United States District Court
District of New Jersey

Clean Ocean Action, et. al.,	:	
Plaintiffs	:	Civil Action No.
	:	
vs.	:	Certification of Dr. Angela Cristini
The U.S. Army Corps of Engineers, et. al.	:	
Defendants	:	

I, Angela Cristini, being of full age, hereby certify as follows:

1. Identification. ~~I, Dr. Angela~~ Cristini, am a professor of Biology at Ramapo College, Ramapo, New Jersey, and reside at 455 Kings Highway, Valley Cottage, New York.

2. Education. I was educated at City University of New York, where I received a doctorate in Biology. From 1977-1978 I was a Postdoctoral Fellow at the University of West Florida, Pensacola Florida.

3. Experience. Formerly, I was the Assistant Director of Environmental Research, New Jersey Department of Environmental Protection and Energy, Division of Science and Research. I have been studying the effects of organic pollutants on the physiology of marine organisms since 1980. My studies have been funded by 14 research grants, two of which were funded by the N.J. DEPE to study dioxin in Newark Bay.

4. The 1986 Newark Bay Dioxin Study. My first research project on dioxin funded by the N.J. DEPE began in 1986. Maxus Energy Co. provided monies for a research fund to be administered by the N.J. DEPE to study the effects of organisms, terrestrial and aquatic, in the area of the Maxus property. Maxus Energy is the owner of the Former Diamond Shamrock property, located on the Passaic River in Newark , New Jersey, a Superfund site believed to be the major source of dioxin contamination in the Newark Bay system. I submitted a proposal, together with Dr. Keith Cooper of Rutgers University, to study the effects of dioxin on organisms in Newark Bay, and was chosen to conduct the study.

A previous study conducted by the N.J. DEPE in 1982 had established that there were very high levels of dioxin in the tissues of blue crabs, carp, brown bullhead, and striped bass collected from the Newark Bay system. The levels of contamination were as high as 1,063 parts per trillion (ppt) in blue crabs and 56 ppt in striped bass fillets (see attached figure 1). This study prompted the N.J. DEPE to issue a ban on the harvesting and consumption of fish and shellfish from Newark Bay. The focus of our study was to assess the effects of dioxin on organisms such as blue crabs, soft shelled clams, and killy fish, that live in the estuary.

We discovered that the growth of juvenile blue crabs was retarded when they were fed clams that live in Newark Bay. This, in turn, resulted in a longer than usual time span between molting.

Crabs have the ability to regenerate lost legs and claws, and we observed this process was also retarded in crabs that were fed clams from Newark Bay.

The next part of the study was conducted in the laboratory and was aimed at establishing that (1) dioxin could be accumulated by juvenile crabs and (2) dioxin could cause the same effects on marine organisms as those caused by feeding on clams from Newark Bay. Our results conclusively demonstrate that (1) juvenile crabs rapidly accumulate dioxin from their food; within 96 hours, the hepatopancreas (the liver and pancreas) accumulated 4 to 6 times the concentration of dioxin in the food they ate and (2) food containing dioxin caused the same retardation in growth and limb regeneration as we observed when crabs were fed clams from Newark Bay.

We also focused on soft shelled clams and compared clams collected from Newark Bay with clams collected from Tuckerton, New Jersey. The dioxin concentrations in the Newark Bay clams ranged from 15 to 29 ppt while those from Tuckerton were less than 1 ppt. In addition, we discovered a much higher incidence of tumors in the gills, kidneys, and digestive glands of the clams from Newark Bay. Exposure of killy fish eggs to dioxin levels comparable to those of Newark Bay were found to cause severe birth defects (lesions) in the developing embryos.

5. Conclusions of the 1986 Dioxin Study. The results of this

study indicated that the populations of organisms living in the Newark Bay system contained elevated levels of dioxin and were being adversely affected by the concentrations of dioxin present in the sediments and moving through the food web of the entire estuary. The N.J. DEPE study in 1982 demonstrated that there was a health risk to people who might consume fish and shellfish from Newark Bay; our study showed that the organisms themselves were being adversely affected by the dioxin present in their environment.

