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WASTEWATER TREATMENT AND DISPOSAL SYSTEM

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I have been asked to describe the Districts' operations, indicate some of the things we know or don't know about our system's effect upon the ocean and describe some of the programs we are involved in to evaluate what is happening to the environment as a result of our waste discharges.

Figure 1 is a map of the Sanitation Districts of Los Angeles County. These colored areas are the districts. We serve some 4 million people in some 71 incorporated cities and considerable unincorporated territory, but we do not include the City of Los Angeles, which has its own treatment plant and outfall system at Hyperion.

Our major system, the area on the southern and eastern portion of Los Angeles County, includes 15 sanitation districts, united into a single treatment system. This system has a large primary treatment facility called the Joint Water Pollution Control Plant and it has a number of upstream plants. We are in the process now of expanding our system in the upstream area. The joint plant has a present capacity of 450 million gallons per day and a present flow of 380 million gallons per day. It is planned that this plant will remain at that capacity over the next 40 years, and all additional flow or increase in capacity will be accomplished by providing secondary treatment at 4 major inland treatment plants.

Some of the water from these plants is currently reused and more will be in the future. Water that is not reused is discharged to the lined portion of the San Gabriel River and passed out to the ocean through the San Gabriel River estuary.

Figure 2 shows an aerial view of the Joint Water Pollution Control Plant. The major components are primary sedimentation tanks. This is the form of treatment where you use gravity separation of heavy materials and light materials, both of which are removed from the flow. About 50% of the suspended materials are removed from the flow and fed into anaerobic digesters which are located toward the back of the picture. The anaerobic digestion process is designed to biologically and anaerobically decompose approximately 50% of the organic matter which enters the digesters; the heavy materials which remain in the digested sludge are separated from the smaller, lighter fraction by means of a centrifuge and converted to fertilizer. Only about 40% of the solids are converted to fertilizer—the remainder, a fine material which will pass a 200 mesh screen, remains in the centrate and is reconstituted with the primary effluent and discharged to the ocean. The combined discharge from our present system has an average suspended solids concentration of about 325 mg per liter, and an average BOD of about 275 mg per liter. These values are above the limits which were established on September 23, 1970, by the Regional Water Quality Control Board and we are in the process of designing additional sedimentation tanks and in an extensive research program to do something different with the centrate solids so that they will no longer be discharged to the ocean at all. We are in full swing on the studies to accomplish this but it is still going to require some time to make this fairly major change in our treatment process.

Historically speaking, the development of waste treatment for this plant was begun in the late 20's—some 40 years ago. The original purpose of waste treatment was to protect the public health. We feel we have been fairly successful at that. Later on there was a concern about esthetics and we feel we are doing reasonably well there. However, in the area of the protection of the environment, which is a relatively recent concern in the waste treatment field, we all have a lot to do to determine what needs to be done and how we can accomplish it most satisfactorily.

After the treatment plant, the flow passes through two 8 mile tunnels under the Palos Verdes hills and into the outfall system at Whites Point (Figure 3). We have 4 outfalls—the smallest one (60″ in diameter and built about 1935) and the 72″ diameter outfall (built about 1945) are no longer in use, because they are both too shallow. We have two outfalls in operation. One is a 90″ diameter outfall with 2400 feet of 60″ diffuser on the end. The last outfall, put into service about 1965, is 120″ in diameter at its start, dropping to 72″ at the end and has about 4,000 feet of diffuser length. In the diffuser, 3″ ports every 12 to 24 feet distribute the wastewater into a large volume of sea water. In a sense, these progressions represent our increased knowledge as to what is happening in the environment and how we can better engineer the utilization of that corner of the ocean.

Figure 4 shows what we are discharging through. This is the transition from the 102″ to the 72″ portion of the 4th outfall. In the side of the pipe two 3″ ports are visible about 12 feet apart. These are now at a depth of approximately 200 feet.

We are monitoring, and have monitored for many years, the ocean in the vicinity of the outfalls. Historically, most of our monitoring has been on the physical characteristics making depth profiles, temperature, currents, bacteriological studies and things like that. Here is a limited summary of some of the data developed over the years.

