APPENDIX M

RESPONSE TO REPORT BY ARTHUR GOLDBERG Ph.D.

"Pesticide Analysis of the Draft Environmental Impact Statement Submitted by Discovery Land Company for the Hills at Southampton Change of Zone Proposal from Five Acre Zone and Aquifer Protection Overlay District to Planned Development District (PDD) and Recommendations"

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February 8, 2017

Response to Report by Arthur Goldberg, Ph.D., "Pesticide Analysis of the Draft Environmental Impact Statement Submitted by Discovery Land Company for The Hills at Southampton Change of Zone Proposal from Five Acre Zone and Aquifer Protection Overlay District to Planned Development District (PDD) and Recommendations" (February 8, 2017)

by

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May 5, 2017

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EXECUTIVE SUMMARY

This is a detailed response to Dr. Arthur Goldberg's 2/8/17 report on pesticide impacts of the proposed The Hills at Southampton project. Dr. Goldberg focused on potential human and environmental risks, but he based all of his comments on a simple, preliminary list of potential ground water monitoring analytes. Apparently, he was not aware of our comprehensive human and environmental risk assessment. Several of his statements were provocative and unsubstantiated with no scientific basis. His conclusions went well beyond the scientific data available to support those conclusions. Finally, he requested depictions of the chemical structures as well as the pesticides' water solubilities, and these are all provided herein.

RESPONSE TO REPORT BY ARTHUR GOLDBERG, PH.D.

Dr. Goldberg produced a report on the human and environmental risks of pesticides associated with The Hills at Southampton DEIS. His report was submitted to the Town twice, once by himself, presumably close to the date of his report – 2/8/17, and once by attorney Carolyn Zenk. His analysis of potential pesticide risks focused exclusively on a preliminary/tentative list of planned ground water monitoring analytes. He was apparently unaware of the extensive amount of risk assessment-related information provided elsewhere in the DEIS, specifically our 89+ page comprehensive risk assessment (cited below), which was an appendix to the information-rich Integrated Turf Health Management Plan (ITHMP).

He made sweeping generalizations, with minimal scientific basis, and presented his analysis in language that was often provocative. We take his allegations seriously, and we respond accordingly.

Our responses follow Dr. Goldberg's statements below.

1. *"Section 1: A list of pesticides appears in Table 1 of the DEIS (Draft Environmental Impact Statement). Examination of this list shows 42 pesticides proposed for use. Current zoning does not allow a golf course. See Attached as Exhibit A. Table I, page 13 of 20. Exhibit K. Groundwater Monitoring Protocols from Developer's Draft Environmental Impact Statement. The Discovery Land Company plans to use these pesticides on their proposed Golf Course in their Hills at Southampton Proposal. It should be noted that (1) only the names of the 42 pesticides are listed."*

Response:
As he stated, Dr. Goldberg copied the list from a tentative list of analytes to be monitored. A ground water monitoring protocol is limited in scope and presentation, by design. Rather, we provided extensive data on the environmental fate, effects, and risks of these pesticides in our report (89 pages + appendices), which was part of the DEIS, "Comprehensive Risk Assessment for Pesticide Use at the Proposed The Hills at Southampton Golf Course and Homes" (12/2/2015; revised 3/28/2016 and 6/22/16). Our report is Appendix 13 of the Integrated Turf Health Management Plan (ITHMP), which is Appendix J of the DEIS. Much of Dr. Goldberg's concerns were addressed in our report.

2. *"No chemical structures (2) are presented for the 42 pesticides in the Hills Proposal. Examination of the chemical structures gives critical information, which helps predict both the physical and chemical properties and also the toxic properties of each pesticide."*

Response:
Structures of the 45 pesticides for which we do not advise against use (Table 19, pp. 86-87 of our report) are attached (Attachment 1).

3. *"THE HAZARDOUS PROPERTIES OF THESE 42 PESTICIDES ARE NOT LISTED IN THE DEIS AND THUS THE "HARD LOOK" OR THOROUGH ANALYSIS REQUIRED BY THE STATE ENVIRONMENTAL QUALITY REVIEW ACT HAS NOT BEEN TAKEN."*

Response:
This is absolutely not true. Extensive information on these pesticides is provided throughout our report. Further, we definitely took a "hard look" and conducted a "thorough analysis" when we integrated all of these chemical-specific and site-specific data with the environmental exposure models PRZM-GW and AgDRIFT in our comprehensive risk assessment.

4. *"Critical properties and impacts are missing from the available data presented for the pesticides, especially solubility in water, affinity of pesticides to accumulate in the fatty tissues of animals and humans and most importantly toxicity data. The physical and chemical properties of a pesticide may also be predicted by comparing it to a pesticide from the same chemical group, in which significant data has been collected."*

Response:
Most of the information stated as missing is provided in the documents found on the Town of Southampton's website http://www.southamptontownny.gov/988/DEIS---September-2016. In addition, we provide the location of the data within the documents below. Finally, water solubility measurements for the proposed pesticides are included as Attachment 2.

Section 2.2.2 "Anticipated Impacts" in the 9/16/16 DEIS (page 2-47) states – "Appendix 13 of the ITHMP (see Appendix J) contains a Comprehensive Risk Assessment of the risks to the public from use and application of both pesticides…". Table 9 (Appendix 13 to the ITHMP, which is Appendix J of the DEIS) provides a list of pesticides and associated human health effects reference points, and Table 18 provides a more detailed toxicological analysis for selected pesticides. Table 10 (Appendix 13 to the ITHMP) provides a list of pesticides and associated eco effects/aquatic life benchmarks (freshwater).

Water solubility is an important parameter for pesticides and is relevant to the sorption of soil, which is characterized by K_{oc}. The K_{oc} is the soil organic carbon-water partitioning coefficient, which is used to calculate a concentration of a pesticide that is protective of ground water. We provided the K_{oc} values in Table 6 (Appendix 13 to the ITHMP, Appendix J of the DEIS). Water solubility data are listed in Attachment 2.

Toxicity information is also an important parameter. We provided detailed comments on the toxicology of pesticides flagged for special concern in Table 18 (Appendix 13 to the ITHMP, Appendix J of the DEIS). We explain that several of the pesticides that yielded positive results in the rodent cancer bioassays have elevated thresholds for causing any type of cancer effects (they are not governed by linear low-dose extrapolation); i.e., if one protects for the most sensitive non-cancer endpoint, one will be very protective for potential cancer effects.

5. *"All relevant data on the 42 pesticides considered for use in the golf course should have been included in the DEIS. This was not the case. The information is radically incomplete."*

Response:
This statement is incorrect. See the location of the "missing" data in our responses above.

6. *"Section 2: Why are Pesticides a Problem?"*

   "Section 2A: Pesticides are basically designed and manufactured to kill living organisms. Many Pesticides (1) however are also toxic to non-target organisms such as plants, butterflies, animals and also (2) humans, which harms ecosystems."

Response:
This is basically correct. However, turf pesticides are applied only by NYSDEC licensed pesticide applicators governed by strict label regulations that protect the environment, such that the offsite

concentrations are either non-existent or well below toxic thresholds. The conservative modeling we did indicates the vanishingly low offsite exposure potential. Also, many pesticides are not designed to kill pests, but to control them in other ways, e.g., repel them, disrupt reproduction cycles, or regulate growth.

