COMMENTS FOR SUBMISSION TO THE USEPA OFFICE OF PESTICIDE PROGRAMS RE-REGISTRATION ELIGIBILITY DECISION (RED) DOCKET FOR ATRAZINE

The Significance of the Hayes et al. (2001) Study on the Current Understanding of Developmental Disorders in Amphibians Exposed to Atrazine

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COMMENTS FOR SUBMISSION TO THE USEPA DOCKET PERTAINING TO THE SIGNIFICANCE OF THE HAYES STUDY ON THE CURRENT UNDERSTANDING OF DEVELOPMENTAL DISORDERS IN AMPHIBIANS EXPOSED TO ATRAZINE

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I. EXECUTIVE SUMMARY

The Triazine Network is respectfully submitting comments to the United States Environmental Protection Agency's (USEPA) public docket on atrazine pertaining to the results of a study conducted by Dr. Tyrone Hayes and co-researchers at the University of California, Berkeley reportedly linking altered sex steroid levels and gonadal abnormalities in the African clawed frog (*Xenopus laevis*) to exposure to atrazine at concentrations below the current no observed adverse effect level (NOAEL) of 20 ug/L and the current 3 parts per billion drinking water standard.

The study was first reported in a fifteen-line abstract published as part of the proceedings of the annual Society of Environmental Toxicology and Chemistry (SETAC) meeting held in Nashville, TN in November 2001[1]. The results of the Hayes et al. (2001) study were subsequently reported in the news media on January 21, 2002[2], along with statements by the National Resources Defense Council (NRDC) suggesting that the Agency must pay greater attention to the new information on low-dose/endocrine disruptor issues raised by the Hayes et al. (2001) study. At this time, the full study has not been published in the scientific peer-reviewed literature.

The Triazine Network is a coalition of over 1,000 local and state agricultural associations and farmers located throughout the United States. The coalition was established in 1995 as a result of the USPEA's November 1994 decision to initiate a special review of the triazine herbicides, including atrazine, simazine and cyanazine. The USEPA convenes a special review panel when sufficient concerns are raised that use of an agricultural chemical may pose unacceptable risks to human health or the environment. Since its inception, the members of the Triazine Network have committed to the use of sound science and established scientific methods to evaluate the health and environmental impacts of the triazine herbicides.

As part of this commitment to support sound decision making by USEPA with regard to the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) re-registration process, The Triazine Network asked ENVIRON International Corporation (ENVIRON) to perform a review of the relevant scientific literature and to provide their professional opinion of the significance of the findings reported in the study conducted by Hayes et al. (2001) linking atrazine to endocrine disruption in frogs.

Technical Findings

It is evident from a review of the scientific literature that pollution has been a commonly hypothesized causal factor for the declines in amphibian populations worldwide (deSolla

[1] Hayes TB, Stuart AA, Vonk A, Liu R. Atrazine disrupts sex differentiation in the African clawed frog (*Xenopus laevis*) at ecological relevant doses. SETAC 22nd Annual Meeting, Abstract 421, page 90.

[2] "Atrazine exposures under 1 ppb may disrupt endocrine disruption". Risk Policy Report - In the News, InsideEPA, page 27.

et al., 2002; Houlahan et al., 2000; Lutz and Kloas, 1999; Blaustein and Wake, 1990). Although several factors, both anthropogenic and environmental, have been suggested as the cause in declines of several species, a unifying or clear cause has not been identified (Corn, 1994; Bishop and Pettit, 1992). Many chemicals released into the environment without toxicological risks have the capacities to disrupt the function of endocrine systems in nearly all classes of vertebrates, including amphibians (deSolla et al., 2002; Lutz and Kloas, 1999). Increased mortality of eggs, physical deformities, altered steroid sex hormone levels, and changes in male:female sex ratios are among the developmental effects most often observed in laboratory studies. However, in general, information on the effects of agricultural chemicals on wild populations of frogs and other amphibians is lacking (Solomon et al., 1996; Bishop and Pettit, 1992).

