Polynuclear Aromatic Hydrocarbons in the Oysters from Galveston Bay, Texas

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Polynuclear aromatic hydrocarbons (PAHs) are ubiquitous environmental contaminants. Galveston Bay is subjected to PAH contamination from a large number of petroleum related industries and intense anthropogenic activities in the heavily populated surrounding area. PAHs from municipal and industrial wastewater treatment plants, urban runoff and discharge, atmospheric deposition, and petroleum and petroleum product spillage can all contribute to PAH pollution in Galveston Bay.

Results of PAH analyses of oyster samples collected from 1986 to 1997 as part of NOAA's National Status and Trends (NS&T) Mussel Watch Program are discussed. Oyster samples and sediment samples were collected from six sites in Galveston Bay (Houston Ship Channel (GBSC), Yacht Club (GBYC), Todd's Dump (GBTD), Hanna Reef (GBHR), Confederate Reef (GBCR), and Offatts Bayou (GBOB), Fig. 1). Analysis of PAHs includes 20 non-substituted PAHs and six groups of alkyl substituted PAHs. The alkyl PAH determination was not initiated until 1990. Relative abundance of PAHs and alkyl PAHs are used as an indicator of whether the source is pyrogenic or petroleum products related. Oysters from GBHR and GBTD have the lowest PAH concentrations. The non-alkylated PAHs range from 20 ng/g to 300 ng/g and the alkyl PAHs range from 300 to 2500 ng/g at these two sites. The oysters collected from GBCR, GBYC, and GBOB have higher PAH concentrations with non-alkylated PAHs range from 200 ng/g to 3,000 ng/g, with the majority of the samples below 1,000 ng/g, and alkyl PAHs range from 340 to 9,500 ng/g. Samples collected from GBSC have the highest PAH concentrations. Parent PAH concentrations range from 1,400 ng/g to 15,600 ng/g and alkyl PAHs range from 3,500 to 80,000 ng/g at GBSC site (Fig. 2). The alkyl PAHs, which are indicative of direct exposure to petroleum products, in oyster samples are in higher abundance than the parent PAHs at many sites, indicating that one source of the PAH contaminants in Galveston Bay is petroleum and petroleum products. In addition, four to six ring PAHs, which are indicative of a pyrogenic source, are in higher concentrations than that of the two and three ring PAHs at several sites, suggesting incomplete combustion generated PAHs as another source of PAHs in Galveston Bay.

The PAH concentrations in oysters varied randomly from year to year during the 12 years of sampling. There is no apparent temporal trend of changes in PAH concentrations at most sites, suggesting that the PAH pollution in Galveston Bay remain relatively unchanged between 1986 and 1997. Sporadic high concentrations of PAHs were recorded in oysters in some years, such as in oysters from GBSC and GBTD in 1991 and GBCR in 1995. These oysters had PAH compositions typical of petroleum products with predominantly alkyl PAHs and two and three ring PAHs. The increase in the PAH concentrations, particularly the alkyl PAHs at GBTD and GBSC coincides with

the Apex Barge spill which happened in July 1990 (four months prior to 1991 sampling) near GBTD. The spilled oil residue was observed on the shore near GBSC. Therefore the high concentrations of PAHs at GBSC and GBTD were most likely resulted from the Apex Barge spill in 1990. The alkyl PAH concentrations at GBTD and GBSC decreased to some extend during the following years. The high concentration of PAHs at GBCR in 1995 may be the result of another one time petroleum product related release at that location.

In comparison with that of the oysters, the PAH concentration in sediment samples are low at all sites except GBOB site. The PAH concentration ranges from 60 ng/g at GBTD to 670 ng/g at GBSC. The PAHs in sediment at GBOB, which has the concentration of 6800 ng/g, consist predominantly of four to six ring parent PAHs. Alkyl PAHs and two and three ring PAHs are low at this site. The PAH composition at GBOB site is typical of combustion generated PAH feature, suggesting that the source of PAH pollution at this site is primarily pyrogenic. The high concentrations of PAHs in oysters as compared with that of sediment indicates the complexity of processes that provide bioavailable PAHs to oysters.