Committee on Resources

Subcommittee on Fisheries Conservation, Wildlife and Oceans

Statement

TESTIMONY OF
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BEFORE THE
SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

FEBRUARY 22, 2000

Thank you for the opportunity to testify before the Subcommittee on Fisheries Conservation, Wildlife and Oceans regarding the effects on living marine resources of material deposited in the New York Bight, including activities associated with the Historic Area Remediation Site(HARS)off the coast of New Jersey.

I am Angela Cristini, a biology professor at Ramapo College of New Jersey. I have conducted research on the effects of organic contaminants on marine invertebrates - especially crustaceans from the New York Bight for approximately 20 years. I had the pleasure of serving on Governor Whitman's Dredged Materials Management Team; as a member of the Team and as a concerned scientist I have a strong commitment to supporting environmentally sound dredging and disposal strategies that will keep our ports open to shipping and not harm our living marine resources.

The sediments that exist at the HARS have the potential to cause harm to:

- the inhabitants of the ecosystem and the structure of their communities;

- humans who may consume fish and shellfish.

Harm can be direct toxicity; in fact, levels measured by EPA in some of the sediments in the mud dump will cause mortality of marine species.

Harm can be sub-lethal - effects on reproductive success; birth defects (structural and physiological); and effects on the immune system which result in increased susceptibility to disease and parasite infestation. Research has shown that if regulations are promulgated to protect the inhabitants of an ecosystem from sub-lethal effects human health is also protected.

Setting levels of concentrations of chemicals of concern to protect marine organisms from direct toxicity is not enough to ensure the continuation of sustainable marine communities. Therefore, the bioaccumulation of chemicals in the tissues of organisms is measured to attempt to understand what may cause harm to the next generation, increase disease, and/or affect humans who consume them. Environmental research over the past 20 years has indicated that:

- Bioaccumulation of a chemical may not result in harm.

- Regulations must be based on studies that indicate correlations between body burdens and sub-lethal effects.

Because of time limitation, I would like to focus the remainder of my remarks on three examples of chemicals of concern. I will present evidence that strongly suggests that the levels of concern set by EPA Region II for bioaccumulation are high and will not protect the organisms inhabiting the HARS region from harm and may result in increased human health risk.

Studies of embryonic development in fish eggs and the incidence of tumors in adults represent good models to understand the relationship between bioaccumulation and potential harm because they indicate the affect on: (1) the next generation, and (2) standing stocks of those individuals responsible for reproduction. Eggs are sensitive stages in the life cycle because the enzyme systems necessary to metabolize the contaminants often are not present in early developmental stages - making them similar to invertebrates who have not evolved these systems.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHS or Polynuclear aromatic hydrocarbons (PNAs) are released into the environment during the incomplete combustion of organic material (e.g. petroleum refining, waste incineration etc.) and from hydrocarbon spills or seepage. They are found in every environmental media including the sediments in the HARS and those intended as remediation material.

The EPA has set the level of bioaccumulation for total PAHs that will cause harmful effects at **40,000 parts per billion (ppb) in tissues** from worms and clams. This level is arrived at by a series of calculations based on a limited literature search. Worms at the HARS have 437.52 ppb and ocean background in this area for worms is 104.6 ppb.

There are several publications that have examined the direct relationship between tissue levels of PAHs and sub lethal effects in marine organisms. I will highlight two recent studies on the development of fish embryos and hatching.

- Exposure of eggs from the pink salmon to weathered oil contaminated gravel yielded the following data:

tissue levels of 2,000 - 32,000 ppb caused birth defects (abnormalities of heart development); alterations of the activity of enzyme systems critical to normal development; changes in the swimming behavior at emergence and possible influence on future reproductive success of the survivors. [Marty et.al. (1997)]

- Pacific herring eggs exposed to water containing 0.7-7.6 ppb PAHs resulted in **tissue levels that ranged from 22 - 1,400 ppb.** Tissue levels in this range caused mortality and/or structural abnormalities (lack of jaw development, small jaws, spinal defects, failure to develop fins); yolk sac swelling; pericardial (heart) sac swelling; alterations in swimming behavior; and chromosomal damage. A mean tissue **concentration as low as 22 ppb** caused yolk sac swelling, jaw abnormalities, and premature hatching. [Carls et.al. (1999)]

These two studies provide cause and effect evidence that bioaccumulation of PAHs at tissue levels well below 40,000 ppb cause sub-lethal harm. Therefore, this level can not be protective for marine organisms.

Human Health

The EPA (1997) has produced guidance for assessing contaminant data for use in fish advisories for the protection of human health. Evidence from occupational studies of workers exposed to PAHs in their jobs indicates that mixtures of PAHs are carcinogenic in humans. Exposure can occur through ingestion, dermal exposure and/or inhalation.

The EPA document for PAHs suggests limiting consumption to 6 fish meals/year (4-8 oz servings) when tissue levels reach 2-3 ppb. No consumption is recommended when tissue levels reach 6 ppb.

Polychlorinated Biphenyls (PCBs)

PCBs are a group of synthetic organic chemicals that contain 209 possible individual chlorinated biphenyl compounds. They are not produced naturally, but are the products of industrial processes. The major sources of PCBs are environmental reservoirs from past industrial practice that have persisted because of the long half-life of this class of chemicals. PCBs are not very soluble in water, rather they are contained in fresh water and marine sediments world-wide including those at the HARS and those proposed as remediation material.