We have two relatively distinct periods with variations in both. Looking at the summertime (Figure 5),

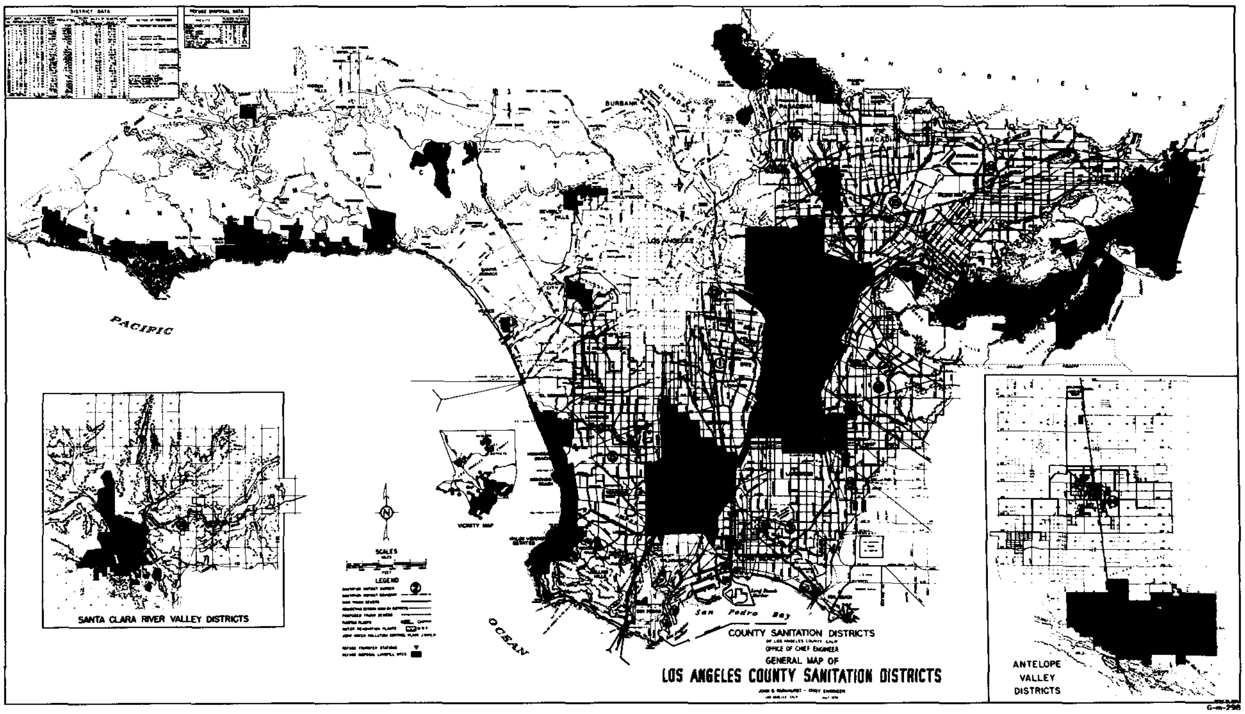

FIGURE 1. General map of Los Angeles County sanitation districts.

FIGURE 2. Aerial view of Joint Water Pollution Control Plant.

we see a temperature gradient from 70° F at the surface to about 52° F at 200 ft. with a well defined thermocline in the vicinity of about 50 feet. In the wintertime, the temperature profile is much straighter with a lower gradient and weaker thermocline. In the summertime and really for 9 months of the year, we have generally very optimal conditions for discharging a diffused wastewater into 200 foot depth. With these very small ports and long diffuser areas, we achieve mixing of about 1 part wastewater with 200 to 300 parts of the cold and denser bottom waters which results in a mixture having an intermediate density and a field that stays below the 50 foot level. Work still has to be done on the rate of dilution and diffusion that goes on beyond this point, as the field travels away with the currents and diffuses out into the ocean.

In the wintertime, with our presently designed outfall and with a temperature differential of only 3 to 4 degrees, we can accomplish our objective of keeping the field in a submerged level. However, if we have storms or other conditions which mix the entire water column then we have a surface field and at those times we have to chlorinate to protect the public health.

I would like to give you some other data. This is fairly recent data and therefore some of it is still questionable, both in terms of where we are sampling and as to whether it is truly accurate.

