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Augmentative probable impact of Atrazine and Ubiquitous persistent on Prokaryotic and Eukaryotic organisms

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Abstract

Atrazine is the common name for an herbicide that is widely used to kill weeds. It is used mostly on farms. Pure atrazine-an odorless, white powder-is not very volatile, reactive, or flammable. It will dissolve in water but it does not occur naturally. Atrazine is used on crops such as sugarcane, corn, pineapples, sorghum, and macadamia nuts, and on evergreen tree farms and for evergreen forest regrowth. Atrazine is moderately toxic to slightly toxic to most fish species, and somewhat less toxic to aquatic invertebrates also this herbicide is highly toxic to aquatic vascular plants and algae. Atrazine was first released for experiment station evaluations in 1957 and became commercially available in 1958. Intensification of agriculture and the corresponding increase in herbicide use has led to concern regarding the effects these chemicals may have on non target plants of agroeco systems. Current pesticide registration guidelines are focused on testing crop species grown singly in pots under greenhouse conditions and may not provide adequate measures of protection to non crop species. It quickly became the most popular of the triazines for its effectiveness against a wide spectrum of weeds in a range of conditions, including in dry soil. It has since become one of the most widely researched herbicides to date. It is chlorinated herbicide and most heavily used worldwide. It has been observed that their long-term, low dose exposure are increasingly linked to human health effects such as immune-suppression, hormone disruption, diminished intelligence, reproductive abnormalities, and cancer. It has been detected in water bodies Chronic fish tests primarily evaluated the potential for reproductive effects and effects on the offspring. This paper is an attempt to review is outlined the possible ill effect created by atrazine usage both prokaryotic and eukaryotic organisms.

Keywords: Atrazine, Impact, Environment, Toxicity, Health Effect

Contents

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1. Introduction

One of the most widely used agricultural pesticides in the U.S., atrazine may be applied before and after planting to control broadleaf and grassy weeds. It is used primarily on corn, sorghum, and sugarcane, and is applied most heavily in the Midwest even India. The use of herbicides in agriculture to boost food production is a major factor contributing to the degradation of our environment. The implementation of appropriate management strategies requires that adequate information be developed regarding the types, physical and chemical properties, fate, and toxicity of these herbicides. The contamination of soil, ground water and surface waters by herbicides posse€s major problems (Rousseaux *et al.*, 2001). At present the most common approach is contamination involving costly removal of highly contaminated soil to landfill sites (Antonio *et al*., 2010). Bioremediation methods for in situ treatments are needed as alternate and /or supplementary residue free clean up. (Parag *et al.,* 2007).

Herbicides are increasing being used to enhance crop production controlling vegetation. (Luciane *et al.,* 2010). Atrazine (2-chloro-4-ethylamino-6-isopropylamino)-s-triazine is a triazine herbicide that is used primarily on corn and soybean crops to control growth of broadleaf and grassy weeds. It is the most heavily used agricultural pesticide in the United States, with an estimated 76.4 million pounds applied annually, (Lucian *et al*., 2010). At the same time several countries not agree to concede atrazine because of it toxicity (Jin and Ke 2002). Atrazine is now being used in Indian as the herbicide of corn, sugarcane, soybean, and so used some rains verity also (Khan *et al*., 2006). It is at most heavily applicable agricultural herbicide for crop production in the united state (Gianessi and Puttor, 1991; Gianessi *et al*., 1985). According to world health organization which can be allowed boundary is restricted to 2 Mg/l (chan and chu 2005).The average half-life Periods of atrazine in soil range from 30-261 days (Us pA, 2003) in ground water more than (100 days) (Seiler *et al* ., 1992) in salt water around 10 days (Armbrast *et al*., 1991) and nearly 660 day in case non degradation sites (Fraitage *et al*., 1984) Atrazine possible to case carcinogenic in both animal and human studies, because cancer induced in atrazine exposed pesticide applicators among 53,943 participant in the Agricultural Studies (Ruziicka *et al*, 2002, National cancer Institutions, USA).