Several ecotoxicological and ecological risk assessment studies of atrazine, including laboratory studies of potential developmental and reproductive effects, on amphibians have been conducted and the results published in the scientific peer-review literature (e.g., Mendoza et al., 2002; Allran and Karasov, 2001a, 2001b; Diana et al., 2000; Howe et al., 1998). In general, developmental effects have been observed in amphibians exposed to concentrations significantly greater (10-fold and higher) than the 20 ug/L NOAEL identified for atrazine in surface waters (Giddings et al., 2000; Solomon et al., 1996). Research in this area is ongoing and new information is anticipated in the peer-reviewed literature as scientists better understand endocrine mechanisms in amphibians.

Based on a review of the current scientific literature, USEPA's guidelines for evaluating chemicals and endocrine disruption, and the limited information describing the methods and results of the Hayes et al. (2001) study, ENVIRON has reached the following conclusions:

1. The methods, results and conclusions of the Hayes et al. (2001) study are reported only in the SETAC 2001 abstract, which is insufficient to warrant consideration by USEPA as scientifically valid.

2. The scientific accuracy and credibility of the conclusions claimed by Hayes et al. (2001) and others cannot be ascertained at this time. In the absence of both a full documentation of the Hayes et al. (2001) study and full and unbiased scientific peer-review by qualified independent experts, the significance of the Hayes et al. (2001) study cannot be fully appreciated by the news media, regulatory authorities, the general public, the agricultural community, or the scientific community;

3. There are significant scientific uncertainties associated with the current state of the science regarding the association between chemical exposure, including exposure to atrazine, and adverse developmental and reproductive effects in amphibians. The experimental and environmental factors that are widely recognized by scientists to confound the study of physiological processes involving growth and development in amphibians and other invertebrates need to

be addressed through additional independent experimental studies using scientifically valid and reproducible methods.

4. The relevance of the Hayes et al. (2001) study to current regulatory deliberations concerning re-registration of atrazine for continued agricultural use in the United States is not known at this time. At present, the scientific community does not have complete documentation of the experimental methods, results, and conclusions. Furthermore, the study has not been subject to full scientific peer-review by qualified independent experts.

5. Lastly, it is evident that there is a great need for additional study of both atrazine and endocrine processes in amphibians and the factors that can modify those processes using USEPA-approved experimental methods and generally accepted principles for conducting and reporting scientific information.

II. INTRODUCTION

The Triazine Network is a coalition of over 1,000 local and state agricultural associations and farmers located throughout the United States. The coalition was established in 1995 as a result of the USEPA's November 1994 decision to initiate a special review of the triazine herbicides, including atrazine, simazine and cyanazine. The USEPA convenes a special review panel when sufficient concerns are raised that use of an agricultural chemical may pose unacceptable risks to human health or the environment. Since its inception, the members of the Triazine Network have committed to the use of sound science and established scientific methods to evaluate the health and environmental impacts of the triazine herbicides.

Atrazine is vitally important to the American agricultural community.

Agricultural producers across the country rely on atrazine as the foundation of their weed control programs. After more than 35 years on the market, two herbicides, atrazine and simazine, have become weed control staples of American agriculture. Atrazine is used on more than two-thirds of all U.S. corn and sorghum acreage, as well as 90 percent of sugarcane acreage. Simazine is used on 30 high-value crops, including citrus, apples, grapes and other fruits, nuts, vegetables, turf grass, ornamentals and conifers. The members of The Triazine Network are very concerned that a rush to judgment by the USEPA regarding atrazine's environmental impacts would result in unnecessary and significant economic costs to American farmers and environmental damage if atrazine products were unavailable or their use strictly limited on the basis of poor or inadequate science and risk assessment.

The Triazine Network supports USEPA decisions that are based on sound science.

Since its inception in 1995, The Triazine Network has committed to assist the USEPA's Special Review panel and the Office of Pesticide Programs in the use of sound science and established scientific methods to evaluate the health and environmental impacts of atrazine and the other triazine herbicides. The Triazine Network is aware of the more than 80,000 individuals and organizations from the U.S. agricultural community who have responded with information on farming practices and to express their concerns to the USEPA Special Review panel. The members of The Triazine Network share the concerns of the U.S. agricultural community that the Special Review of the triazine herbicides and the Office of Pesticide Programs re-registration eligibility decision (RED) for atrazine base their deliberations on a thorough understanding of U.S. farming practices and a comprehensive, scientifically defensible evaluation of the available environmental data.

The Triazine Network is troubled by recent news reports identifying atrazine as an endocrine disruptor based on unsubstantiated research linking atrazine exposure to adverse developmental effects in a species of frog not indigenous to North America.