Figure 6 shows our best estimates of some of the heavy metals in our effluent. We just got the results of our first samples for mercury, which was run by an outside laboratory because we are still unable to run it, and found it to be about 0.006 ppm or milligrams per liter (mg/l). The other thing you will notice is that most of our heavy metals are in some sort of precipitate form. We believe most of them are in a precipitate with sulphide, the soluble portion is noted on the right. In addition to heavy metals, we believe we have about 6 mg/l of phenol, about 9 mg/l phosphorous, ammonia levels of about 50–70 mg/l, cyanide of 0.2 mg/l, and arsenic of 0.01 mg/l. We have also checked radioactivity for many years and it runs about 0.2×10^{-7} microcuries per ml. We have just recently begun toxicity studies with the assistance of Marineland, and determined an approximate 96-hour TLM of about 60% for killifish, which was frankly a lot higher than we thought it would be.

We have, for many years, been conducting a monitoring program on stations established by the Regional Water Quality Control Board. Figure 7 shows

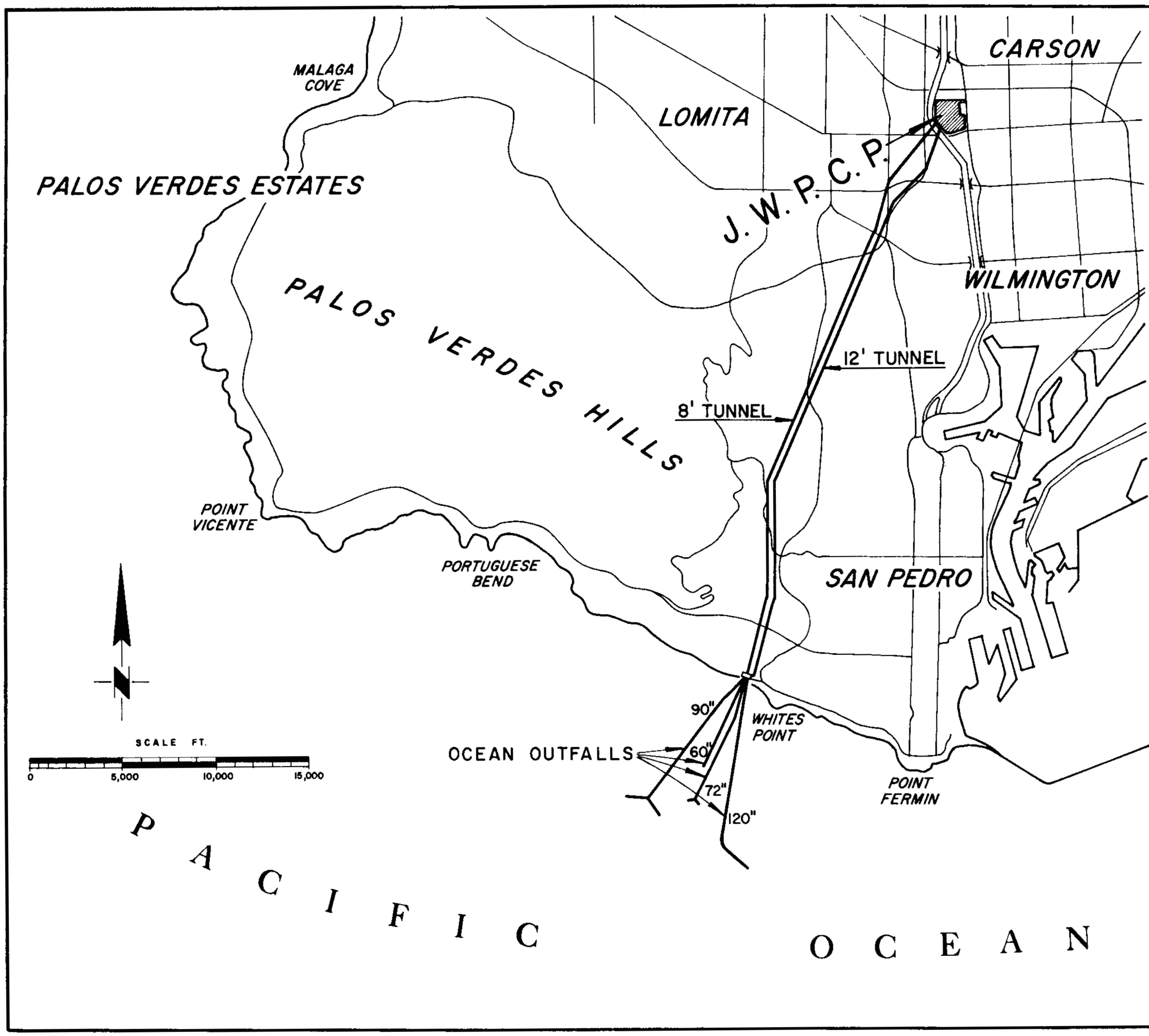

FIGURE 3. Tunnels through Palos Verdes into outfall system.

the outfall area and the dark dots represent the various sampling stations we occupy.

