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November 14, 2011

Richard P. Keigwin Jr.,
Director, Pesticide Re-evaluation Division (7508P)
Office of Pesticide Programs (OPP)
Environmental Protection Agency,
1200 Pennsylvania Ave., NW.,
Washington, DC 20460-0001

Re: Petition Requesting Ban on Use and Production of Atrazine,
Docket Number: EPA-HQ-OPP-2011-0586

Dear Mr. Keigwin,

Beyond Pesticides, on behalf of our members, would like to take this opportunity to once again urge the agency to ban the herbicide atrazine. These comments are in support of a ban requested by Save the Frogs, whose petition with over 10,000 signatories was submitted to the agency. Similarly, the Natural Resources Defense Council (NRDC) and the Center for Biological Diversity have also requested the agency to take steps to phase out atrazine. Atrazine is a widely used herbicide whose use over the decades has led to widespread environmental contamination that threatens wildlife as well as public health. About 73-78 million pounds of atrazine are used in the U.S. annually, primarily on corn. The U.S. Geological Survey (USGS) has routinely found atrazine in rivers and other water bodies at constant levels near or above EPA's levels of concern. USGS researchers have also found atrazine to adversely affect aquatic organisms.

The European Union and other countries across the globe have banned atrazine, however the agency continues to put U.S. citizens and the environment in harm's way with the continued use of atrazine.

Atrazine is a potent endocrine disruptor with strong associations with birth defects, cancer, sex reversal and hermaphroditism in animals whose risk to environmental and human health is exacerbated by pervasive surface, ground and drinking water contamination. In the past, Beyond Pesticides has commented to the agency that atrazine use in the U.S. should be halted.

Beyond Pesticides still believes that atrazine poses unreasonable risks to humans and the environment and that risk mitigation measures proposed by EPA and the registrants fail to protect atrazine users and the general public. We hope the agency will take a look again at the information provided below and reconsider the current registration on atrazine.

1. Atrazine is an Endocrine Disruptor at Environmental Concentrations

Atrazine is the most widely used herbicide in the U.S. applied by farmers in the Midwest and used in residential lawn management in much of the Southeastern U.S. Due to the dangers of routine use and production on humans and the environment, atrazine must be immediately banned and all tolerances revoked. Studies have shown that concentrations as little as 0.1 parts per billion (ppb) impacts hormone function in organisms and turns tadpoles into hermaphrodites - creatures with both male and female sexual characteristics. The research also finds that atrazine interferes with mammary gland development in the breast of mammals and is linked to certain birth defects. Recent studies highlight the dangers posed by atrazine's endocrine disrupting ability are presented below. We hope that with this information, which the agency is undoubtedly aware of, will help the agency in its review of the chemical and convince the agency that immediate action must be taken to stop the gender-bender atrazine from doing more harm, and help EPA be assured that a phase out of atrazine is the only acceptable route.

1.1 Ecological Effects

Many studies, including those by Haynes and Reylea have documented hormone disruption in amphibians and other aquatic organisms. Some are highlighted below:

-The study, "Atrazine induces complete feminization and chemical castration in male African clawed frogs (*Xenopus laevis*)," demonstrates the reproductive consequences of atrazine exposure in adult amphibians. Here the atrazine-exposed males were both demasculinized (chemically castrated) and completely feminized as adults. Exposed genetic males developed into functional females that copulated with unexposed males and produced viable eggs. The eggs produced were all male offspring since both parents contributed male genes.[1]

-One study, "Demasculinization and feminization of male gonads by atrazine: Consistent effects across vertebrate classes,"[2] finds evidence that the effects of atrazine on male development are consistent across all vertebrate classes examined. It found atrazine demasculinizes male gonads producing testicular lesions associated with reduced germ cell numbers in teleost fish,

[1] Hayes, T., et al. 2010. Atrazine induces complete feminization and chemical castration in male African clawed frogs (*Xenopus laevis*). *PNAS*, doi: 10.1073/pnas.0909519107

[2] Hayes, T., et al. 2011. Demasculinization and feminization of male gonads by atrazine: Consistent effects across vertebrate classes. *J. Steroid Biochem and Molecular Bio*. 127(1-2):64-73.

amphibians, reptiles, and mammals, and induces partial and/or complete feminization in fish, amphibians, and reptiles. These effects were explained by mechanisms that lead to reductions in androgen levels and the induction of estrogen synthesis, which were demonstrated in fish, amphibians, reptiles, and mammals.

-A review by Rohr and McCoy[3] found evidence that atrazine can have indirect and sublethal effects in fish and amphibians. They determined that the relationship between atrazine concentration and timing of amphibian metamorphosis was regularly nonmonotonic, indicating that atrazine can both accelerate and delay metamorphosis. Atrazine reduced size at or near metamorphosis, reduced antipredator behaviors, reduced olfactory abilities for fish but not for amphibians among other effects.