7. *"Section 2B: Pesticides also have (3) profound affects* (sic) *on Aquatic Ecosystems. If a pesticide affects one or more of the organisms involved in the food chain of an aquatic ecosystem, the entire ecosystem will dramatically be affected. This is of great concern for this East Quogue proposal because pesticides will be released in close proximity to Weesuck Creek, which directly drains into Shinnecock Bay, which is already severely compromised by Brown Tide blooms and Red Tide blooms."*

Response:
This statement is decidedly nonscientific. We are not aware of any current use or recent use pesticides that have been demonstrated to have profound effects on aquatic ecosystems. Further, pesticides will not "be released in close proximity to Weesuck Creek . . .". Rather, sprays directed downward typically 18 inches from the ground would be applied not less than 1,500 ft from the headwater of Weesuck Creek (p. 19 of our report).

8. *"Section 2C: Bioaccumulation of Pesticides*

   Another important mechanism of some pesticides is bioaccumulation where aquatic organisms uptake the pesticides from the sediments and water and may therefore acquire tissue levels much greater than those in the environment. This is of concern because Shinnecock Bay contains shellfish and shellfish, which are likely to be consumed by humans.

   The chemical structures of some pesticides will enable us to predict that they are likely to bio accumulate in specific food chains.

   The chlorinated pesticides are well known for their ability to bio accumulate in the food chains from very low to very high concentrations. Examples include: DDT, PCB's, Dioxins. These substances are currently proposed for The Hills at Southampton, thus bioaccumulation is of great concern."

Response:
It is not scientifically ethical to imply that any of the proposed pesticides would behave in the environment similar to DDT, PCBs, and chlorinated dioxins. Any scientist who works in this field – or even those with casual knowledge of the field – understands that NYSDEC registered pesticides approved for golf courses that are metabolized to more polar degradation products, such as these, are not a threat to biomagnify, and certainly not approaching the extent of PCBs, etc.

9. *"Section 3A: Organophosphates* (sic) *Pesticides*

   The Organophosphate pesticides are also proposed for "The Hills" golf course. They are highly toxic to humans, especially when applying these pesticides to large areas. Special equipment and clothing are required during application of this pesticide. These highly toxic substances should not be used near the East Quogue Elementary School, the East Quogue downtown area, or populated areas. The proposal is several blocks from all of these areas.

Individuals living in the proposed Hills Development or in a nearby area community should be alerted to the use of these substances so that they have an opportunity to protest this PDD and avoid exposure to these pesticides. The organophosphate pesticides are related to the nerve gases used by the Nazis during World War II. Both are made from phosphoric acid and both are in the same chemical family"

Response:
This statement is also incorrect. Organophosphate pesticides (plural) are not proposed for use; rather, only one is proposed*. This pesticide will not be applied to "large areas"; rather, as stated in Table 19 of our report, to tees and greens only. Finally, the Nazis used a completely different class of chemical in their extermination effort.

Once again, this is an unethical nonscientific comment that one would not normally expect to see written by a scientist.

10. *"Section 3B: Pesticides that contain chlorine atoms in their chemical structure are highly bioactive and very likely to affect Non harmful-Target Species. These are also proposed for use at "The Hills" and present serious problems."*

Response:
The author seems to ignore the principle that there is limited or no risk if there is limited or no toxicity and limited or no exposure. The author states definitively that proposed pesticides "present serious problems" without scientific support.

11. *"The DDT pesticides are in the Organochlorine chemical family. They are the most powerful pesticides the world has ever known and have been documented to kill 100's of different kinds of insects, which is likely to harm nearby ecosystems. They have been investigated for decades. Scientific studies consistently reveal new toxic effects to humans and ecosystems."*

Response:
There are no "DDT pesticides" recommended in the DEIS. Once again, there is no scientific support that this comment has any relevance to the DEIS.

12. *"Section: 3C: Pesticides Acting as Endocrine Disruptors*

The pesticides acting as Endocrine Disruptors are also proposed for use in "The Hills" POD. Their impacts are not yet very well known, but some of them have been researched extensively. An endocrine disruptor disturbs the hormone activity in humans, often with dire results.

Table 2 shows the variety of pesticides that have endrocrine (sic) ***disruptive activity.*** *About 105 substances can be listed, and most of them are shown in Table 2. Of these, 46% are insecticides, 21 % herbicides and 31 % fungicides; some of them were withdrawn from general use many years ago but are still found in the environment due to their long-standing effects. (ex. DDT and atrazine in several countries).*

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* Ethephon is not an organophosphate ester, therefore it does not have the typical organophosphate toxicological profile.

Endrocrine (sic) *Disruption by pesticides has been documented to occur at concentrations significantly above published safe published* (sic) *limits" for known detrimental effects to humans.*

Medical problems caused by these pesticides (1) are difficult to diagnose and cure. It is also difficult to determine the cause and treatment of many of the more severe medical conditions. Many of these pesticides have not yet been shown to act as Endocrine Disruptors.

This is due in part to the very low concentrations these compounds are capable of inducing harmful reactions to humans.

Secondly, there is no easy way to test for the presence of these Endrocrine (sic) *Disrupting Pesticides since there are so many different chemical structures involved."*

Response:
The comment is not supported by the facts. The lay reader would likely infer that pesticides that are proposed for use at The Hills have been demonstrated to have endocrine disruptive effects in humans. That would be incorrect. To our knowledge no current or recently used pesticide has demonstrated "known detrimental [endocrine] effects to humans". Also, it would actually be somewhat reassuring if the concentrations that cause endocrine disruption are higher than "published safe published *(sic)* limits. It would mean that the published limits are protective for endocrine effects. It is likely that Dr. Goldberg is confused.

Here are the facts.

- Since ca. 1982, pesticides allowed for use in the US (registered with the US EPA) have been required to undergo 75-100+ studies prior to federal registration. (The State of New York sometimes adds more study requirements.) Of these studies, 15-27 are in various areas of toxicology; e.g., acute oral toxicity, 90 day neurotoxicity, prenatal developmental toxicity (2 species), *in vivo* cytogenetics, etc. These study results would tend to demonstrate the toxic effects (apical endpoints) of endocrine disruption if it were happening.
- Nonetheless, the US EPA implemented a comprehensive battery of 11 *in vivo* (live animal) and *in vitro* (in cell cultures, etc.) tests for mammalian, fish, and amphibian endocrine activity ca. 10 years ago (https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-timeline). This is considered a Tier I/conservative screen, and it is more rigorous and state-of-the-art than most of what had been published in the scientific literature until that time. As of 2016, of the 14 most common turf pesticides – most of which are proposed for The Hills – the EPA is recommending Tier II mammalian testing for none of them.
- Dr. Goldberg states, "About 105 substances can be listed, and most of them are shown in Table 2." ?? This is confusing. "Most" of 105 pesticides would indicate at least 53 pesticides. But Dr. Goldberg's Table 2 only lists 10 pesticides, three of which are not listed by us for The Hills, two of which we recommend no use, and three of which are misspelled.

Regarding testing, perhaps Dr. Goldberg is not familiar with modified GC-MS and LC-MS methods that, together, can detect well over 100 current use pesticides in water at sub-part per billion concentrations.