Human exposure to atrazine occurs occupationally in farming and manufacturing and environmentally through contaminated drinking water or drift. Atrazine is the most commonly detected pesticide in surface water in surveys in the Midwestern United State, (EPA, 2004). Atrazine is a highly pollutant of environment anxiety due to its low durability and high potential contamination of surface water and ground water (Chan and Chu, 2005). The atrazine related suppression of prostate carcinogenesis was probably caused by the decreased in calorie in tale, Rather than by atrazine related endocrine disruption (Kandori *et al,* 2005).

Animal and human studies on the carcinogenic effects of exposure to atrazine have been mixed. Oral administration of atrazine was associated with increased incidence and earlier onset of mammary tumors female Sprague• Dawley rats but not in other strains of rats or in other mammals, (Stevens *et al*., 1999). Atrazine exposure was also associated with lymphomas and testicular cancer in rats and mice in some studies *(*Pinter *et al., 1990).* Several epidemiologic studies in humans have evaluated cancer risks associated with atrazine exposure *(*De Roos e*t al*., 2003). Slightly greater than expected numbers of bladder, oral cavity, and lymph hematopoietic cancers were observed in a cohort of triazine herbicide manufacturing workers; however, none of the increases were statistically significant, and the people in the study were exposed to carcinogens other than atrazine, (MacLennan *et al*., 2002). The present article represents the site-specific probable impacts of atrazine on two broad kinds of organisms and risk among pesticide applicators exposed to atrazine in animals and human beings.

Detrimental impacts of Atrazine on plants and wildlife

Atrazine is the second largest selling pesticide in the world (largest up until 2001) (Miller, 200; Muller, 1997). It is an herbicide (weed-killer) used primarily on corn, but also on crops such as sorghum, sugar cane, and Christmas trees. Also of note, it is used in forestry after tree harvesting. In addition to the ecological impacts on land, recently, the National Oceanic and Atmospheric Administration (NOAA), showed that atrazine negatively affects marine phytoplankton (Rohr, 2004; Rohr and Palmer, 2005**).** These microscopic organisms serve as food for other organisms such as clams and oysters and the effect of atrazine is likely reflected throughout marine food webs (Gianessi, 2003).

Phytoplankton serves as food for zooplankton which is in turn food for many larval and young fish and several species of whales (Fairchild *et al*., 1998). Thus, atrazine impact on this critical member of the marine food web will have dramatic and irreversible effects on marine life including damage to commercially important shellfish and finfish populations as well as sea mammals (whales) of which many are already threatened or endangered. According to Heap, (1997) and Gadamski, (2003) predicted that the number of documented atrazine resistant super weeds are more than 80. Also they profounded no other herbicide has produced such a dramatic effects on the evolution of the weeds. Similarly atrazine negatively affects the freshwater aquatic habitats. Several studies have shown that atrazine decreases algae and other aquatic plant life (Fairchild et al., 1997, Rohr, 2004; Rohr and Palmer,

2005). Aquatic exposure is likely to be transient in flowing waters. However, because of the exceptions where terrestrially applied herbicides could have effects on aquatic plants, OPP does evaluate the sensitivity of aquatic macrophytes to these herbicides to determine if populations of aquatic macrophytes that would serve as cover for fish would be affected **(**Johnson and Finley, 1980). Furthermore, Saglio and Trijasse, (1998) indicated that there were morphological effects to the kidney of rainbow trout (Oncorhynchus mykiss) when this species was exposed to atrazine for 28 days at a level of 5 ppb level of concentration.

Table 1. Predominant effect and measurable affected quantity of Atrazine for categories of fish, aquatic invertebrate and plant toxicity

Fish And Aquatic Invertebrate	
Affected Quantity (in ppm)	**Measurable effect(s)**
0.1	Very highly toxic
< 0.1- 1 ppm	Highly toxic
>1 < 10	Moderately toxic
>10 < 100	Slightly toxic
>100	Practically non-toxic
Plants	
5mM	Iron leakage, increased production of Lipid peroxide products and Change the activites of antioxidant enzymes, SOD and GP
8mM	Altered the different metabolite production
12-15mM	Block the Electron Transport chain in Chloroplast
15-18mM	Affect the Photosystem-II and scratch the photosynthetic membrane
Algae	
>3.7 ppb	Arrest the photosynthetic pigments and its production