-Significantly reduced survival and growth (weight, length and fat body size) in male and female tadpoles exposed to atrazine was also identified in the study, "Chronic exposure to high levels of atrazine alters expression of genes that regulate immune and growth-related functions in developing *Xenopus laevis* tadpoles."[4] Genes associated with growth and metabolism, proteolysis, fibrinogen complex formation, immune regulation, immune system function, specifically defense molecules present in the skin were altered and downregulated especially in female tadpoles.

-A U.S. Geological Survey study, "Atrazine Reduces Reproduction in Fathead Minnow (Pimephales promelas)" finds that concentrations of atrazine commonly found in agricultural streams and rivers caused reduced reproduction and spawning, as well as tissue abnormalities in laboratory studies with fish. The results of this study show that normal reproductive cycling was disrupted by atrazine and exposed fish did not spawn as much or as well when exposed to atrazine. Total egg production was also lower in all atrazine-exposed fish, as compared to the non-exposed fish, within 17 to 20 days of exposure. In addition, atrazine-exposed fish spawned less and there were abnormalities in reproductive tissues of both males and females.

-A recent study by the U.S. Department of Agriculture (USDA) found that the volatilization of atrazine consistently results in herbicide movement off the target site that exceeds nontarget field runoff, varying widely depending upon weather conditions. On average, atrazine and metolachlor, the two herbicides looked at in this study, losses by volatilization was about 25

[3] Rohr, J and McCoy, K. 2010. A Qualitative Meta-Analysis Reveals Consistent Effects of Atrazine on Freshwater Fish and Amphibians. Environ Health Perspect; 118(1): 20–32.

[4] Langerveld, A.J., Celestine, R., Zaya. R., et al. 2009. Chronic exposure to high levels of atrazine alters expression of genes that regulate immune and growth-related functions in developing *Xenopus laevis* tadpoles. *Environmental Research*, 109(4):379-389.

times larger than movement from surface runoff, despite low vapor pressures. [5] This increases the mobility of atrazine, causing off site deposition to non-target areas not accounted for by surface runoff.

1.2 Human Health Effects

As a result of its endocrine disrupting ability, studies are now beginning to find associations between atrazine exposure, birth defects and certain cancers. EPA's past findings for the carcinogenic potential of atrazine- 'not likely to cause cancer in humans'- is at odds with current research which finds atrazine to impact mammary glands in the breast, increasing the risk for mammary cancer. In the publication *Environment and Breast Cancer*, the authors note that atrazine alters the developing mammary gland, makes it susceptible to tumorigenesis or hyperplasia, alters lactational ability, and decreases weight gain in second-generation litters.[6] Specifically, researchers find that atrazine is associated with impaired lactation observed in conjunction with altered mammary gland development in one or more generations after gestational exposure.[7] Another published by researchers at the National Institute of Environmental Health Sciences and EPA shows that male rats prenatally exposed to low doses of atrazine are more likely to develop prostate inflammation and to go through puberty later than non-exposed animals.[8]

A sampling of recent studies detailing atrazine's impact on human health are listed:

-A National Institute of Environmental Health Sciences study finds that atrazine delayed mammary gland development when exposure occurred around gestational day 17-19 but had less of an effect after earlier three-day windows. Developmental changes in offspring were observed characterized by stunted development, and when laboratory rats were bred, their second generation offspring had significantly reduced weight gain, suggesting insufficient milk production.[9]

-A review of the literature by authors from the Breast Cancer Fund, notes that atrazine is of

[5] Gish, T., et al. 2010. Comparison of Field-scale Herbicide Runoff and Volatilization Losses: An Eight-Year Field Investigation. *J. Environ. Qual.* doi:10.2134/jeq2010.0092

[6] Rayner, J and Fenton, S. 2010. Atrazine- An Environmental Endocrine Disruptor That Alters Mammary Gland Development and Tumor Susceptibility. In a J. Russo (Ed.), *Environment and Breast Cancer*, (pp 167-183). New York, NY: Springer

[7] Rudel RA, Fenton SE, et al. 2011. Environmental Exposures and Mammary Gland Development: State of the Science, Public Health Implications, and Research Recommendations. *Environ Health Perspect* 119:1053-1061. http://dx.doi.org/10.1289/ehp.1002864

[8] Stanko, J., et al. 2010. Effects of prenatal exposure to a low dose atrazine metabolite mixture on pubertal timing and prostate development of male Long-Evans rats. *Reproductive Tox.* 30(4): 540-549

[9] Ref7

particular concern for breast cancer because it disrupts, in fact increases, the activity of aromatase, which can lead to increased estrogen levels. The chemical has also been shown to increase estrogen levels and/or stimulate growth of breast cancer cells.[10]

-A 2011 French cohort study[11] finds the presence of quantifiable levels of atrazine or atrazine metabolite in urine samples of pregnant women which were associated with fetal growth restriction and small head circumference for sex and gestational age compared to babies of women not exposed to atrazine.

