is well below the allowable level for this class of compound in water. In 1969 and 1970, pesticides of the chlorinated hydrocarbon class were detected in finished water at levels up to 0.002 ppm. Surveillance of this supply is continuing from 1971 through a contract with a private laboratory to do monthly screening tests on raw and finished water.

SUMMARY AND CONCLUSION

Table 1 shows the present allowable limits for specific economic poisons in water. At this time we have a statewide support capability of three operational laboratories directing their efforts to potable water supplies: Brevard County Health Department, Tampa Water Plant, and Department of Pollution Control (Winter Haven).

To clarify the status of "pesticide" chemicals in the State of Florida, as of the date of this presentation, there is only one which has an allowable level in potable water. That chemical is copper. The current recommended maximum limit, as set by the Drinking Water Standards, is 1.0 ppm.

With reference to other products, you can check those listed in the table. The general, yet unofficial, rule for Florida is that none of these levels shall be exceeded where any raw water sources are involved, and suitable analytical techniques must be available for the detection of the stated residue levels in that water. There must also be a referee laboratory engaged or participating in any intentional addition of chemicals to a water supply source.

A product must be registered with both the Federal and State Regulatory Offices. The Department of Natural Resources has the assigned responsibility for the application of herbicides under the Florida Aquatic Weed Control Act of 1970. They have published a booklet "Guidelines for Aquatic Weed Control" (January, 1972) which presents established procedures or policies in areas of aquatic weed control.

In conclusion, the impact of pesticide chemicals in our potable water supply is expected to be one of chronic and low level exposure over a period of many years. Acute poisoning cases in man are not probable as a result of drinking water from a public water supply system receiving either intentional or indirect residue levels of economic poisons. This is especially true when the commercial product is used as directed. Hence, we are faced with a nonspectacular threat which the man on the street neither feels nor understands. It is even hard for us in the business to get too excited over things we cannot see, smell, or feel and therefore tend to forget them or put them aside until they cause us trouble. We must not allow these common tendencies to result in the failure to provide routine surveillance of residue levels of toxic chemicals in the water we drink. In conclusion, all of us who drink water have a personal interest and should support necessary control and surveillance programs. Water is essential to our life and health. Let us protect it!

Aquatic Plant Problems in the Walla Walla District

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ABSTRACT

The Walla Walla District, Corps of Engineers, maintains some 21 miles of drainage ditches behind the Tri-City Levees (Kennewick-Pasco-Richland, Washington) of Lake Wallula. The ditches drain water from both residential and farming lands. Drainage water is discharged into the Columbia River, which supports an important anadromous fishery. The resulting aquatic weed problem prompted the Corps to initiate a program to find a chemical which would control the aquatic weeds and still be compatible with fish life. Treatment with 6,7-dihydrodipyrido (1,2-*a*:2′,1′-c)-pyrazinediium dibromide (diquat) was found to be satisfactory for the conditions present. Diquat was used at the rate of 1.0 gal./cfs for a 20-min exposure. This was equivalent to 26 ppm of chemical.

INTRODUCTION

With the completion of McNary Dam in 1954 and the raising of the McNary pool, it was necessary to construct some 21 miles of drainage ditches in the Tri-City area to