We have recently spent another \$200,000 to equip a boat to do the monitoring which we think is necessary particularly in the biological area where we have not been involved in the past. Figure 8 shows the SEA-S-DEE, our new marine research vessel. It is equipped with an articulating crane and davits for its various types of instrumentation packages.

Figure 9 summarizes the monitoring we are now conducting. These various programs are performed *weekly*. We measure these parameters at the various stations shown on the previous map. This is all in accordance with the requirements of the Water Quality Control Board. On a *monthly* basis (Figure 10) we take depth profiles of these same parameters including dissolved oxygen, temperature, grease and turbidity.

Semiannually, we get into some of the biological parameters with use of the otter trawl and scuba diving surveys to observe the sediments and count the fish found in the area (Figure 11). This program is just getting under way and therefore we are not prepared to report on the findings, but this information will be available as well as that of the Southern California Coastal Water Research Project.

I think what I would most like to say to you is that you represent a scientific community concentrating upon the marine environment and we look to you to tell us what to be concerned with in our waste. The pesticide DDT, for example, had never been analyzed for in our wastewater. It was generally believed that

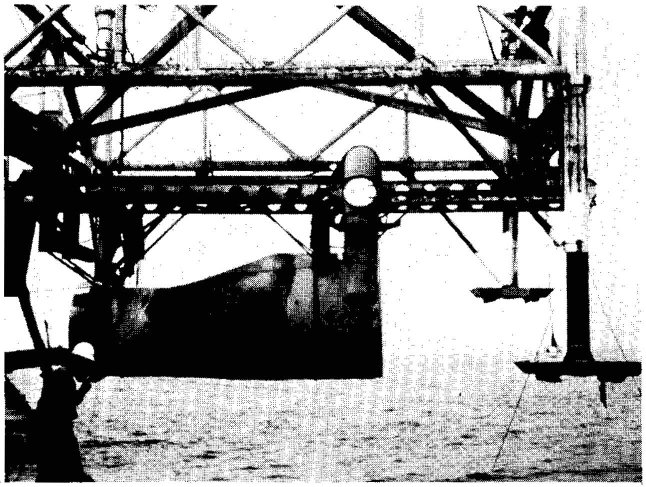

FIGURE 4. Discharge port being installed.

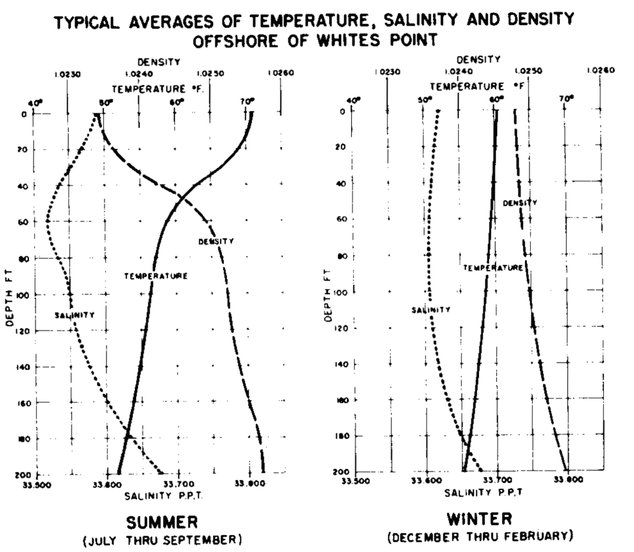

FIGURE 5. Typical averages of temperature, salinity and density, offshore of Whites Point.

most DDT was transmitted through the atmosphere and through fields where it was used in agriculture. Even analyses of other wastewaters indicated DDT levels were very low.