13. "I was amazed to find iprodione listed as an endocrine disruptor."

Response:
Iprodione is registered by NYSDEC for use on golf course turf in Suffolk County, NY. However, we recommend against use of this product in Table 19 (pp. 86-87) of our report.

14. "Section 5: Summary

Contamination by pesticides in the Upper Glacial aquifer will constitute a major disaster."

Response:
The comment is unsupported, indicates a general lack of impact assessment methods, and represents a gross and irresponsible exaggeration. We stand behind our ground water risk assessment, which used a conservative EPA model, and which was peer reviewed by the Town's consultant, Dr. A. Martin Petrovic. In addition, the golf course will be required to conduct a ground water monitoring program.

15. "A literature search for the Presence of Hazardous Pesticides among the 42 pesticides listed and recommended for use by the Discovery Company resulted in the results contained in Table 2 below."

"The Hazardous data for these pesticides comes from the PAN (Pesticide Action Network) INTERNATIONAL List of HIGHLY HAZARDOUS PESTICIDES (2011)."

[NOTE: PAN is an anti pesticide advocacy group.]

"These 10 highly toxic pesticides are also recommended for use on the Discovery Company, proposed golf course."

Response:
As stated previously, risk is a function of toxicity <u>and</u> exposure, and we have accounted for both. In addition, see the third bullet above, regarding the inaccuracy of Dr. Goldberg's list.

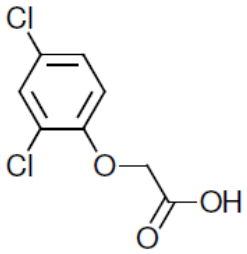
16. "Section 6: Conclusions

I note that the Attorney General of the State of New York has warned against use of highly toxic pesticides over Long Island's sole source aquifer and has noted that pesticides can travel aerially far from their point of application."

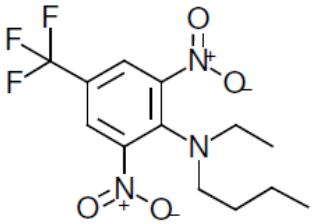
Response:
Please see attached our response to the NYS Attorney General's report (Attachment 3). Regarding aerial drift: we addressed that in section VI of our report, pp. 57-61. We assumed there is a pond 1,000 ft away, even though there are no water bodies within 1,500 ft of the golf course turf. In this highly conservative scenario, all pesticide concentrations in the highly hypothetical pond would be less than 1 ppb (part per billion; microgram per liter).

Attachment 1. Structure of the 45 Pesticides that are not Rejected in Table 19 of our Comprehensive Risk Assessment

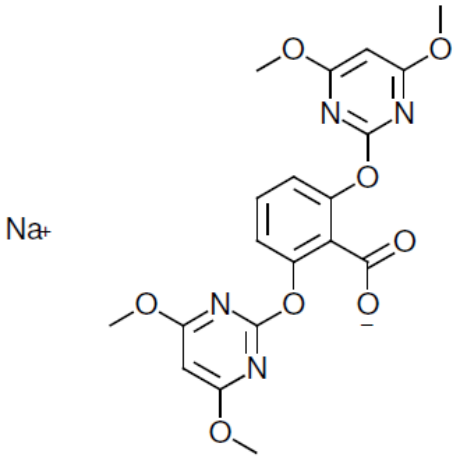
HERBICIDES



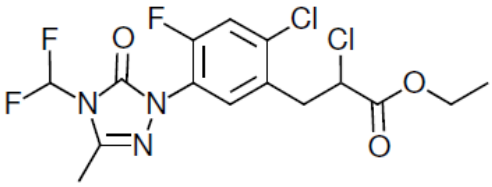
2,4-D



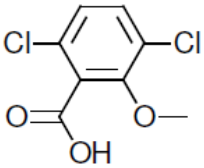
Benefin



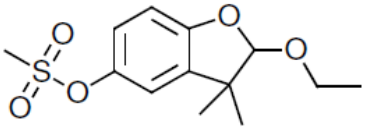
Bispyribac sodium



Carfentrazone ethyl



Dicamba



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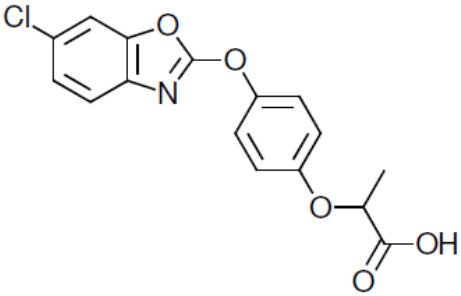
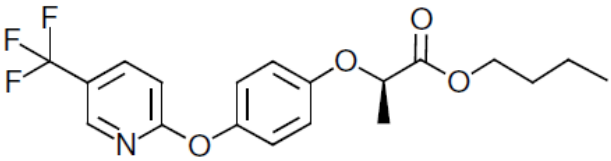
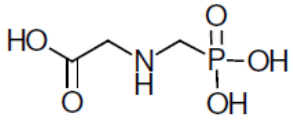


Fenoxaprop



Fluazifop-p-butyl

HERBICIDES (cont'd)



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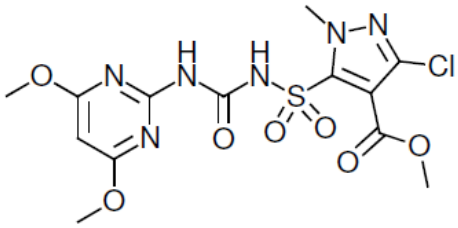

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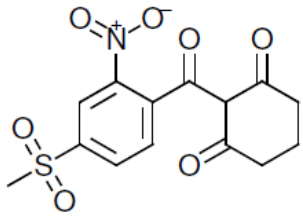

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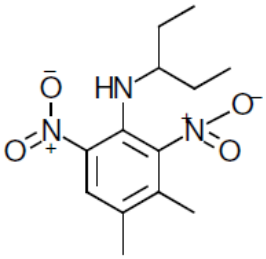

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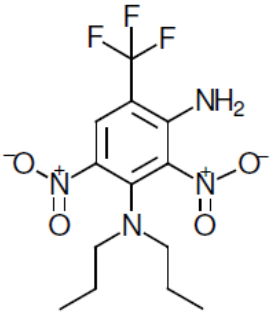

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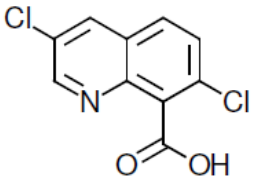
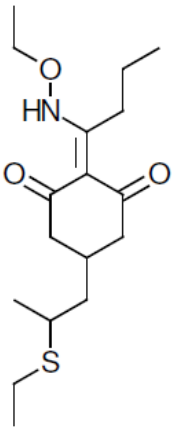


Quinclorac



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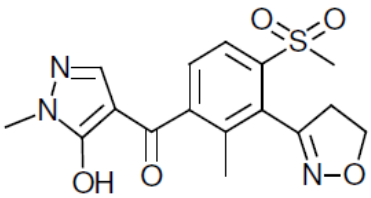