Recently, a study conducted by Dr. Tyrone Hayes and co-researchers at the University of California, Berkeley Department of Integrative Biology reportedly linked exposure to atrazine at concentrations below the current no observed adverse effect level (NOAEL) of 20 ug/L and the current 3 parts per billion (ppb) drinking water standard to endocrine disruption in the African clawed frog (*Xenopus laevis*). The study was first reported in a fifteen-line abstract published as part of the proceedings of the annual Society of Environmental Toxicology and Chemistry (SETAC) meeting held in Nashville, TN in November 2001[3]. The results of the Hayes et al. (2001) study were subsequently reported in the news media on January 21, 2002[4], along with statements by the National Resources Defense Council (NRDC) suggesting that the Agency must pay greater attention to the new information on low-dose/endocrine disruptor issues raised by the Hayes et al. (2001) study. At this time, the full study has not been published in the scientific peer-reviewed literature.

As part of The Triazine Network's commitment to support the use of sound science in decision making by USEPA with regard to the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) re-registration process, The Triazine Network asked ENVIRON International Corporation (ENVIRON) to perform a review of the relevant scientific literature and to provide their professional opinion of the significance of the findings reported in the study conducted by Hayes et al. (2001). Statements attributed to Dr. Hayes by the news media claim that frogs exposed to low concentrations (below 1 ppb) of atrazine suffered various abnormalities in gonadal development, including sexual development in frogs by increasing levels of aromatase, an enzyme that converts testosterone to estrogen and results in feminization and hermaphroditism, which would likely render male frogs sterile. This document summarizes ENVIRON's professional opinions.

[3] Hayes TB, Stuart AA, Vonk A, Liu R. Atrazine disrupts sex differentiation in the African clawed frog (*Xenopus laevis*) at ecological relevant doses. SETAC 22nd Annual Meeting, Abstract 421, page 90.

[4] "Atrazine exposures under 1 ppb may disrupt endocrine disruption". Risk Policy Report - In the News, InsideEPA, page 27.

III. TECHNICAL CONCERNS

A. Preliminary Nature of the Hayes et al. (2001) Study

The experimental methods and results described by Dr. Hayes at the November 2001 annual SETAC meeting and in the news media have not been subject to full scientific peer-review by qualified experts. Additionally, the results of the study conducted by Dr. Hayes have not been published in a scientific peer-reviewed journal. In the absence of both a full documentation of the Hayes et al. (2001) study and a full scientific peer-review by qualified independent experts, the study and its results are preliminary, at best.

B. Scientific Uncertainties in Amphibian Developmental Studies

Several sources of scientific uncertainty associated with the study conducted by Dr. Hayes (role of aromatase induction, correlation of native intersex frogs with atrazine use patterns, and selection of Xenopus laevis as a test subject) raise concerns.

1. Significance of Aromatase Induction in Amphibians

The assessment of the estrogenic potencies of atrazine (as well as the potency of any other chemical) includes several levels of biochemical investigation: (I) the ability of the chemicals to bind to a specific liver estrogen receptor, (II) clear evidence of chemically altered estrogenic activity *in vitro* by inducing vitellogenin synthesis in primary cultured hepatocytes, and (III) clear evidence of *in vivo* effects on sexual development caused by exposure of larvae (Lutz and Kloas, 1999). Hayes et al. (2001) appear to suggest that all three of these biochemical actions occur in frogs exposed to atrazine. Specifically, Dr. Hayes has suggested in early news reports that atrazine affects frog sexual development by stimulating an increase in levels of aromatase, an enzyme that converts testosterone to estrogen, which may result in partial male frog feminization, gonadal deformities, and sterility in male frogs (Renner, 2000).

The biochemical mechanism(s) of action associated with the manifestation of developmental disorders in frogs and other vertebrate species is poorly understood. Many chemicals released into the environment without toxicological risks have the capacities to disrupt the function of endocrine systems in nearly all classes of vertebrates, including amphibians (deSolla et al., 2002; Lutz and Kloas, 1999). Increased mortality of eggs, physical deformities, altered steroid sex hormone levels, and changes in male:female sex ratios are among the developmental effects most often observed in laboratory studies. However, in general, information on the effects of agricultural chemicals on wild populations of frogs and other amphibians is lacking (Solomon et al., 1996; Bishop and Pettit, 1992).