2. Toxicological profile of Atrazine

The Atrazine toxicological profile succinctly characterizes the toxicologic and adverse health effects information for the hazardous to prokaryotic as well as Eukarotic organisms described here. Each peer-reviewed profile identifies and reviews the key literature that describes a perilous phenomenon and its toxicologic properties of atrazine herbicides (Chan and Chu, 2007). Other pertinent literature is also presented, but is described in less detail than the key studies (De Roos *et al*., 2003). Atrazine can cause moderate toxicity to humans and other animals. It can be absorbed orally dermal and by inhalation (Luciane *et al*., 2010). Acute toxicity data indicates atrazine is moderately to practically non-toxic to freshwater fish with values ranging from 4,500 ppb to 69,000 ppb depending on species and percent active ingredient being tested (Freitag *et al*., 1985).

Acute toxicity to marine and estuarine fish ranged from slightly to highly toxic with values from 1,000 ppb to 13,400 ppb. Chronic toxicity values ranged from 60 ppb to 250 ppb for freshwater invertebrates and fish described by Moore *et al*. (2003). On an acute basis, atrazine is highly to practically nontoxic to freshwater invertebrates with values ranging from 720 ppb to 115,000 ppb; for estuarine invertebrates acute toxicity range from 94 ppb to 197,850

ppb. Again, Moore and Waring (1998) found endocrine effects of atrazine on Atlantic salmon when excised olfactory bulbs were perfused with atrazine solutions. This is indicative of endocrine disruption, but the test levels of an in vitro study cannot be assigned to whole fish in natural environments.

Figure 1. Additional Sensibly viable Health effect of Atrazine

3. Ecological Classic Effects

Atrazine is practically, non toxic to birds. The LD-50 is greater than 2000 mg/kg in mallard ducks. Atrazine is slightly toxic to fish and other aquatic life. In whitefish, Atrazine accumulates in the brain gall bladder, liver and gut (Zucker, 1985). Atrazine is highly persistent in soil through a Chemical hydrolysis, followed by degradation by soil microbes, accounts for most of the breakdown of Atrazine (Rousseaux *et al.*, 2003). Hydrolysis is rapid in acidic or basic environments, but is slowed at natural pH. Addition of organic material increases the rate of hydrolysis. Atrazine can persist for longer than 1 year under dry or cold conditions. Atrazine is moderately too highly mobile in soils with low clay or organic matter contents (Houard *et al.*, 1989). Atrazine is second most common pesticide found in private wells in community wells. Atrazine is absorbed by plants mainly through roots, but also through the foliage. Once absorbed it is translocated upward and accumulates in the growing tips and the new leaves of the plant. In susceptible plants Atrazine inhibits photosynthesis. In tolerant plants it is metabolized (U.S. Environmental Protection Agency, 2003).

Concentrations of atrazine that affect aquatic plant community structure, function and productivity typically occur at levels lower than those that directly affect fish and aquatic invertebrates. When the atrazine concentration increases on aquatic system automatically plant community structural and productivity changes, irregular efficiency occurred in invertebrates, fish, and amphibians from the direct effects of atrazine as well as the effects that atrazine chemical components were mixed with the food web chain from primary producers to top consumers (human being). The Agricultural Health Study has several important strengths. It is the largest study to date of pesticide applicators exposed to atrazine. Exposure information was gathered prior to cancer diagnosis, thereby minimizing recall bias. In general, farmers provide reliable information and considerable detail regarding their pesticide application history (Blair *et al.*, 2001). The Agricultural Health Study cohort consists of licensed pesticide applicators who are responsible for thoroughly understanding pesticide regulations and for purchasing and applying chemicals on their farms, (Hoppin *et al.*,2002).