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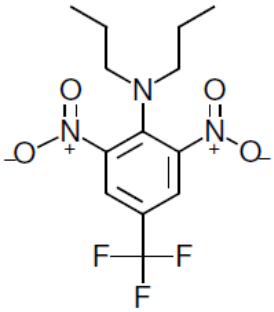
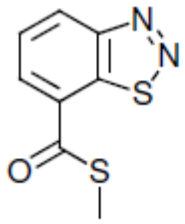
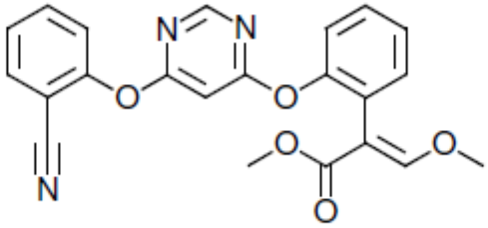


Trifluralin

FUNGICIDES



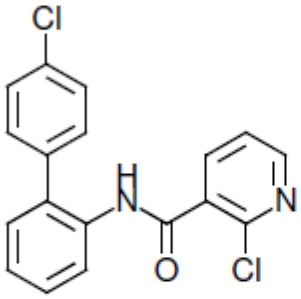
Acibenzolar S-methyl



Azoxystrobin

NA

Bacillus subtilis



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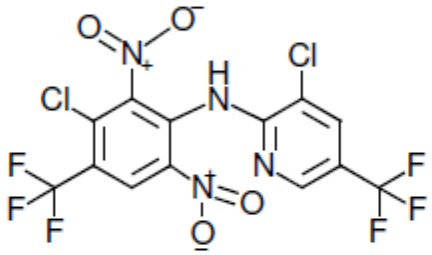

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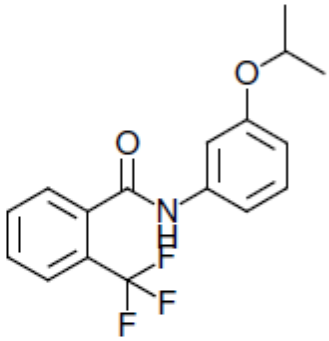

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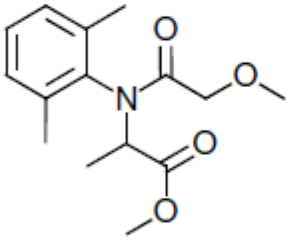

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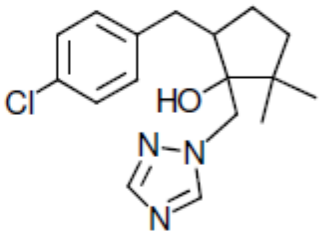
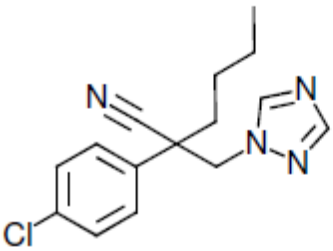


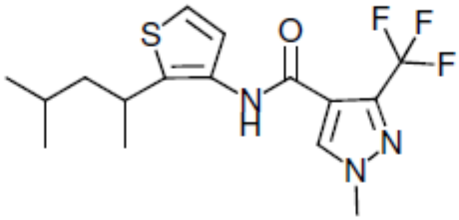
Metconazole

NA

Mineral oil

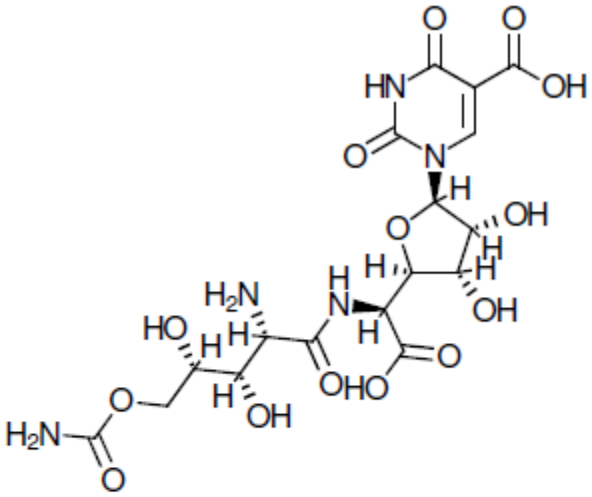


Myclobutanil



Penthiopyrad

FUNGICIDES (cont'd)



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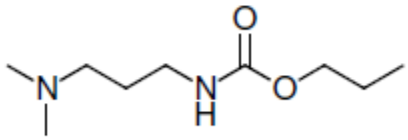
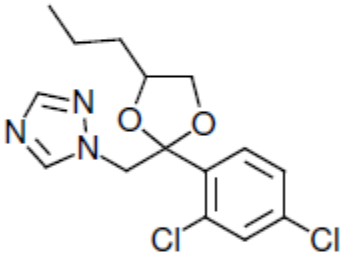


Propamocarb



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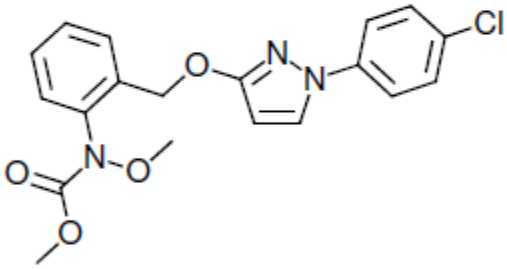

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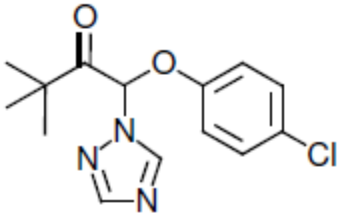
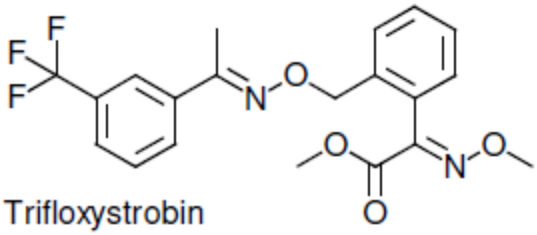
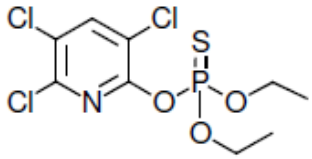