The specific mechanism by which atrazine could alter sexual differentiation in *Xenopus laevis*, and whether the biochemical mechanism includes aromatase induction, is poorly understood at the present time (Mendoza et al. (2002). Scientists have long suspected

that the production of aromatase can lead to conversion of androgens to estrogens, which, in turn, may affect sexual differentiation at a critical stage of development (Guerriero et al., 2000). However, the significance of aromatase induction and factors that may confound normal hormonal functions in humans, amphibians and other vertebrates are not well understood.

It is widely recognized that a wide range of environmental and xenobiotic factors can stimulate induction of enzyme activities, including aromatase (SETAC, 2000; Sheehan et al., 1999). For example, a recent study suggested that several agricultural chemicals might either promote or inhibit aromatase activity, although the biochemical mechanisms remain unclear (Raun-Andersen et al., 2002). Raun-Andersen et al. (2002) speculate that although the potencies of different pesticides to react as hormone agonists or antagonists are low compared to natural ligands, the response to exposure by an organism might be amplified by the ability of the pesticides to act via several mechanisms and frequent simultaneous exposure to several pesticides and environmental chemicals.

Other recent studies indicate that aromatase activity can be altered by short term captivity stresses in frogs (Gobbetti and Zerani, 1996), temperature changes (Baroilla and D'Costa, 2001; Chardard et al., 1995), subtle genetic differences in seemingly identical species (Takase, 1998), ultraviolet light (Blaustein et al., 1994), pathogens (Morell, 1999) and, at times, spontaneously (Wallace et al., 1999). According to a recent NRC (2000) review of hormonally active agents in the environment, studies are needed of altered hormone concentrations or modifications of the endocrine system of free-living amphibians to explore whether deformities and other developmental effects observed or suspected in the wild are related to hormonal modification. Hence, attributing aromatase induction to atrazine requires a considerable amount of additional investigation to account for potentially confounding factors.

2. Correlation of Native Frog Spawning with Atrazine Use

There is no statistical evidence or detailed scientific study to support statements attributed to Dr. Hayes in the news media indicating that he has found a relationship between the spawning season in wild frogs and exposure to atrazine. According to Dr. Hayes, wild frogs spawn at the same time atrazine levels in surface waters are highest; surface water concentrations are highest at the time of the first heavy spring rains, which is also the period when frogs spawn (Renner, 2000). As a consequence, Dr. Hayes claims that wild frogs could be exposed to concentrations of atrazine sufficient to cause adverse developmental effects (Renner, 2000).

In addition to the absence of scientific evidence, any correlation between wild frog spawning and the presence of atrazine in surface waters is not a basis for establishing cause and effect with any degree of certainty. Several confounding factors, including fluctuations in water temperature and the presence of other chemicals, could exert similar effects (Raun-Andersen et al., 2002; Baroilla and D'Costa, 2001; Sheehan et al., 1999; Gobbetti and Zerani, 1996; Chardard et al., 1995). Several studies suggest that declines

in amphibian populations are attributable to anthropogenic factors such as introduction of non-native species, habitat destruction, and habitat fragmentation (Howe et al., 1999). In fact, several studies report the disappearance of several species of frogs from areas that could arguably be considered pristine and unaffected by environmental chemicals, including agricultural chemicals (Howe et al., 1998).

3. Relevance of *Xenopus laevis* to Indigenous North American Species

A source of uncertainty typically acknowledged by scientists in nearly all ecotoxicological studies involving experimental animals pertains to the issue of whether the results observed in tested animals can be extrapolated to native, indigenous (i.e., wild) populations. The African clawed frog is a native species of the Lake Victoria basin in Africa and is not representative of species indigenous to North America (Goleman et al., 2002; Osono et al., 2002). *Xenopus laevis* is not native to North American surface waters. Additional testing is needed to determine if the results reported by Hayes et al. (2001) are evident in species of frog indigenous to North America and, specifically, species from agricultural regions where atrazine is used, before drawing conclusions about environmentally relevant concentrations of atrazine disrupting sexual development of native frog species in the Midwest.

African clawed frogs have been shown to be hypersensitive to various environmental and xenobiotic factors, including those that may play a role in enzyme induction at critical life stages (Gidding et al., 2000). Experimental studies involving this species have reported on the highly sensitive nature of this species, and the difficulties associated with maintaining these animals for experimental use (deSallo et al., 2002).