Typical Chemical moieties present in Atrazine and its ill effect

Atrazine has been classified a class possible human carcinogen (Lories *et al.*, 1980) This classification was observed Chromosomal damage of Chinese hamster ovary calls exposed to atrazine ovary cells exposed to atrazine for two days (Birader & Rayburn 1995) Atrazine, dealkylation, metabolites such as deethylatrazine(z-chloro-4amino,6-isopropylamine-1,35-triazine) and deisopropyltrazine 1,2,1,chloro 4-ethlamino 6-amino-1,3,1,5-triazine are also regulated compounds & expose health risks thus warranting investigation of their tastes (Brower *et al.*, 1990; Kolpin *et al.*,1998). Ingested atrazine is readily absorbed in to the body through the gastro intestinal tract and also mainly affect in the liver, kidney and lungs (Hays *et al.*, 1990). Atrazine can cause the changes in blood hormones level in animals that is affect the ability of reproduction system and also affected the human reproduction system for

various mechanism (Michelle *et al*., 2008). Studies of human population indicates that there may be link between atrazine use and some type of cancer but the information was not specific enough to make a definitive connection between cancer and atrazine (Miscalle *et al.,* 2008). The health effect of atrazine are classified in three categories

In the First case post implantation lessees. Decreases in fetal body weight, Neuro developmental affects incomplete bone formation (Pesticide news, 2002). In the second things atrazine reduce the ability to reproduce and also found to be the reason for the premature birth, miscarriage, and various birth defects in human (Pathak and Dikshifr., 2011). The last one carcinogenic effect it includes non-Hodgkin€s lymphoma. Prostrate, brain, breast and ovarian cancer (pesticide News, 2002) Atrazine has no significant carcinogenic effect in rats, mice, rabbits, so it is not considered to be carcinogenic (U.S.D.H.H.S., 2003). The U.S environmental protection Agency has approved the use of atrarine because of the least of a clear association between the level of expose and caner incidences in pesticide application (Gammor *et al*., 2005, Mcelroy *et al.,* 2007; Rusieei *et al.,* 2006). Previous studies can demonstrate that atrazine herbicide does not bind or activated the classical estrogen receptors in human (Monnor *et al*., 1996). In Recent research increasing evidence demonstrated in different experimental models that steroid hormone including estrogen, can exert rapid active interacting with receptors located within cell membrane (Fdellenstein *et al*., 2000; Norman *et al*., 2005)

Atrazine and its Consequences in Animals and Birds

Brodkin *et al*., 2007 reported that atrazine is immune disruptors in frog atrazine alter the expression of the rag gene in Zebra fish, Which is involved in Acquired immune system Disruption (Lieake *et al*., 2008). Solomon *et al.,* (2008) concluded that the environmentally relevant concentration of atoning do not effect reproduction and reproductive development in fish. Atrazine has been continuously affected in the reproductive tissues in the rat (Chatsworth and wetzal, 1998). In the chronic feeding studies using Sprague • Dowdy Female rates shows atrazine causes premature reproductive aging with regular ovarian cycles are replaced by the presence of persistent vaginal cornification and polytollicular ovaries that continue to secrete estrogen, (Eldridge *et al* ., 1999).

In both male and female rats atrazine can suppressed the estrogen • induced surge of lit and probation within 3 days of atrazine treatment (Cooper *et al*., 1996; 2000). Atrazine can interfere with hypothalamic activity in a manner ,it is altered with hormone secretion for oral Atrazine exposure to female adult rates , hypothalamic neuroepinephrine concentration were decreased and turnover were increased (Copper *et al.,* 1998) .The evidence available for atrazine is not directly estrogenic , but many or may not causes some anti estrogenic properties (Graumann *et al.,* 1994). Lephart and Ojeda (1990) reported that hypothalamic aromatizes activity decrease in the per pubertal animal and that is decrease was associated with the decline in sensitivity to testosterone feedback that occurs as puberty progresses , atrazine induced purbertal decay but the increases in serum estrogen in the highest dose of atrazine .

A delay in preputial separation and reproductive tract development in a well known effect of environmental anti androgenic compounds when administered in the male pubertal assay (Monsoon *et al*., 1999).In increased sensitivity of the testes to lit prior to puberty, due to other hormonal influences, such as increased probation, secretion, that facilitate an up regulation of lit Factors (Kamberi *et al*., 1980; O dell *et al.,* 1973; Vihko *et al.,* 1991). Atrazine can suppress the male rate prolactin secretion by the pituitary (Copper *et al*, 2000; Stoker *et al*., 1999). The lit receptors present on the laying cells from PNP 45 and PNP 53 there were no significant difference between control, pair-fed and high dose atrazine males, lit receptor appear on the fetal tastes around GD 15, and their concentration rises significantly between DND 15 and 38 (ketelslegers *et al*.,1978).