-A case-controlled study[12] using Washington State Birth Certificate and US Geological Survey databases finds maternal exposure to surface water atrazine is associated with fetal gastroschisis, particularly in spring conceptions. Gastroschisis occurred more frequently among those who resided <25 km from a site of high atrazine concentration and risk was inversely related to the distance between the maternal residence and the closest toxic atrazine site.

-A study entitled, "Agrichemicals in surface water and birth defects in the United States"[13] which evaluated pesticide concentration in surface waters between April and July and birth defects finds birth defects to be positively correlated with atrazine with atrazine exposure increasing the odds of birth defects found to be associated with time of conception in April–July.

-A study investigating growth effects on human liver cells[14] determines that after exposure to increasing concentrations of atrazine, growth of immortalized human hepatoma HepG2 cells was inhibited and expression of cell cycle specific cyclin proteins altered after exposure.

-A cohort study, "Drinking-Water Herbicide Exposure in Indiana and Prevalence of Small-for-Gestational-Age and Preterm Delivery,"[15] finds women's exposure to atrazine in drinking water during the third trimester and the entire pregnancy was associated with a significant increase in the prevalence of 'small-for-gestational-age,' (SGA, :birth weight below the 10th percentile for a given sex and gestational week). Atrazine in drinking water > 0.1 µg/L during the third

[10] Nudelman,J., et al. 2009. Policy and Research Recommendations Emerging from the Scientific Evidence Connecting Environmental Factors and Breast Cancer. *Int J Occup Environ Health*;15:79–101

[11] Chevrier , C., et al. 2011. Urinary Biomarkers of Prenatal Atrazine Exposure and Adverse Birth Outcomes in the PELAGIE Birth Cohort. *Environ Health Persp*. doi: 10.1289/ehp.1002775

[12] Waller **,** S., Paul , K., Peterson, S. and Hitti , J. 2010. Agricultural-related chemical exposures, season of conception, and risk of gastroschisis in Washington State. *Am J Obstet Gynecol*;202:241.e1-6.

[13] Winchester, P., Huskins, J and Ying, J. 2009. Agrichemicals in surface water and birth defects in the United States, *Acta Pædiatrica*,98 (4):664–669

[14] Powell, E., et al. 2010. Atrazine exposure leads to altered growth of HepG2 cells. *Toxicology in Vitro,* 25(3):644-651

[15] Ochoa-Acuña , H. et al. 2009. Drinking-Water Herbicide Exposure in Indiana and Prevalence of Small-for-Gestational-Age and Preterm Delivery. *Environ Health Perspect.* 117(10): 1619–1624.

trimester resulted in a 17–19% increase in the prevalence of SGA compared with the control group.

A 2011 study[16] finds preliminary evidence that atrazine exposure, at levels below the EPA's maximum concentration levels detected in drinking water is associated with increased menstrual cycle irregularity, longer follicular phases, and decreased levels of menstrual cycle endocrine biomarkers of infertile ovulatory cycles in women 18–40 years old residing in agricultural communities where atrazine is used.

2. Atrazine is a Pervasive Surface, Ground and Drinking Water Contaminant

According to USGS data,[17] atrazine concentrations in streams and rivers have been relatively constant for the past decade. Atrazine remains among one of the pesticides detected most frequently in both streams and shallow ground water in agricultural areas, and also in urban streams.[18]

As noted in previous comments to the agency, along with numerous reports especially the 2009 report by the Natural Resource Defense Council (NRDC) "Poisoning the Well,"[19] 97% of surface drinking water systems in Midwestern States showed atrazine contamination.[20] According to NRDC's report, 40 watersheds tested showed detectable levels of atrazine, and 25 had average concentrations above 1 ppb. In accordance with the Safe Drinking Water Act, EPA set a maximum contaminant level (MCL) goal for atrazine at 3pbb which is a yearly average. However daily mean samples in various parts of the county have been as high as 30-50ppb during the spring and summer months.[21] USGS reports that in the spring after the application of herbicides, the concentrations of atrazine and others are frequently 3-10 times greater than the MCL.[22]

Currently EPA has in place a monitoring program to look for atrazine residues in drinking water from approximately 100 community water systems (CWS) located primarily in the Midwest,

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[16] Cragin, L., et al. 2011. Menstrual cycle characteristics and reproductive hormone levels in women exposed to atrazine in drinking water. *Environmental Research***,** doi:10.1016/j.envres.2011.09.009

[17] Sullivan, D.J., Vecchia, A.V., Lorenz, D.L., Gilliom, R.J., and Martin, J.D., 2009, Trends in pesticide concentrations in corn-belt streams, 1996–2006: U.S. Geological Survey Scientific Investigations Report 2009–5132.