Currently, "sentinel" species (that is, organisms used to detect effects of chemical exposures and/or physical stresses) are typically used to evaluate environmental contaminants. According to USEPA (1997), research is needed to determine whether species such as *Xenopus laevis* and other vertebrates are adequate surrogates for identifying and evaluating chemicals as endocrine disruptors. An important component of this evaluation process is validation of the physiological, behavioral, and stress (either chemical or physical) responses observed in experimental organisms with their native, indigenous counterparts (USEPA, 1997).

4. Confounding Physiological, Anthropogenic and Environmental Factors

Although the study of developmental disorders in amphibians is a relatively new area of ecological investigation, several studies have been conducted within the past few years to evaluate sex determination in frogs as well as the effects of atrazine on amphibians. The findings reported in several recent studies suggest that significant additional research is needed to understand developmental disorders in amphibians.

There is no indication from the limited information describing the experimental methods used in the Hayes et al. (2001) that the influences of several potentially confounding

physiological and environmental factors, few of which are well understood at the present time, were properly controlled in accordance with a rigorous experimental design. For example:

- Studies by Miyata and Kubo (2000) of *Xenopus laevis* tadpole gonads in the indifferent stage indicate that estradiol is important for ovarian differentiation in *Xenopus laevis*. The majority (90%) of indifferent gonads cultured in estradiol for 14 days showed female histological characteristics. Gonads maintained for 14 days *in vitro* in a medium containing an aromatase inhibitor (CGS 16949A showed the histological characteristics of the male phenotype. According to Guerriero et al. (2000), both aromatase activity and nuclear estrogen receptor binding fluctuate in synchrony throughout the reproductive cycle in the female frog, *Rana esculenta*. The role of estrogens in the modulation of the reproductive behavior in frogs requires further investigation.

- In reptiles and amphibians displaying environmental sex determination, the main environmental factor influencing sex seems to be temperature (sometimes referred to by scientists as TSD, or temperature sex determination). In most thermosensitive species such as amphibians and reptiles, the male to female ratio in a population increases with temperature and/or ovarian differentiation is induced by low temperatures. In reptiles and amphibians displaying TSD, temperature treatments must be applied at a critical sensitive period, relatively similar to the hormone sensitive period (Baroliller and D'Cotta, 2001).

- Because temperature is known to play a key role in sex determination in several species, particularly in cold-blooded animals (Sheehan et al., 1999), the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC) has strongly recommended research to develop a reptilian reproduction test that is sensitive to temperature-dependent sex determination (USEPA, 1998).

- According to Allran and Karasov (2001), field grade atrazine contains other chemicals such as solvents and surfactants that may be toxic to amphibians. In fact, studies suggest that field grade mixtures appear to be more toxic to amphibians than the pure compound (Allran and Karasov, 2001). It is possible, in some studies reported in the scientific literature, that other chemicals/agents may be responsible for, or enhance, observed adverse effects, including hormonal-mediated effects.

C. USEPA's Endocrine Disruption Guidelines

Because studies such as the Hayes et al. (2001) study represent a relatively new area of ecological study, claims such as those by Hayes must be carefully evaluated and in accordance with established principles of scientific study. These principles include independent peer-review and the reproducibility of experimental methods. In the context of regulatory decision-making involving USEPA, studies also must adhere to established guidelines and use agency-approved experimental methods.

For known or suspected hormonally active chemicals, USEPA's Endocrine Disruptor Screening Program guides the Agency's focus on establishing methods and procedures to detect and characterize endocrine activity of pesticides, commercial chemicals, and environmental contaminants. The program is overseen by an advisory committee, the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), to review recommendations for implementation and expansion of the screening program. Because many of the endocrine disruptor screens and tests involve cutting-edge science, few of them have actually undergone the standardization and validation requirements required by USEPA to support pesticide and chemical regulations.

USEPA intends to validate all proposed experimental systems to ensure that the tests are reliable and reproducible. Many of the tests proposed for the screening program have been used in research, but have never been formally standardized or validated through inter-laboratory comparisons. Accordingly USEPA (1997) has stated that standardization and validation is essential to establish the relevance, reliability, and reproducibility of any proposed methods or test data provided for regulatory consideration.