Atrazine was presence at Ppb level it has been shown to disrupt sexsual development of amphibians and also may poses serious ecological risks (Rhine *et al* .,2003) Atrazine delays in the male rat and it mode of action appear to be altering the secretion of steroids and having subsequent effect on the development of the reproductive tract, which affect due to the atrazine effect on the CNS (Stoker *et al*., 2000). Dietary feeding of 500-1000 PP.M atrazine using male probasin / SV 40 T antigen transgenic (TG) ratsts tested as a results testosterone level were not affected by atrazine dietary restriction but atrazine related suppression of prostate carcinogenesis was probably caused by the decreasing of calorie intake, rather than by atrazine related endocrine disruption occur (kanodori et al., 2005). Goldman *et al*., 2000 reported the physiological and Biochemical changes occur during sexual maturation in the female rat and also the influence of per pubertal exposure to endocrine disrupting the atrazine. The effect of atrazine on female pubertal development and thyroid function, using the dosing regimen (Goldman *et al.,* 2000). Marty *et al*., (1999) demonstrated the female pubertal profcol using estrogen & selected pharmaceuticals that are known to alter thyroid function or steroid biosynthesis Cooper. The effect on estrous cyclist was observed in the 100 mg/kg AT 2 group where no significant reduction in between was observed (Susan *et al*., 2000).

The Atrazine treated rat indicate that the carcinogenic of fact of high doses of atrazine observed in the Female Sprague • Dacutey is a strain sex and tissue • specific response that does not have biological relevance to human

(James and Stevens, 2010). Grazicell *et al*., 2008 evaluated that atrazine alone did not Stimulate the expression of any of the genes analyzed in both male & female. Atrazine induced gene expression modulator only in female. The major significant changes on the gene expression occur the co-exposure to atrazine in both male & Female mice (Microarray an analysis of 1185 cancer relates gens from RNA extracted from bone marrow of cd-1mice exposed for a months to atrazine in drinking water (1 Mg/L) found that atrazine did not alter expression of any of the genes (Cimio-Reale *et al*., 2008).

4. Multiple Terrible Effects in Humans

A recent study of cancer incidence among atrazine herbicide manufacturing workers in a plant in Louisiana found a statistically significant excess of prostate cancer for actively working company employees (excluding contract or inactive company employees), compared with the general population in that region, (MacLennane *et al* .,2002). Slight suggestions of increased risk were found for lung and bladder cancer in the highest quartile of lifetime days of exposure to atrazine. However, the rate ratios in the intensity weighted lifetime days of exposure analyses were weak for lung cancer and essentially null for bladder cancer. However, atrazine was found in lung tissue at autopsy of a suicide victim poisoned by ingestion of an herbicide mix containing atrazine, (Pommery *et a*l., 1993). Based on the International Agency for Research on Cancer (1999) report the toxicological activity of atrazine in humans is unclear. Toxicity studies have examined various endpoints from atrazine exposure, including carcinogenicity, genotoxicity, endocrine disruption, and immune toxicity. The majority of animal studies indicate that atrazine has low genotoxicity, but there has been no study of genotoxicity in humans. In male and female rats, atrazine disrupts hypothalamic stimulation of pituitary function, resulting in attenuation of luteinizing hormone levels. The EPA has classified atrazine as ,not likely to be a human carcinogen*().* However, the limited data on the effects of atrazine among humans, the provocative findings in animal studies, and the frequency with which this herbicide is used warrant further investigation among exposed populations. According to Hooghe *et al*.,(2000) observed impaired immune function associated with administration of atrazine to cells *in vitro,* including impaired cytokine production (interferon , interleukin 5, and tumor necrosis factor-) by human peripheral blood mononuclear cells and decreased ability of human natural killer cells to lyses tumor cells, (Whalen *et al*.,2003).