As a result of the findings of recent times we have analyzed now for DDT in our system and we have found it and have already succeeded in controlling at least 80% of it. We are seeking the other sources so that we can control them also. There are certainly other industrial waste materials of concern within our system since we take $\frac{2}{3}$ of the industrial waste of Los Angeles County. We have a community with practically every kind of industry and with many kinds of wastes. We know very little about the specifics of some of these wastes or their influence upon the environment. We need to have scientists determine what materials in the waste are detrimental to the environment so that we may either control them at the source, which we have the capability of doing and prevent them getting in, or, if they cannot be handled that way, treat them. But first we have to know what it is that is environmentally important. This is where we have to rely on you to a large degree, although we are also in the process of doing some work on our own and through the Southern California Coastal Water Research Project. We hope to find out what some of the negative effects of wastewater are on the environment.

JOINT WATER POLLUTION CONTROL PLANT
EFFLUENT HEAVY METAL CONCENTRATIONS

CONSTITUENT	TOTAL (mg/l)	SOLUBLE (mg/l)
CADMIUM	0.170	0.025
CHROMIUM	1.173	0.013
COPPER	0.898	0.040
NICKEL	0.218	0.116
ZINC	2.640	0.102
LEAD	0.320	0.001
MERCURY*	0.006	—

ALL DATA ARE AVERAGES OF MONTHLY SAMPLES FROM APRIL THRU OCTOBER 1970
*A SINGLE SAMPLE

FIGURE 6. Joint water pollution control plant effluent heavy metal concentrations.

I would like to emphasize that wastewater is not a single thing. It has many, many things in it and not everything in it is bad. In fact, there are some that believe, and I share this belief, that particularly the nutrient component of wastewater may provide a source of nutrient which would be essential to increasing the productivity of the ocean's desirable forms. We need to know more about how to utilize this potential for improved productivity and, again, this is an important area which we need your help on. I think if you were to decide you wanted to run a farm in the ocean, so to speak, and many people in your field have spoken of this, one of the first things that you would find you needed was a source of fertilizer or nutrient and there is probably no more economical or available source than wastewater. I think we need to be careful not to eliminate that source before we find out how to use it for our benefit.

Question: Regarding the DDT flap. The last data I saw was that you had cut your output about $\frac{1}{2}$—400–200 pounds per day.

Dryden: I would speculate it had been higher to begin with. I would say we are down in the vicinity of 100–200 lbs. per day now and we may have been, at one time, on the order of 600–800 lbs. per day. The problem is we began setting up for the DDT tests in the summer of 1969. We didn't even get our instrumentation set up to begin running anything until late last year and didn't begin to get any reliable data until spring and we can only speculate as to what had