Triadimefon

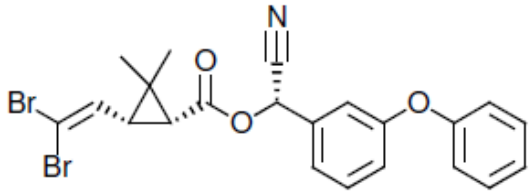


Trifloxystrobin

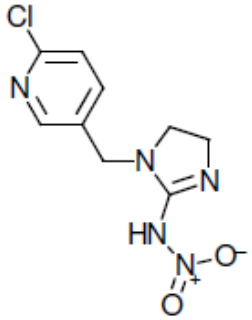
INSECTICIDES



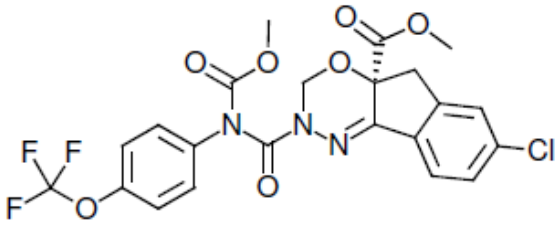
Chlorpyrifos



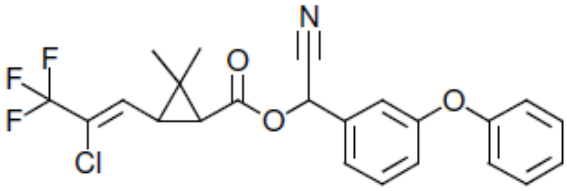
Deltamethrin



Imidacloprid



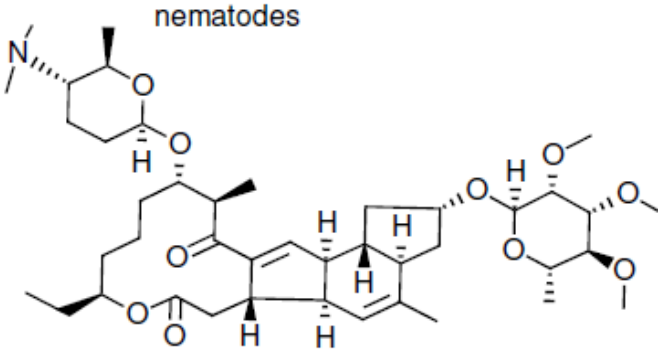
Indoxacarb



Lambda cyhalothrin

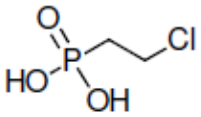
NA

Parasitic nematodes

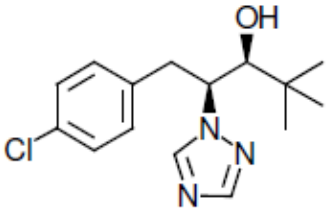


Spinosad

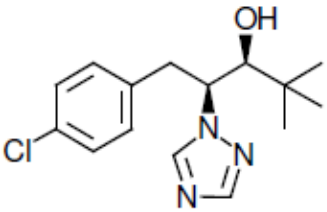
GROWTH REGULATORS



Ethephon



Paclobutrazol



Trinexapac-ethyl

Attachment 2. Water Solubility Values of the 45 Pesticides that are not Rejected

Table 19. Summary List of Pesticide Recommendations with Water Solubilities Added[Δ]

Pesticide	Are Special Golf Course Restrictions Recommended?	Are Special Home Lawn Restrictions Recommended?	Water Solubility (25°C; mg/L)	WS References[‡] Most from EPISuite except where noted
Herbicides				
2,4-D amine salt	No	No	4.575E+4	Est : from Kow, WSKOW v1.42
Benefin (with trifluralin below)	--	No	0.1	Exp : (Tomlin, C. 1997)
Bispyribac-sodium	Yes (lined greens only)	--	171.1	Est : from Kow, WSKOW v1.42
Carfentrazone-ethyl	No	No	22	Exp : (Tomlin, C. 1997)
Dicamba	No	No	8310	Exp : USDA pesticide prop database
Ethofumesate	No	--	50	Exp : (Tomlin, C. 2003)
Fenoxaprop	No	No	270	Exp : (Tomlin, C (1997); pH 5.1)
Fluazifop-p-butyl	No	--	1	Exp : (Tomlin, C (1994); pH 6.5)
Glyphosate	No	No	1.05E4	Exp : (Tomlin, C. 2003)
Halosulfuron-methyl	No	--	15	Exp : (Tomlin, C. 1997; pH 5)
MCPP	Yes (no GC use)	Yes (no lawn use)	NA	NA
Mesotrione[$]	No	No	1) 157.5 2) 160 3) 160	1) Est : (from log Kow (WSKOWv1.41) http://www.chemspider.com/Chemical-Structure.153301.html?rid=b61199b5-c638-4de6-873f-de29e7984c0d 2) PANNA (ave value, see footnote $) 3) US EPA, 2010 (see ref. for other values pH related)
Pendimethalin	--	Yes (no lawn use)	NA	NA
Prodiamine[†]	No	No	0.013	Exp : (Tomlin, C. 1994)
Quinclorac	Yes (limited use G&T only)	--	0.065	Exp : (Tomlin, C. 1997; pH 7)
Sethoxydim	No	--	25	Exp : (Tomlin, C. 1997; pH 4)
Topramezone	--	No	1) 541.7 2) 305.4 3) 305	1) Est (from Log Kow (WSKOW v1.42) http://www.thegoodscentscompany.com/episys/ep1690911.html 2) Est (from Kow, WSKOW v1.41) (not in current EPI, old run online) 3) Est (Toxnet – US EPA EPI v. 3.12; Available from, as of Mar 13, 2007: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm **PEER REVIEWED**) https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7500

Pesticide	Are Special Golf Course Restrictions Recommended?	Are Special Home Lawn Restrictions Recommended?	Water Solubility (25°C; mg/L)	WS References‡ Most from EPISuite except where noted
Trifluralin (with benefin above)	--	No	0.184	Exp : (Tomlin, C. 1997; pH 5)
Fungicides				
Acibenzolar S-methyl	No (pending lab method)	***1***	7.7	US EPA fact sheet, 2000
Azoxystrobin	No		6	Exp : (Tomlin, C. 1997)
Bacillus subtilis	No		NA	NA
Boscalid	No		6	US EPA fact sheet, 2003
Chlorothalonil	Yes (no GC use)	Yes (no lawn use)	NA	NA
Etridiazole	Yes (no GC use)	Yes (no lawn use)	NA	NA
Fluazinam	No (pending lab method)		1.76	Exp (Tomlin, C. 1997; pH 6.8)
Flutolanil	Yes (lined G &T)		6.53	Exp (Tomlin, C. 1997)
Fosetyl-Al	Yes (no GC use)		1.113E5	111.3 g/L [Tomlin CDS, ed; The e-Pesticide Manual. Fosetyl-aluminum. 13th ed. PC CD-ROM, Version 3.0, 2003-04. Surrey, UK: British Crop Protection Council (2003)] **PEER REVIEWED** https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/f?./temp/~RTGaT1:1
Iprodione	Yes (no GC use)	Yes (no lawn use)	NA	NA
Mefenoxam (metalaxyl-M)	No		2.6E4	Exp : (Tomlin, C. 1997)
Metconazole	No		15	Exp : (Tomlin, C. 1997)
Mineral Oil	No		NA	NA
Myclobutanil	Yes (G&T use only)		142	Exp : (Tomlin, C. 1997)
Penthiopyrad	No (pending lab method)		1) 0.3208 2) 7.53	1) Est (from log Kow (KSKOW v. 1.41)) (http://www.chemspider.com/Chemical-Structure.9563463.html?rid=b91335c0-072f-48ca-8ed8-1fc1391ffad8 2) http://www.greencastonline.com/sds-label/velista
Polyoxin D	No		1E6	Est : from Kow, WSKOW v1.42
Propamocarb	Yes (G&T use only)		9E5	Exp : (Tomlin, C. 1997; pH 7)
Propiconazole	Yes (G&T only, limited use)		110	Exp : (Tomlin, C. 2003)
Pyraclostrobin	No		0.08069	Est : (EPISuite http://www.chemspider.com/Chemical-Structure.4928348.html)

