# WHITE PAPER FACT SHEET

## *Pesticides and the Maryland Chesapeake Bay Watershed:*
### *Understanding the Problem and Identifying Solutions to Reduce the Impact of Pesticides on the Watershed*

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**The Johns Hopkins Center for a Livable Future**

**White Paper Overview**

The Pesticides and the Chesapeake Bay Watershed Project has published a White Paper examining the impact of pesticides on the Bay watershed and proposing a range of actions, both to address key data gaps and to reduce pesticide contamination of Bay waters.

The report urges government agencies at all levels to make reducing pesticide pollution a priority, while simultaneously expanding and accelerating much-needed research. The paper – *Pesticides and the Maryland Chesapeake Bay Watershed: Understanding the Problem and Identifying Solutions to Reduce the Impact of Pesticides on the Watershed* was produced by Project staff with topical technical reviews provided by scientists from federal and state agencies and research institutions. The paper was not critiqued by independent reviewers, and while its recommendations were developed by the Project's scientific working groups; their inclusion did not indicate full endorsement of all or any of the recommendations by individual working group members.

**Research Science Review**

The White Paper presents an important review of relevant scientific research conducted over the past 15 years. A 2007 U.S. Geological Survey (USGS) report (Phillips et al. 2007), found that *"synthetic organic pesticides and their degradation products have been widely detected at low levels in the watershed [Susquehanna River Basin, Potomac River Basin, Delmarva Peninsula]."* Pesticides were detected more frequently in streams than in ground water. While the most commonly detected pesticides were herbicides used on corn, soybean and small grain crops in agricultural regions, pesticides were also detected in streams and groundwater in urban areas at lower concentrations. Pesticides in ground water were found at higher concentrations in areas underlain by permeable soils and aquifer material than in areas underlain by less permeable materials.

Other studies indicate that pesticides and their degradation products have occurred at concentrations that exceed water quality benchmarks for the parent compounds. For example, a USGS team found that while concentrations of parent compounds were lower than drinking water standards in ground water samples from the Maryland coastal plain, degradation products for some pesticides were found to exceed the parent compounds. Pesticides detected in the streams in the Potomac River Basin (Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia), included atrazine, metolachlor, simazine, prometon, tebuthiuron, diazinon, carbaryl, and 18 other compounds. (Ator and Denver, 2006).

The report took note of several important studies reporting detection of pesticides in Bay waters and its tributaries, as well as some of the effects that are being found, e.g.;

- **Susquehanna**. Liu et al. (2002) concluded that the annual mass loads for atrazine, CIAT, metolachlor, simazine, and CEAT from the Susquehanna River to the Chesapeake Bay ranged from high to low (1600, 1600, 1100, 820, and 720 kilograms/year, respectively). Annual loadings of insecticides and organochlorine compounds ranged from 2.8 kg/year for alpha-HCH to 34 kg/year for diazinon. While the Susquehanna contributes a significant portion of river inputs to the Bay, it is but one of many sources of pesticide loadings.
- **Patuxent**. McConnell et al. (2004) found herbicides and two triazine degradation products, 2-chloro-4-isopropylamino- 6-amino-s-triazine (CIAT), and 6-amino-2- chloro-4- (ethylamino)-s-triazine (CEAT), in surface water from four sites sampled at regular intervals from April 4 through July 29, 1996 in the Patuxent River estuary. Of the pesticides measured, atrazine was most persistent and was present in the highest concentrations (maximum = 1.3 µg/L). This is below the U.S. Environmental Protection Agency (EPA) drinking water standard of 3 µg/L. Metolachlor, CIAT, CEAT, and simazine were frequently detected (with maximum concentration values of 0.61, 1.1, 0.76, and 0.49 µg/L, respectively).
- **Across the Bay**. In a study of Chesapeake waters in 2004, researchers detected atrazine in 100% of water samples taken at 60 different stations spread across five different Bay tributaries (McConnell et al., 2007). A

growing body of evidence has shown that many pesticides, which are designed to affect specific organisms, may also be toxic to non-target species, such as aquatic life, wildlife, and humans that co-inhabit the ecosystem. Even at low levels, the toxic effects of pesticides place additional stress on resident microbiota, plants, fish and other wildlife. Reduction in the growth of key living resources of the Chesapeake Bay have been observed in the laboratory at low part per billion concentrations for some pesticides. The cumulative effect of pesticides and their degradation products on aquatic life is poorly understood and may present additional challenges to the living resources of the Chesapeake Bay watershed.

- **Potential Effects on Humans**. Another important concern is that many pesticides are now being shown to cause harm even at low doses to the environment or to humans. For example, low-dose exposures to the herbicides aldicarb and atrazine in well water, along with nitrate used as fertilizer, may cause adverse effects on behavior and on the immune and endocrine systems (Porter, et al. laboratory study, 1999). Epidemiological data suggest seasonal changes in atrazine and nitrate in water may alter genitalia, language and mathematical skills and other subtle biological responses in children conceived in months when concentrations are high (Winchester et al, 2009). Chronic exposure to low levels of atrazine leaves phytoplankton more susceptible to a short-term exposure to higher levels (Pennington and Scott, 2001).
- **Endocrine Disruptors**. Another concern is the effect of pesticides as endocrine disruptors triggering reproductive abnormalities. Endocrine disruptors mimic hormones and may be mistaken for hormones by the body, altering the functions of the endocrine system. In spring 2003, scientists found male fish in the Potomac River with immature oocytes in their testes (Blazer et al. 2007). In 2010, intersex fish were found in the Susquehanna River, and the Baltimore Sun reported (11/02/2010) that intersex fish have been found on the eastern shore- in 6 lakes and ponds on the Delmarva Peninsula
- **Intersex fish**. In March 2008, USGS scientists identified several pesticides in the Potomac River that could be responsible for "intersex fish," or male fish with testicular oocytes. One of these – atrazine, a common herbicide used in agriculture and on lawns – is already linked to sexual abnormalities in frogs (Hayes et al, 2006). EPA does not currently evaluate or consider the endocrine-disrupting properties of pesticides during registration or re-registration, but in 2009 EPA released a list of 67 pesticides that will be evaluated as potential endocrine disruptors.

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**The full report can be downloaded at http://www.mdpestnet.org**

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**Background on the Project**

The Pesticides and the Chesapeake Bay Watershed Project, founded in 2007, is a diverse group of 100-plus scientists, public health experts, agronomists, watermen, waterkeepers, environmentalists, and others working under the sponsorship of the Maryland Pesticide Network and the Johns Hopkins Center for a Livable Future. Its shared mission is to reduce risk of adverse effects to living resources from pesticides in the Bay and its tributaries.