LOCATION OF SANITATION DISTRICTS SAMPLING STATIONS

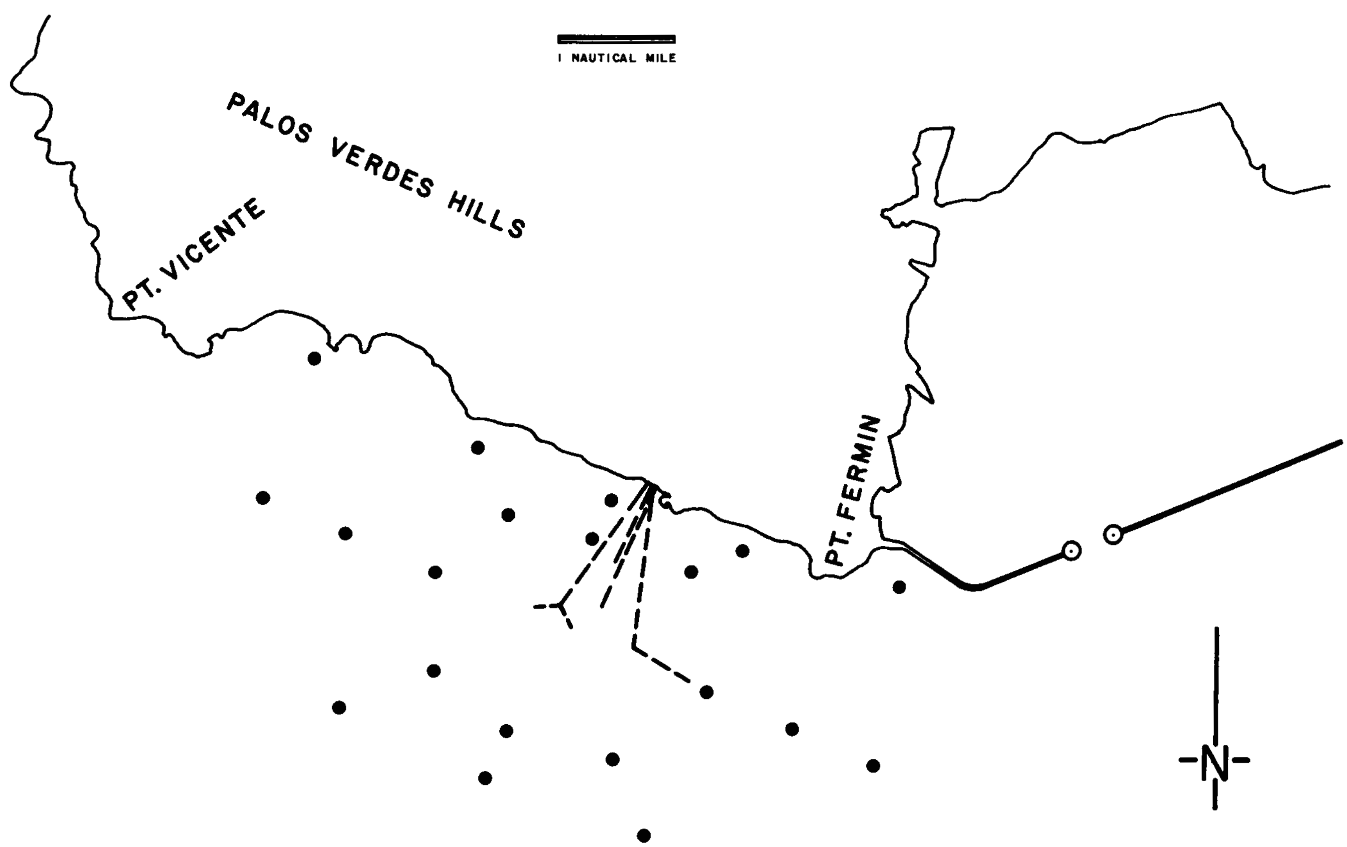

FIGURE 7. Location of sanitation districts sampling stations.

FIGURE 8. SEA-S-DEE

OFFSHORE MONITORING

WEEKLY

DISSOLVED OXYGEN

GREASE

TEMPERATURE

TRANSPARENCY (SECCHI DISK)

COLIFORM (MPN)

FIGURE 9. Offshore monitoring—weekly.

OFFSHORE MONITORING
MONTHLY

DEPTH PROFILES OF:
DISSOLVED OXYGEN
TEMPERATURE
GREASE
PERCENT TRANSMISSION OF LIGHT (TURBIDITY)

FIGURE 10. Offshore monitoring—monthly.

OFFSHORE MONITORING
SEMI-ANNUALLY

BOTTOM TRAWL
SCUBA DIVING STATIONS: MACROBENTHOS COUNT
BLUE LIGHT ENERGY
BOTTOM SEDIMENTS:
PERCENT ORGANICS BY NITROGEN ANALYSIS (SHIPEK SAMPLER)
BIOMASS (SHIPEK SAMPLER)
PHOTOGRAPHS OF CORES

FIGURE 11. Offshore monitoring—semi-annually.

been happening before that time. Then between March and April when we found that we had at least one major source in Montrose Chemical, we began to work with them because they seemed to represent at least 80% of all that we had. They have cut down close to nothing as near as we can tell. Now we seem to have that under control and we are working very hard within the entire system in a sleuthing project to find out what other sources there may be. All we can say so far is, there seems to be no single large source. We seem to have a number of small sources which add up to maybe 100–200# per day.

Question: Do you think this is merely part of the consumption process of the population or is it close to an industrial discharge?

Dryden: It is speculating to answer because we haven't much to go on. You will find that the largest concentrations of pesticides are in the larger industrial areas, but that practically covers the whole southern part of the county. When you get up into strictly residential areas, the concentrations drop down to fairly low values which probably represent the amount contained in foods.

Question: Doesn't Hyperion have lower values of DDT than the Districts?