Pesticide	Are Special Golf Course Restrictions Recommended?	Are Special Home Lawn Restrictions Recommended?	Water Solubility (25°C; mg/L)	WS References‡ Most from EPISuite except where noted
Thiram	Yes (no GC use)		30	Exp : (Yalkowsky & He, 2003)
Triadimefon	Yes (lined greens only)		71.5	Exp : (Wauchope et al. 1991A)
Trifloxystrobin	No		1) 0.006087 2) 0.610	1) Est (EPISuite - from log Kow (WSKOW v1.41)) http://www.chemspider.com/Chemical-Structure.9839700.html?rid=ef73e3ed-66cd-4b70-b363-57e651954cd8. 2) US EPA fact sheet, 1999
Insecticides				
Bifenthrin*	Yes (no GC use)	Yes (no lawn use)	NA	NA
Carbaryl	Yes (no GC use)	Yes (no lawn use)	NA	NA
Chlorpyrifos	Yes (G &T)	Yes (no lawn use)	1	Exp : (Racke, K. 1993)
Deltamethrin*	*	*	0.0002	Exp : (US EPA, 2016)
Imidacloprid	Yes (timing restriction)	Yes (timing restriction)	610	Exp : (Tomlin, C. 2003)
Indoxacarb	--	No	0.20	EPA Fact Sheet 2000 (distilled water)
Lambda-cyhalothrin*	*	*	0.005	Exp : (USDA pesticide properties database)
Parasitic Nematodes	No	No	NA	NA
Spinosad	No	No	0.003399	Est : (from Kow, WSKOW v1.42)
Growth Regulators				
Ethephon	No	No	1E6	Exp : (Tomlin, C. 1994; Shiu et al. 1990)
Paclobutrazol	No	No	26	Exp : (Tomlin, C. 1994)
Trinexapac-ethyl	No	No	2.8	Exp : (Tomlin, C. 1994; pH 4.9)

‡ Est = estimate; Exp = experimental

Δ "--" means it is not part of the program indicated by the column heading.

†Use when benfluralin or benefin are not successful for control.

*A spray shroud should be placed over the tractor boom, if it is used. Otherwise, granular and hand-directed applications do not need additional restrictions beyond the legally enforceable product labeling

$ http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC37436. Pesticide Action Network North America (PANNA).

1 ***Fungicides not generally recommended for lawn care; professional firms should choose one of the pesticides in the left column with no restrictions for rare applications***

References for Attachment 2 (Table 19 EPI Suite data):

The water solubility data were obtained from the US EPA's combination database + software package, EPI Suite (https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface). Below is a partial listing of the references cited in the table above. Please consult EPI Suite for details about the other references.

Racke, K.D. 1993. Environmental Fate of Chlorpyrifos. *In*: (Ware, G., Ed.) Reviews of Environmental Contamination and Toxicology, Table 4, p. 12.

Tomlin, C. (Ed.) 1994. The Pesticide Manual. Crop protection publication, 10th edition, UK.

Tomlin, C. (Ed.) 1997. The Pesticide Manual, British Crop Protection Council, 11th ed., Surrey, UK.

Tomlin, C. (Ed.) 2003. The Pesticide Manual, 13th ed. British Crop Protection Council, Surrey, UK and the Royal Society of Chemistry, Cambridge, UK.

US EPA 2016. Preliminary Comparative Environmental Fate and Ecological Risk Assessment for the Registration Review of Eight Synthetic Pyrethroids and the Pyrethrins. Memorandum from Pyrethroid Review Team (Melendez et al.) to Risk Management and Implementation Branch 2, Pesticide Re-evaluation Division (Waleko et al.), September 30, 2016, p.33. US Environmental Protection Agency, Washington, DC.

US EPA. 2012. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. United States Environmental Protection Agency, Washington, DC, USA. Updated EPI Suite™ May 2, 2017

US EPA. 2010. Memorandum, January 13, 2010. Mesotrione Request for New End-use on Corn. EPA OPP, Washington DC.

US EPA. 2003. Pesticide fact sheet for boscalid. Office of Pesticide Programs, US EPA, Washington DC.

US EPA. 2000. Pesticide fact sheet for acibenzolar S-methyl. Office of Pesticide Programs, US EPA, Washington DC.

US EPA. 2000. Pesticide fact sheet for indoxacarb. Office of Pesticide Programs, US EPA, Washington DC.

US EPA. 1999. Pesticide fact sheet for trifloxystrobin. Office of Pesticide Programs, US EPA, Washington DC.

WSKOWWIN™: Estimates an octanol-water partition coefficient using the KOWWIN™ program, then estimates a chemical's water solubility from this value and applicable correction factors if any.

Yalkowsky, F.H. and Y. He. 2003. Handbook of Aqueous Solubility Data, By Samuel H. (University of Arizona). CRC Press LLC: Boca Raton FL. 2003. xii + 1496 pp.

Attachment 3. Review of "Toxic Fairways: Risking Groundwater Contamination from Pesticides on Long Island Golf Courses"

August 25, 2015

Review of "Toxic Fairways: Risking Groundwater Contamination from Pesticides on Long Island Golf Courses"

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Environmental & Turf Services, Inc.
Wheaton, MD

I. EXECUTIVE SUMMARY

In 1991, the Environmental Protection Bureau of the Attorney General of New York issued a report on the use of pesticides on Long Island golf courses, their potential for ground water contamination, and their potential for health effects. Some statements were made regarding pesticide use on lawns, as well. This report was revised in 1994 and 1995. Conclusions about pesticide use were based partly on a survey of the golf courses and partly on the work of Cornell researchers regarding agricultural use. Most of the statements about health effects were not supported with references. The authors were highly critical of the US EPA's regulatory program for pesticides. Many people have been citing this report as part of public discussion about a proposed development in Suffolk County, The Hills at Southampton.

The authors concluded that Long Island golf course managers use pesticides at rates four to seven times the number of pounds per acre used in agriculture, and home owners use between three and six times the number of pounds per acre used in agriculture. They also made many allegations regarding the deficient review of pesticides on the market and their health effects.

Golf Course Pesticide Use. It was difficult to critically examine the quantitative analysis done by the Cornell group of the broad agricultural use categories. This is because they did not provide the underlying data. A quantitative analysis of pesticide use on 90 crops I did in collaboration with the US EPA and the National Center for Food & Agricultural Policy concluded the following (Cohen, 1995): *"Golf courses are in the middle range of pesticide use when one considers total acreage, and do not reach the top 10 percent when one considers actual treated acreage. Golf courses appear to account for about 1 percent of agricultural pesticide use in the United States."*

Further, the AG's office apparently made arithmetic errors. I obtained an application rate comparison of 3.7-4.9 times for the golf to agricultural use rate ratio using their information (rounded to four to five times), not four to seven times.

Home Lawn Pesticide Use. The support for the three to six times the ag use rate statement (see above) was a highly biased article published in Time magazine. It was written by a reporter who provided no references nor offered any data to support his claim. It is unconscionable that the State Attorney General's scientific staff would rely on this source for such a conclusion.