The EPA has set the level of bioaccumulation for total PCBs that will cause a harmful effect at **400 parts per billion (ppb) in tissues from worms** and **100 ppb for clams**, arrived at by a series of calculations. Worms at the HARS have 208.76 ppb and ocean background in this area for worms is 88.1 ppb.

> - Scientists from NOAA have been publishing studies since 1994 examining the levels of PCBs in sediments, liver, stomach contents, and bile for at least three different species of fish from 49 stations in US waters. Their sub-lethal end points were neoplasms, degenerative necrotic lesions and other histological evidence indicating compromised health of the fish. Their results from hundreds of fish indicate that concentrations of PCBs: in sediments of <500 ppb; in liver ranging from 230 - 7,000 ppb; and in the stomach of <490 ppb caused positive statistical correlations with histological abnormalities (tumors, lesions, etc.). [Myers et.al., (1994, 1998)]

Human Health

The EPA (1999) has just produced a new fact sheet on PCBs for contaminant data for use in fish advisories for the protection of human health. Exposure is primarily through consumption of fish and seafood although eggs, poultry, meat, and dairy products are additional sources of these chemicals. PCBs are readily absorbed into the circulatory system and accumulate in lipid rich tissues (liver, fat, skin and breast milk).

Numerous studies have documented that PCB mixtures cause developmental abnormalities in animals and humans. A long term study on women who consumed contaminated fish for 16 years prior and during pregnancy showed positive correlations between fish consumption, PCB levels and infant delayed neuromuscular development; lower birth weight; subnormal visual recognition memory; and other effects. Effects have also been documented on liver function, nervous, endocrine, and reproductive systems. This group of chemicals has also been classified as probable human carcinogens.

The EPA document suggests limiting consumption to 2 fish meals/month (8 oz servings) when tissue levels reach 16 - 24 ppb. No consumption is recommended when tissue levels reach 97 ppb. Clearly, the proposed minimum effects level of 400 ppb for bioaccumulation in worms and 100 ppb in clams is to high to be protective of marine communities and human health.

Dioxins

Dioxins are a group of synthetic organic chemicals that contain 210 structurally related individual chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. They are produced as the by-product of incomplete combustion and various chemical processes. Incineration of waste and combustion of fossil fuels and wood produce small quantities of dioxins. The major sources are as unintended products of paper bleaching and chemical production, particularly chlorinated phenols. Dioxins are distributed world-wide; they are highly persistent, and their very low solubility in water has created reservoirs in fresh water and marine sediments including those at the HARS and those proposed as remediation material.

The EPA has set the level of bioaccumulation for the most dangerous isomer of Dioxin - 2,3,7,8,TCDD that will cause a harmful effect at **1 part per trillion (ppt) in tissues** from worms and clams, arrived at by a series of calculations. Levels in the parts per trillion range rather than parts per billion reflect the toxic potential of these chemicals. Worms at the HARS have 3.89 ppt and ocean background in this area for worms is 2.5 ppt.

> - Studies have shown that fish embryos exposed to water containing low levels (1 - 12 ppt) of 2,3,,7,8 TCDD resulted in disruption of critical enzyme systems, and hemorrhagic lesions as the liver developed.[Wisk and Cooper, (1990,1992)] Threshold effect levels are estimated to be less than 1ppt.

Human Health

The new EPA fact sheet on Dioxins (1999) for use in fish advisories for the protection of human health indicates that exposure is associated with a wide array of adverse effects in animals including death. As is the case with PCBs the primary route of exposure for dioxin is consumption of fish, seafood, meat, and dairy products. Dioxins are readily absorbed into the circulatory system and accumulate in lipid rich tissues (liver, fat, skin and breast milk).

Studies show that dioxin causes developmental effects in fish, mammals, and birds at very low levels. In humans, data indicate adverse effects in children and developing fetuses. Numerous animal studies show hepatic, gastrointestinal, endocrine, immunological, neurological, and reproductive effects. This group of chemicals has also been classified as probable human carcinogens.

The EPA document suggests limiting consumption to 2 fish meals/month (8 oz servings) when tissue levels reach 0.21 - 0.31 ppt. No consumption is recommended when tissue levels reach 1.2 ppt. The proposed minimum effects level of 1 ppt for bioaccumulation in worms is 10X lower than the value used to regulate the disposal of dredged material at the "mud dump" through the mid 1990ies. However, based on the latest research it is to high to be protective of marine communities and human health.

I believed that the alternative chosen to remediate the HARS in 1997 was designed to reduce the levels of contamination in the sediments resulting in improvements in the health of the resident marine organisms and communities. However, the standards presently proposed do not reflect data available in the scientific literature, are not protective, and will not result in remediation.

If all dumping stopped today, I do not know how long it would take natural processes to cover the contaminated sediments present in the HARS and reduce the adverse effects on marine organisms and human health risks. However, I think this would be a preferable scenario unless we can do a much better job of ensuring that materials proposed for remediation improve existing conditions.

Thank you for the opportunity to present this testimony.

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