Recall of pesticide use by the Agricultural Health Study cohort has been shown to be consistent with the dates these pesticides came on the market, (Hoppin *et al*., 2002) In addition, most atrazine applicators were male (99%), precluding our ability to assess the association between atrazine exposure and female cancers, including ovarian and breast cancers, which have been associated with exposure to triazine herbicides,(Kettle *et al.*,1997). There are hypotheses concerning gestation and early childhood as periods sensitive to endocrine disruptors, (Birnbaum *et al*., 2003). The only other prospective study on cancer and atrazineis from a cohort of triazine herbicide manufacturing workers, in which there were increased standardized incidence ratios for all Lymphatic and hematopoietic cancers, non- Hodgkin lymphoma (NHL), and multiple myeloma among a group of men with ,definite*ƒ* or ,probable ,exposure, (MacLennan *et al.*,2002).

Occur occupationally Studies Concerning atrazine and its Possible association with carcinogen effect in human (Luciana *et al.*, 2010). Based on inadequate data for human and limited data for experimental animals, atrazine was classified possibly carcinogenic to human (International Agency For Research on cancer in 1999). Alanvanja *et al*., 2003 investigated site specific cancer incidence and risk among pesticide applicators exposed to atropine in the Agricultural Health study cohort using a longer follow-up period & larger number of case patient than the prostate cancer exported number of bladder, oral carity, and lymph hematopoietic caner were observed in a cohort of trizine herbicide manufacturing workers (MacLennan *et al*., 2002). A case control study reported variant care found in an increased risk among women farmers ,possibly or definitely exposed to atrazine in their occupation Incidence Among patricide Applicators exposed to in the Agricultural Health Study Fan *et al*., evaluated atrazine incused binding of Sf-1 chromatin and mutation of the sf1 binding site in Ar p11 Dominated SF1 binding and atrazine responsiveness in H2 95 R call, so atrazine, as a risk factor in andesine disruption in worldliest & reproductive cancer in humans. Roberge *et al*., 2000 investigated the interference of atrazine with androgen and estrogen action does not occur by direct agonist or antagonism of cognate receptors for these stories as a shown by binding affinity studs in previous investigations have suggested that atropine redoes androgen synthesis and action and stimulates estrogen production (Huneker *et al*.,2011; Spano *et al*., 2004).

Lehmann *et al*., 2005 reported transcription of the aroma tore gene increases both mimetic acuity of aromatize and estrogen production. Fan et al., 2007b derscribed atropine binds to SFI and facilitates the recruitment of this lauder and PII promoter of the aromatize gene Epidemiologic studies have associated long •term exposure to atrazine herbicide with increased risk of ovarian cancer in female form workers in Italy (Pone *et al*., 1990) he has been demonstrated atropine lead to tumor development in the mammary gland and reproductive organ of female. At the first time Lidia *et al*. 2008 demonstrated that atropine stimulates gene expression and growth effect in estrogen • sensitive ovarian cancer calls through GPR 30 and involvement of ER. GPR 30 Mediates the stimulatory effect of

atrazine in ER-negative Sk Br 3 breast cancer cells. (Tusick *et al*., 2006) he has been reviewed that 68%.applicator using atrazine exposure was not associated with overall cancer incidence composer of concern incidence in applicator with the highest atrazine exposure and those with lowest exposure, assessed by littlie daily (a figure.2).