6. The 1990 Newark Bay Dioxin Study. In 1990, the N.J. DEPE commissioned another study, this time aimed at determining (1) if there was still a potential danger to humans consuming blue crabs from Newark Bay and (2) if crabs collected from Newark Bay and three locations in Raritan Bay, were accumulating dioxin. The study was prompted, in part, by numerous observations of people continuing to harvest and consume fish and shellfish from Newark Bay. The N.J. DEPE were also concerned that contaminated crabs from Newark Bay were moving into Raritan Bay, where there is no ban on consumption. I was chosen to conduct the study with Dr. M. Gross from the University of Nebraska, who performed the chemical analyses.

The study focused on adult, legal size, blue crabs collected from Newark Bay and three locations in Raritan Bay: Sandy Hook, Keyport, and Wards Point. Crabs were collected in September 1991 and June 1992 and their muscle and hepatopancreas tissues were sent

to [illegible]. Gross for dioxin analysis. The results show that crabs from Newark Bay still contain extremely elevated levels of dioxin in their tissues (see Table I). Levels as high as 940 ppt were detected in the hepatopancreas and 45 ppt in the muscle. The levels of dioxin in crabs from Raritan Bay were lower, but all animals had elevated levels of dioxin. Sandy Hook crabs were found to contain 80 ppt in the hepatopancreas and less than 10 ppt in the muscle; Keyport crabs had 90 ppt in the hepatopancreas and less than 10 ppt in the muscle; and Wards Point crabs had 200 ppt and less than 15 ppt dioxin in the muscle.

7. Conclusions of the 1990 Dioxin Study. The results of the 1990 study show conclusively that the organisms living in Newark Bay are still heavily contaminated with dioxin and the consumption ban should remain in place. The levels of dioxin found in the crabs of Raritan Bay are such that a consumption advisory, at least for the hepatopancreas, is warranted with strict guidelines for preparation of crabs before cooking.

8. Involvement With the Port Authority Permit. The N.J. DEPE requested my input on the proposed dredging project in Newark Bay for which the Permit has been issued in the within legal action, regarding the "no barge overflow" issue. I apprised them of the results of my study and my concerns about the effects of re-suspending sediments into the water column that are highly contaminated with dioxin and other chemicals. The results of the concerns expressed by myself and others resulted in a partial

requirement for "no barge-overflow" method of dredging for the Permit.

Clean Ocean Action requested that I attend a meeting with them and the N.J. DEPE staff to discuss my concerns about the disposal of the sediments dredged from Newark Bay at the Mud Dump Site. I pointed out that my studies, as well as the earlier N.J. DEPE work, clearly show that organisms living in Newark Bay have elevated levels of dioxin in their bodies; when these organisms are dumped with the sediments at the Mud Dump Site, fish and other animals who feed upon these contaminated organisms will end up with elevated levels of dioxin in their bodies in a very short time. In addition, exposure of the resident populations of benthic worms, crabs, clams, and bottom fish in and around the Mud Dump Site to these contaminated sediments and organisms that either escape before capping, upon cap erosion, or are eaten upon disposal, will result in bioaccumulation and transfer of dioxin through the food web.

Studies conducted at the U.S. Environmental Protection Agency (EPA) laboratory in Rhode Island have established that marine worms exposed to sediments from Newark Bay continuously accumulate dioxin in their bodies. When these worms are fed to lobsters, the lobsters rapidly accumulate most of the dioxin in their hepatopancreas and some of the dioxin in their muscle. It appears that levels of dioxin in the muscle are about 5 to 10% of the levels in the hepatopancreas. These results are very similar to

t[illegible]results of my studies on blue crabs.

There have been no studies in Newark Bay that have examined the transfer of dioxin from lower trophic levels to fish. However, N.J. DEPE's 1982 study of Newark Bay showed levels of dioxin in striped bass fillets of 47, 56, 32, and 23 ppt. These levels are very similar to the 40 and 45 ppt levels of dioxin detected in the muscles of the blue crabs. This makes it probable that this species of fish can, like the blue crab and the lobster, accumulate dioxin in the muscle tissue from the food it eats. Further, these data make it probable that fish in the vicinity of the Mud Dump Site, particularly those with a high oil content, that feed on dioxin-contaminated food will accumulate comparable elevated levels of dioxin.

Clean Ocean Action requested that I present my data and discuss my concerns at a meeting sponsored by the EPA and attended by the Army Corps in January, 1993. After my presentation, staff from both the EPA and the Army Corps asked for copies of my data which, with permission from the N.J. DEPE, I provided. The EPA and the Army Corps have never requested my input on the overall merits of the Permit, nor have they attempted to contact me concerning the results of my study.