[18] Gilliom, R, Barbash, J., et al. 2006. Pesticides in the Nation's Streams and Ground Water, 1992–2001. U.S. Geological Survey

[19]

[20] USEPA. 1999. A Review of Contaminant Occurrence in Public Water Systems. EPA 816-R-99-006, Office of Water, Washington DC

[21] Christensen, V. and Ziegler, A. 1998. *Atrazine in Source Water Intended for Artificial Ground-Water Recharge, South-Central Kansas*. USGS Fact Sheet 074-98

[22] Thurman, E.M. et al. 1992. A Reconnaissance Study of Herbicides and Their Metabolites in Surface Water of the Midwestern United States Using Immunoassay and Gas Chromatography/Mass Spectrometry. *Environ. Sci. Technoi. 26:* 2440-2447

which are among the most vulnerable to atrazine exposure. Under this program, CWS that may approach levels of concern are monitored for a period of time. Monitoring is not enough. Plans must immediately be put in place to decrease atrazine use in all areas, especially those located around CWS that are of concern to the agency. All areas must show a marked decrease of atrazine concentrations in surface waters. The agency's goal must be to reduce exposure across the board, not just in areas of high concern. On EPA's website[23] the agency states, "Some people who drink water containing atrazine in excess of the MCL over many years could experience problems with their cardiovascular system or reproductive difficulties." EPA is aware of the severity on continued atrazine exposures and yet has taken no effect action in reducing atrazine contamination. In order to reduce exposures, the most effect method is a cancellation of atrazine.

3. Alternatives to Atrazine are Widely Available

The continued use of atrazine represents an "unreasonable risk to man or the environment" when "taking into account the economic, social, and environmental costs and benefits of the use" of the pesticide. (*Federal Insecticide, Fungicide and Rodenticide Act* [(FIFRA), Sections 2(bb) and 3(c)5(D)] Given the availability of alternative pest management practices that incorporate alternative cultural practices and/or less toxic pest management products, including other registered pesticides, the agency has a statutory duty to revoke all registrations of atrazine products. To the extent that EPA assumes the benefits of atrazine in the marketplace, the agency is not fulfilling its statutory and regulatory duty to evaluate benefits in light of risk criteria being exceeded. Certainly, a review of the literature and an inventory of field experience in integrated pest management and organic agriculture evidence the viability of alternative practices that do not use atrazine. If EPA is unable to access this literature and field experience, Beyond Pesticides would be happy to assist in this process. Suffice it to say, EPA is failing to meet its legal responsibility under FIFRA with the continued registration of atrazine. The U.S. lags behind the rest of the world in prioritizing the protection of the health of its citizen's and environment from this toxic endocrine disruptor.

Conclusion

Beyond Pesticides supports the call by Save the Frogs and many others calling for a ban on atrazine. Previous calls for a ban were met with the agency announcing that it was launching a new evaluation of atrazine to determine its effects on humans. At the end of this process, the agency stated that it will decide whether to revise its current risk assessment of the pesticide and whether new restrictions are necessary to better protect public health. Atrazine washes

[23] USEPA. 2011. Basic Information about Atrazine in Drinking Water. Retrieved from http://water.epa.gov/drink/contaminants/basicinformation/atrazine.cfm#four

into surface water and leaches into groundwater, and then finds its way into municipal drinking water. It has been linked to a myriad of health problems in humans including disruption of endocrine disruption, cancer and birth defects. As the most commonly detected pesticide in rivers, streams and wells it has a tendency to persist in soils and move with water, making it a common water contaminant. Atrazine is a major threat to wildlife. It harms the immune, hormone, and reproductive systems of aquatic animals. Fish and amphibians exposed to atrazine can exhibit hermaphrodism. Male frogs exposed to atrazine concentrations within federal standards can become so completely female that they can mate and lay viable eggs. 73-78 million pounds of atrazine are used each year in the U.S., second only to glyphosate. In spite of the availability of other herbicides on the market, including least toxic options, atrazine use has not declined as predicted, but continues to plague much of the Midwest.

These findings cannot go ignored. Atrazine poses unreasonable risks to humans and wildlife at concentrations detected in the environment. Current and anticipated risk mitigation measures, including current best management practices, proposed by EPA and registrants fail to protect. The agency must move quickly to conclude its review of atrazine and find an "unreasonable adverse effect" finding and cancel its registration.

Sincerely,

Nichelle Harriott
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Beyond Pesticides