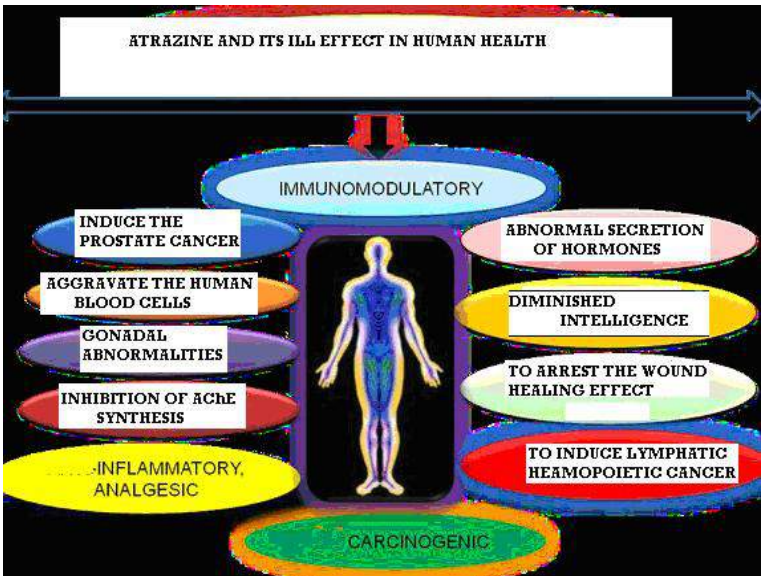

Figure 2. Impact of Atrazine usage in Human health

Interruption of Immunological Mechanisms

During this re-evaluation, EPA will consider the potential for atrazine various immunological effects observed from the wide kinds of applied as well as researched data generated since 2003 from laboratory and population-based studies, including the most recent studies on atrazine and its potential association with birth defects, low birth weight, and premature births (Freitag *et al*., 1985). As an endocrine disruptor, atrazine is thought to have both serious human health and ecological effects. The EPA€s (2013) recent risk assessment states that the EPA suspects that endocrine disruptors may be responsible for adverse effects on the following bodily systems in humans such as female reproductive and development; male reproductive; hypothalamus and pituitary; thyroid; and, immuno-toxicology. Despite the suspicions, however, atrazine-specific human health studies have not been initiated. The EPA€s (2000) risk assessment also states that atrazine is thought to have ecological effects because it can act as a phytoestrogen, as demonstrated by representative examples in: invertebrates, fish, amphibians, reptiles, birds and mammals. Atrazine was also included in an AHS cross-sectional analysis on the effects of pesticide use on menstrual cycle characteristics (Farr *et al*. 2004). Atrazine was grouped with lindane and mancozeb or maneb as a ,probable hormonally active pesticide.*f* Numerous scientific studies have demonstrated the potentially harmful consequences of atrazine, such as its behavior as a phytoestrogen. The government should be more proactive, spend more of its resources encouraging independent research in areas of concern by offering grants, organizing conferences, raising awareness, and keeping a closer eye on new advances in toxicology. Earlier, Stevens and Sumner, (1994) stated that the developmental, reproductive and multigenerational studies in animals show that exposure to atrazine leads to decreased fetal body weight, decreased litter size, and increased incidence of incomplete ossification. There are no quick and easy solutions to these obvious, but complex problems. Awareness of the systemic issues is a good start, but each obstacle must be addressed individually with respect to each chemical in need of regulation. Scientific research on atrazine will continue. It remains to be seen if regulations and regulatory institutions will change to adapt to this new type of toxin.

5. Conclusion

Atrazine (2-chloro-4-ethylamino-6-isopropylamino-1, 3, 5-triazine) is a selective triazine herbicide and the most heavily used agricultural pesticide in North America. It is registered for use in agriculture as a selective pre- and post-emergence herbicide for controlling weeds in numerous crops, including corn (*Zeamays*), sorghum (*Sorghum vulgare*), sugarcane (*Saccharum officinarum*), soybeans (*Glycine max*),wheat (*Triticum aestivum*), pineapple (*Ananas comusus*), and various range grasses. Atrazine also given more or less postemergence activity on crop production at the same time number of other enormous probable impacts also produced on prokaryotic as well as eukaryotic organisms because of the hydroxy metabolites are the dominant plant metabolites of atrazine and risk to biodegradation of such an effective herbicides possessed chemical compounds. Hence, in this study enlightened some of the results obtained for several years of experiment on natural phytoplankton populations and its ill effect. Because it clearly showed that bacterium and other microbes, fungi also a wide diversification of living organisms

were less tolerant to the more hydrophobic compounds present in Atrazine. Hence it considers that there is a need to provide users and regalements a more accurate means to evaluate the toxicity of a chemical to algae, not only based on standardized in vitro tests, but also on more relevant, if not standardized our ecosystem. Based on a review conducted by MDH as well as EPA, food-related exposure appears to be negligible. Atrazine is predominately used as a pre-emergent herbicide in soil directed sprays (rather than foliarly applied) or is applied early in the growing season.

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