Pesticide Regulation by the US EPA. The pesticide regulatory program at the USDA - - prior to the creation of the EPA in 1970 - - was weak. But it became much stronger with the passage of the Federal Insecticide, Fungicide, and Rodenticide Act in 1972. Then a series of rigorous, comprehensive data

requirements were promulgated ca. 1982-1984 (Title 40 of the Code of Federal Regulations, Part 158) that required pesticide registrants to conduct 75-100-plus studies in the areas of toxicology, environmental fate, ecological effects, product chemistry, worker exposure, turf transferrable residues, and crop residues for each pesticide. Also, a systematic and comprehensive program to evaluate the "inert" ingredients was begun in 1986. Finally, since 1996, the risk-based standard for most turf pesticides has been "a reasonable certainty of no harm" to children and others. Apparently, the report's authors chose not to balance their criticisms with this information.

Ground Water Contamination by Pesticides. The title of the report and several of its statements tend to give the reader significant concerns about ground water contamination by golf course pesticides. Yet studies by the SCDHS (2002) and us (Baris et al., 2010) indicate groundwater contamination by pesticides applied to golf courses is not a significant problem.

Health Effects. The report contains many comments regarding adverse health effects caused by pesticides. References are not provided to support the statements. For example, the report states in the Introduction, *". . . some [pesticides] have been linked to birth defects."* We are not aware of birth defects caused by pesticide applications, particularly applications made within the last 30 years.

II. DETAILED COMMENTS

A. Publication Version

This report was originally published in July, 1991. It was revised in February 1994 and December 1995. These comments focus on the 1995 version. The authors were from the Environmental Protection Bureau of the Office of the Attorney General (AG) of New York State.

B. A Comparison of Agricultural and Turf Pesticide Use

Subsection 1 below lists some key statements in the AG's report. Subsection 2 describes a pesticide use analysis I published in 1995. Subsections 3 and 4 evaluate the report statements.

1. Key Statements in the Report Regarding Use (The locations of the statements in the report are listed following each quote.)

The report makes the following statements regarding pesticide use. They are based, in part, on the results of a 1990 survey of 1989 pesticide use at 52 Long Island golf courses, plus a section of a handbook coauthored by a Cornell researcher.

- *". . . three to six times as much pesticides are used per acre on home lawns than to grow the food we eat.*[1] *As shown later in this report, golf courses on Long Island use almost four to seven times the average amount of pesticides used in agriculture, on a pound per acre basis."* (Introduction section)
- *". . . many golf course managers apply huge amounts of pesticides following a pre-determined "recipe" of repeated applications, rather than customized treatments addressing actual problems."* (Introduction section) This is not true. Turf professionals managing golf courses apply lower amounts of pesticides on a very specific schedule. The schedules are based on scientific monitoring of regional and local weather conditions, pest development (larval, instar and adult stages of insect development),

pathogen identification, pesticide resistance, and Integrated Pest Management Programs.)

- *"If these 50,000 pounds were applied evenly across the total area of the 52 golf courses, it would amount to an average of seven pounds of pesticides per acre annually. By comparison, a national average of 1.5 pounds of pesticides per acre are applied in agriculture annually.[3] The actual rate of golf course pesticide use may be much higher than seven pounds per acre, since the playing surfaces that are treated make up only a portion of the golf courses' total acreage. A comparison of pesticide usage in agriculture and golf course maintenance which is based on the acreage actually treated with pesticides is even more alarming. Based on responses to our survey, pesticides were applied to only about 50 percent of the total acreage of Long Island golf courses. By contrast, pesticides are applied to about 62 percent of all agricultural land. Using these figures, the average golf course application rate increases to 18 pounds of pesticides per treated acre per year, about seven times the agricultural rate of 2.7 pounds per treated acre per year.[4] Thus, between four and seven times as much pesticides are used on Long Island golf courses than are applied on food crops."* (Summary of Survey Results section).
- *"By comparison, when homeowners follow the directions for various annual do-it-yourself lawn care programs, they may apply from 3.2 to 9.8 pounds of pesticide per acre annually. Thus, homeowners may apply up to 3.6 times as much pesticides as is typically used in agriculture."* (Summary of Survey Results section).

Footnotes Cited in the State Attorney General's Report

1. Time Magazine, June 3, 1991

3. D. Pimentel et al., "Environmental and Economic Impacts of Reducing U.S. Agricultural Pesticide Use," Handbook of Pest Management in Agriculture, 2nd edition, edited by David Pimentel, CRC Press, Boca Raton, Florida, 1991, page 679 [sic].

4. D. Pimentel et al., op cit.

There is some truth to most of these statements. Unfortunately, the statements are misleading, individually and collectively. An analysis follows.

2. A Detailed Published Analysis of Pesticide Use

These statements by the AG and his staff became widely circulated and highly publicized once the 1991 version of the report was issued. Therefore I conducted a detailed analysis of the issue with the collaboration of staff from the Economic Analysis Branch of the US EPA's Office of Pesticide Programs, and Leonard Gianessi of the National Center for Food and Agricultural Policy (Cohen, 1995). Basically, I obtained pesticide use and crop acreage data from these sources for fungicides (75 crops), insecticides (88 crops) and herbicides (90 crops).

The table below summarizes the results for 13 of the 90 crops evaluated, including golf course turf and homeowner turf. The pesticide use rankings for golf course turf were 31st of 90, 47th of 88, and 38th of 75 for application rates (pounds of active ingredient per acre) of herbicides, insecticides, and fungicides, respectively. Homeowner turf ranked lower than golf course turf in all three categories.

The following paragraph summarized the key findings of the analysis (p. 104 in Cohen, 1995).

> *"Now the question can be answered: Do golf courses use greater amounts of pesticides than agriculture on a per-acre basis? It should be apparent the answer is "definitely sometimes." Golf courses are in the middle range of pesticide use when one considers total acreage, and do not reach the top 10 percent when one considers actual treated acreage. Golf courses appear to account for about 1 percent of agricultural pesticide use in the United States."*

Pesticide Use for Various Crops on a Per-Acre Basis*

Crop/Site	Acres	lb a.i./A (rank)		
		Herbicides (90 crops ranked)	Insecticides (88 crops ranked)	Fungicides (75 crops ranked)
Onions	151,676	6.32 (1)	1.41 (48)	6.56 (22)
Citrus	878,300	6.21 (2)	25.86 (4)	6.16 (26)
Sweet Corn	761,045	2.79 (13)	1.81 (42)	1.45 (49)
Pears	72,226	1.57 (39)	77.68 (1)	13.42 (11)
Cotton	11,120,700	2.65 (18)	1.79 (43)	0.19 (59)
Tomatoes	411,361	1.64 (36)	1.82 (41)	21.20 (4)
Feed Corm	78,156,196	2.73 (16)	0.34 (66)	~0
Grapes	764,137	1.42 (44)	6.51 (12)	61.92 (1)
Apples	502,792	1.10 (57)	31.36 (3)	13.64 (8)
Peaches	186,388	1.38 (47)	15.15 (8)	40.11 (2)
Tobacco	784,770	1.52 (41)	4.41 (16)	0.47 (56)
Homeowner turf	20,900,000	1.20 (52)	0.30 (66)	0.03 (66)
Golf course turf	1,400,600	1.79 (31)	1.50 (47)	3.21 (38)

* The number 1 crop in each category is highlighted.