Dryden: That is right. The Hyperion system has much less industry and much lower values of DDT.

Question: Maybe there are some spot sources that you haven't tracked down yet.

Dryden: We feel there may be several hundred spot sources. By the way, this is why I asked the question earlier today concerning records of DDT production and distribution. If only there were some record of DDT from the time it is produced to where it goes next, like we do in the drug industry, then it would be easier to trace. Right now there is no one you can go to and ask who uses it, who handles it, who processes it. You can't find out until you get to agricultural uses and that is not our problem. We are trying to look at both ends; we are checking on who uses it and also trying to sample within the sewerage system. You know we have hundreds and hundreds of miles of sewers and our analytical capability is still only about 4 or 5 samples a day. It's a tough job.

Question: Do you have any samples taken from previous years?

Dryden: No, we really don't have.

Question: Did you know the City of San Francisco is planning to incorporate a waste discharge ordinance? Does your district have such plans?

Dryden: First, our district presently has a policy which permits us to control industry but we work through the cities now and we have 71 cities and they have ordinances. Many of them aren't the same as our policy and some have different wrinkles, but we work through their enforcement power. We are now in the process of writing an ordinance for ourselves with the objective of having more direct control than we have had in the past.

Question: What was the concentration of phenol in your effluent?

Dryden: About 6 ppm.

Question: There is lots of evidence in the literature documenting phenol to tainted fish flesh right now.

Dryden: In what concentrations?

Question: About 0.1 ppm.

Dryden: Well, you see by the time the effluent starts rising in the ocean it is diluted well below that.

Question: Do you take the coliform count before the effluent is discharged or at the point of discharge?

Dryden: We take coliform counts before the effluent goes into the ocean and we take coliform counts in the surface waters and along the shoreline in accordance with the Water Quality Control Board's requirements, but we do not remove coliforms in our treatment process. The test of whether or not you need to remove coliforms is whether or not they are reaching the shore or surface waters where there would be human contact because coliforms are only an indicator of whether or not you could transmit disease. If there is no one to transmit it to then there is no problem. We meet bathing water standards along the shoreline by the method of operation which keeps the field submerged and by keeping the field submerged we do not have to then remove the coliforms. However, when the water column is mixed, as by a storm in the wintertime, then we do need to continue to meet those requirements and, if necessary, chlorinate to kill the coliforms to the point that we continue to meet the requirements.

Question: How high does the coliform count get at the point of discharge?

Dryden: I think is probably runs about 70 million per 100 ml.

Question: What I am interested in is protecting the scuba or skindiver that might be out beyond the bathing area.

Dryden: We have probably sent more scuba divers out there than anyone else to check our outfalls for us and we haven't had any problem yet.

Question: What evidence have you that organics you are putting out are beneficial to the environment?

Dryden: Wheeler North told me once that work with kelp indicated that waste discharges increased the growth rate of kelp. The relationship between waste discharges and kelp is apparently by way of the urchin population. When that relationship is tied down, I trust we will have the ability to find a suitable solution.

Question: What makes you think the nutrients of waste discharges can help increase productivity? Is there any data on it?

Dryden: I would like to point out that there may be, if you will, a type of proof coming up. What you need to tie this thing down is a tracer and one of the potential tracers may be DDT. If we really show that DDT from waste discharges is getting into fish then we have an excellent tracer, which shows that the organic or other material in waste discharges is probably being utilized in a food chain, because the DDT appears to be tied closely with particulate and organic matter.

Question: Would it be feasible to have a separate sewer system for industrial waste?

Dryden: The question is what do you do with it? If something should not get into the sewer system, then it should be treated at the industrial site where it is concentrated before it goes into the sewer; that would be our approach. We do convey certain industrial wastes around a water reclamation plant so that it doesn't have to go there but that is because you don't want that particular material in that plant. If we don't want it in the system at all then it has to be treated at the source.

Question: How much water goes into water reuse and what is it used for?

Dryden: The Sanitation Districts' plant at Whittier Narrows has about 14 MGD of capacity; the water is spread for groundwater basin recharge. In the Pomona area, we have about a 10 MGD plant and some of the water there is recharged and some of it is used for irrigation purposes. There are other plants with limited irrigation uses; probably the biggest potential use is still for groundwater basin recharge.