9. <u>Dangers Associated with the Permit</u>.

The dangers of dioxin to wildlife and humans are well

documented in the scientific literature. Exposure to extremely low doses (ppt) promote cancer in mammals and cause birth defects and reduced survival of the young of a whole range of animals, from fish to birds to minks. The Permit will allow the ocean disposal of contaminated sediments that cause the accumulation of 10 ppt dioxin in worms, and the disposal of organisms with extremely high levels of dioxin in their tissue. This will detrimentally affect the marine organisms and percivorous birds in and around the Mud Dump Site area, as well as humans who consume fish caught both at the Mud Dump Site and in coastal states across the east coast to which these fish will migrate.

Studies performed on organisms from Newark Bay, the Great Lakes, and across the world have demonstrated that dioxin has the potential to adversely affect populations of invertebrates, fish, birds and mammals. However, these effects will be extremely difficult to measure once the sediments are dumped into the uncontrolled environment of 70 to 90 feet of water, in the apex of one of the most dynamic estuaries in the country. For example, the scientific community presently has no adequate method to assess how the known effects of dioxin on the survival of fish and larvae can be measured in the real world of moving fish and a dynamic ocean. In other words, although we know that dioxin causes birth defects and reduced survival of fish embryos, there have been no studies estimating what the birth defects and reduced survival will do to our valuable fish stocks. The same is true of the effects on invertebrates such as clams, lobsters, and crabs.

Much has been made of the Port Authority's retesting of the sediments to be dredged, and their conclusion that the levels of contamination have actually decreased since they first applied for the Permit. However, I reviewed the report and attached comments from the Port Authority's consultant who performed the analysis. Dr. Richard Peddicord, of EA Engineering, Science, and Technology concluded, contrary to the Port's interpretation of the data, that there is no significant difference between the 1990 levels of dioxin contamination and the 1993 levels of dioxin contamination. In other words, the Port's own consultant clearly stated that the sediment is just as contaminated now as it was in 1990.

I conclude that there is currently not enough information available to determine that the project and the dumping allowed by the Permit can proceed and be monitored in a way that is protective of the marine environment. It is my understanding that, at the point of disposal, the Permit will allow up to approximately 25,000 tons of this contaminated sediment to escape into the marine environment where it will be readily available for uptake by organisms in and around the Mud Dump Site. Over time, the amount that enters the environment may increase. From my studies and the information that is available about dioxin, I conclude that there is a scientific basis to state that this Permit will probably cause significant contamination of marine organisms. The time to develop methods to more definitively assess the potential impacts of dioxin on marine organisms as a consequence of this Permit is before we allow dumping of contaminated sediments in the ocean, not after it is

done.

I, Angela Cristini, hereby certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment.

Angela Cristini — signature

5/30/93 — date

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S[illegible]ions, and 2,3,7,8-TCDD (ppt) in muscle and hepatopancreas of blue crabs from the Fall 1991 and Spring 1992 collection trips.

DATE	STATION	COMPOSITE NO.	TISSUE	2,3,7,8-TCDD
9/91	1	1	Mus.	ND
Sandy	1	2	Mus.	ND
Hook	1	1	Hepat.	50
Bay	1	2	Hepat.	40
9/91	2	1	Mus.	ND
East	2	2	Mus.	ND
Reach	2	1	Hepat.	90
	2	2	Hepat.	90
9/91	3	1	Mus.	45
Newark	3	2	Mus.	40
Bay	3	1	Hepat.	940
	3	2	Hepat.	690
9/91	4	1	Mus.	ND
Wards	4	2	Mus.	ND
Point	4	1	Hepat.	210
	4	2	Hepat.	60
6/92	1	1	Mus.	ND
Sandy	1	2	Mus.	ND
Hook	1	1	Hepat.	80
Bay	1	2	Hepat.	NA
6/92	2	1	Mus.	ND
East	2	2	Mus.	ND
Reach	2	1	Hepat.	45
	2	2	Hepat.	65
6/92	3	1	Mus.	30
Newark	3	2	Mus.	40
Bay	3	1	Hepat.	450
	3	2	Hepat.	530
6/92	4	1	Mus.	ND
Wards	4	2	Mus.	ND
Point	4	1	Hepat.	80
	4	2	Hepat.	60