3. Managed Turf Areas

The AG's report states that pesticides were applied to half of the golf course acreage (third bullet in B(1) above). The basis for this conclusion was not disclosed. We note, instead, that a more realistic conclusion is that 67% of golf course acreage receives pesticide applications. This is based on the fact that the average 18-hole golf course is 150 acres (A), of which 100 A are maintained turfgrass[2] (GCSAA, 2007). The 150 A statistic agrees almost perfectly with our calculation using the data in Table 1 of the NY Attorney General's report, an average of 147 A per golf course that responded to the survey. (Note: this table includes data for 18, 9, and 27+ hole golf courses, but the typical number is 18.)

This information is used in subsection 4(b) below to critically evaluate the AG's conclusions.

[2] It should be noted that three private courses in the area all manage less than 100A of turf - - Sebonack, The Bridge, and The Hills.

4. Critical Evaluation of the AG's Conclusion Regarding Pesticide Use

a. Home Lawns. The basis for the statement regarding pesticide use on home lawns (1(a) above) is an article published in Time magazine, written by a reporter who provided no data in support. Most people, particularly most scientists, would not consider this to be an authoritative source.

Nor is it an objective source. ***There was no attempt to disguise the author's pronounced negative bias.*** For example, the first sentence states:

> *"Lawn is the curse of suburban man, his bizarre fetish, the great green god he sprays to."*

Two paragraphs later, the Time reporter states:

> *"Do-it-yourselfers don't read warning labels or take precautions to protect themselves, and they use up to six times as much pesticide per acre as farmers do."*

It is unconscionable that the State Attorney General's scientific staff would rely on this source for such a conclusion.

In contrast, my analysis (Cohen, 1995) relied on objective, authoritative data sources.

b. Golf Courses. We recalculated the average pounds of pesticide applied per golf course acre per year. Our number is 6.6 lb/A (50,035 lb/7543 A), compared with the AG's number, 7 lb/A. We assume the report authors rounded off the 6.6 to 7, which is acceptable.

However, we obtain a significantly different result for pounds of pesticide applied per treated acre, regardless of whether we use our value for treated acres (67%) or the AG's value (50%), as follows:

- using 57% - - (6.6 lb/a)/0.67 = 9.9 lb/treated A, or
- using 50% - - (6.6 lb/A)/0.50 = 13.2 lb/treated A.

Neither 9.9 lb/A nor 13.2 lb/A is close to the 18 lb/A stated in the AG's report (in the "Summary of Survey Results" section). When we divide these two numbers by the generic agricultural-treated-acre (2.67 lb/A, rounded to 2.7 by the AG), we obtained a comparative use range of 3.7-4.9 times. This can be rounded off to four to five times, but it is definitely not seven times, as the AG report claims, and which has been quoted extensively.

There is further uncertainty regarding the basis for the statement that golf course pesticide applications are four to seven times greater relative to cropland agriculture. That uncertainty is in the denominator, i.e., the pesticide application rate in agriculture. The rates quoted in subsection B(1) above are 1.5 lb/A as a national average of pesticides applied to cropland, and 2.7 lb/A of pesticides applied to treated cropland. ***Thus the AG's own data and assumptions do not support its 7-fold use-rate conclusion.***

Unfortunately, the references cited do not provide the bases for their numbers. The AG report cited Pimentel et al. 1991 for both numbers. That paper lists a single source for all of the numbers in the key table relevant to the AG report - - Pimentel and Levitan (1986). The latter reference contains an almost identical table with 63 data entries. The authors cite their data sources as, "Sources: available from the authors."

Thus AG's office apparently made some sort of arithmetic error in calculating the golf:ag ratios, and the fundamental basis for the denominator - - ag application rates - - was not provided.

C. The US EPA's Regulatory Program

Listed below are key statements from the report that are critical of the US EPA, followed by my responses.

1. Data Review

"The U. S. Environmental Protection Agency (EPA), which regulates pesticides, is currently reviewing the data on the health and environmental effects of some pesticides to decide whether these products should be continued to be used. In the meantime, thousands of pesticides still under review are freely marketed--unless the EPA decides to restrict or eliminate their use. So far, only one of the 34 most commonly used pesticides for turf and lawn care has completed this review." (Introduction section)

The statement that the EPA was reviewing the data of *"some pesticides"* was misleading, at best. The truth is that the EPA comprehensively reviewed the data regarding <u>all</u> pesticides in a process that began ca. 1978 and ended in the early 2000s. A followup comprehensive re-review process is ongoing, as part of the continual data review cycle. The data that are reviewed have been developed pursuant to Title 40, Code of Federal Regulations, Part 158, which requires 75-100 plus studies in all relevant scientific disciplines (toxicology, product chemistry, etc.)

The statement, *"In the meantime, thousands of pesticides still under review are freely marketed . . ."* is also misleading. First, although there are thousands of formulated products, there are only hundreds of pesticide active ingredients. Second, by the time of the report - - 1995 - - most pesticides had undergone a comprehensive data/risk review as part of the initial application submission review and/or the Reregistration Eligibility Decision (RED) and/or the registration standards processes. Regarding the number one of 34, I don't know the correct number as of 1995, but I guess it had exceeded 10.

2. Decisions Based on Risk-Benefit Analysis

"The federal pesticide law, known as the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) which gives the EPA authority over pesticides, requires the EPA only to decide that the pesticide poses "no unreasonable *risk" (emphasis added) to public health or the environment, based on its perceived economic, social and environmental costs and benefits. Before the EPA may register a pesticide and allow it onto the market, the agency must first determine that the risks are worth the benefits."* (Introduction section)

This was correct in 1995. But it became incorrect in 1996 with the passage of the Food Quality Protection Act (FQPA). The passage of the FQPA that year had the net effect of ensuring that ***registration decisions for pesticides with food uses are to be held to a higher standard, i.e., "a reasonable certainty of no harm"***, with a focus on children; an evaluation of aggregate risks from aggregate exposures (residues in food + drinking water + post-application contact with treated surfaces [e.g., turf]); and an additional safety factor for pre-natal and post-natal exposures. For example, since 2,4-D has food uses, as well as turf uses, EPA must consider potential risks to children without regard to benefits. [NOTE: risk-benefit balancing is still allowed for ecological effects, unless threatened or endangered (T/E) species are involved. The EPA is extremely conservative in its pesticide risk assessments for T/E species.]

3. Regulation of Ground Water Contamination by Pesticides

"Despite this sobering lesson, government has yet to address groundwater contamination by pesticides before *it happens. Instead, pesticide contamination has been responded to--after the fact--with band-aid measures that only address the immediate problem, not its source."* (Recommendations section)

This was incorrect in 1991, 1994, and 1995, when all three versions of the report were issued. During 1979-1986, I collaborated with others at the US EPA to develop an aggressive pesticides-in-ground-water monitoring, modeling, and regulatory program (Enfield et al., 1982; Cohen et al., 1984; Cohen et al., 1986). We identified pesticides with ground water contamination potential, imposed monitoring requirements, and provided the scientific support needed by our regulatory colleagues to impose pre-registration and post-registration regulatory requirements. We banned two pesticides, helped prevent another from entering the market place, and imposed many legally-enforceable product label statements.

Subsequent monitoring studies indicate that ground water contamination by pesticides applied to golf courses is not a significant issue (Baris et al., 2010; SCDHS, 2002).

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