Based on the limited available information describing the methods used by Hayes et al. (2001), the experimental design is not currently recognized by USEPA in the EDSTAC program. The study design does not appear to be recognized by USEPA as an approved assay in either the Tier 1 screening test battery or Tier 2 *in vivo* test battery (USEPA, 1998). The program cites guidelines established by the National Institute for Environmental Health Sciences (NIEHS) for validation and regulatory acceptance of toxicological test methods (NIEHS, 1997).

The study also does not meet current EDSTAC program requirements for peer-review and independent validation of test methods and results. The EDSTAC program considers the number of available independent, peer-reviewed publications an important indication of the validity of test methods and experimental results reported by the scientific community when evaluating new or modified endocrine disruptor screening assays (USEPA, 1998).

D. Significance to Current Regulatory Deliberations

Of equal and pressing concern to both the scientific and regulatory communities is the representation of information to the USEPA as objective and sound science, but which has not been subject to standard scientific peer-review and the principles prescribed for sound science. Recognizing the need to improve the quality of scientific and other data used in regulatory decision-making, the USEPA Administrator established in October 1999 the Office of Environmental Information (OEI). The OEI has central responsibility over information management, policy and technology, and oversees the way the Agency collects, manages, analyzes and provides access to environmental information for the American public. The Data Quality Act enacted in December 2000 instructs OEI to further clarify and specify standards for the quality of scientific information and statistics used and disseminated by federal agencies.

In the absence of full disclosure to USEPA and the scientific community, the current limitations of the Hayes study (as described herein) are completely lost to the news media, regulatory authorities, and the general public. If actions such as those of Hayes are endorsed by the Agency (either willfully or by failure to properly review and question the study), special interests will continue to use this approach to introduce materials that support their environmental regulatory agendas, but which by pass the legitimacy of the centuries-old application of the scientific method to repeat, validate, and verify scientific studies.

IV. CONCLUSIONS

Based on review of the scientific literature, USEPA's guidelines for evaluating chemicals and endocrine disruption, and the limited information describing the methods and results of the Hayes et al. (2001) study, ENVIRON has concluded that there are several important technical issues that limit the scientific accuracy and credibility of the conclusion reported in the news media that atrazine exposures under 1 part per billion may disrupt the endocrine system in *Xenopus laevis* via induction of aromatase and related hormonal mechanisms of action. The underlying experimental evidence supporting this claim needs to be addressed through additional study using scientifically valid experimental methods performed by several independent researchers before the results of the Hayes et al. (2001) study can be considered as valid by the USEPA.

Consequently, the members of The Triazine Network would become alarmed if USEPA were to consider the Hayes et al. (2001) in the absence of both full documentation of the study and completion of a full scientific peer-review by qualified independent experts. The significance of the methods, results, and conclusions of the study cannot be appreciated by the news media, regulatory authorities, the agricultural community, the scientific community, or the general public at this time.

In summary, ENVIRON has reached the following conclusions with regard to the Hayes et al. (2001) study:

- The scientific accuracy and credibility of statements attributed to Dr. Hayes by the news media and the methods and findings described in the SETAC abstract cannot be ascertained at this time.

- There is no indication that the Hayes et al. (2001) has addressed or resolved the significant scientific uncertainties generally associated with the current state of the science regarding the association between chemical exposure, including atrazine, and adverse developmental and reproductive effects in amphibians.

- There is no indication that the Hayes et al. (2001) study addressed experimental and environmental factors that are widely recognized by scientists to confound the study of physiological processes involving growth and development in amphibians and other organisms.

- The Hayes et al. (2001) must be considered as preliminary until such time as the experimental protocol is replicated independently by other scientists and all methods, results, and conclusions subject to full scientific peer-review.

- In the absence of absence of both full documentation of the experimental methods, results, and conclusions and scientific peer-review by qualified independent experts, the Hayes et al. (2001) study is not relevant to current regulatory deliberations.

Based on ENVIRON's review, the members of The Triazine Network strongly believe that several important technical issues limit the scientific accuracy and credibility of the current preliminary environmental fate and effects chapter. These and other unresolved technical issues must be fully addressed by USEPA prior to completion of the RED process to ensure that results of the RED process for atrazine are founded on a valid, scientifically defensible risk assessment that is supported by sound, scientifically defensible experimental and field studies.

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