TECHNICAL SUPPORT DOCUMENT
ANSWERS TO QUESTIONS FROM CITY COUNCIL AND CITY ATTORNEY
EXECUTIVE SUMMARY

Paul C Chrostowski, Ph.D., QEP
July 5, 2013

This is a summary of information that was supplied to the Committee on the Environment (COE) based on extensive research that I have conducted into the safe grow ordinance and questions asked by Council members and the City Attorney. A complete report is attached. Supporting documentation is available on request.

1) What gaps are there between EPA & Maryland pesticide regulations and the protections envisioned by the Safe Grow Zone ordinance?

There are many scientific uncertainties in the information on which the current regulations are based. These uncertainties include assumptions and data gaps in the human health and ecological risk assessments in addition to problems with circumstances that are unforeseen by regulators. The uncertainties are particularly critical when it comes to protecting children's health, health of pets, and watersheds that run into the Chesapeake Bay. The SGZ ordinance would provide an additional margin of safety for public health and environmental protection over and above existing regulations.

Although the risk assessments that discuss the toxic effects of these pesticides are complicated, one need not be a professional risk assessor to evaluate some of these uncertainties. Many Council members either have had or currently have young children or grandchildren. You could ask yourself if any of the children in your experience up to the age of 3 ever play outside for more than 2 hours per day, ever have explored the world by putting objects in their mouths, or have weighed less than 33 pounds. If the answer is yes, than these children might not be protected by the assumptions in the pesticide risk assessments.

One way to overcome these uncertainties would be for the City to support the Safe-Grow initiative. This action would be a significant advance in the protection of public health and the environment in the City. By restricting the cosmetic use of these materials, the opportunities for creating an inadvertent hazard would also be reduced. Safe Grow would not place any limits on the use of pesticides for public or environmental health purposes. For example, it would not restrict proper application to a tree for borers or use of pest control materials for invasive species or pests, but would only affect cosmetic applications to lawns. As a final point, many people in Takoma Park grow fruits and vegetables at home and many are interested in organic gardening both for food and ornamental crops. Limiting lawn (especially spray/powder broadcast) use of pesticides will certainly help these folks stay "organic" and not be subject to drift or runoff from places where the pesticides are being applied.

2) Should the draft Safe Grow ordinance include pesticides other than those listed in the May 20, 2013 draft, and are there included pesticides that should be removed? Keep in mind that the application focus is lawns. How should new pesticides be added to the list?

A proposed list has been developed based on chemical usage patterns. It consists of 18 pesticides including those on the original list plus some additions. An alternative to the "restricted list" is for the City to advocate an "approved list" This list which is found in the complete report includes EPA's minimum risk

pesticides, EPA's biopesticides, and Ontario's Class 11 list. Any pesticide targeted to ornamental use that is not a minimum risk or biopesticide is a candidate for addition to the banned list. If such a pesticide is found to be used for lawn cosmetic purposes in Takoma Park, it should be added to the list.

3) Are there means of testing lawns for any of the listed pesticides that can be conducted by a trained non-scientist and provide results sufficiently accurate for municipal-enforcement purposes? If there are, which pesticides, and please provide a brief testing description.

Although sampling could be performed by City personnel, chemical analysis would need to be conducted at accredited contract laboratories. For a variety of reasons, testing is probably not a viable enforcement procedure.

4) If the City of Takoma Park were to look to the work of governmental entities with pesticide bans or restrictions similar to Safe Grow's, to guide the inclusion/exclusion of pesticides in/from the city's registry, would that be a justifiable and acceptable approach?

A review of similar and related programs worldwide suggests that Toronto's program may be most relevant. Particularly important is Toronto's experience with both education and enforcement regarding its pesticide ban. There is a great deal of supporting documentation that explains these programs. For example, Toronto found that education alone without enforcement was not effective in protecting public health and the environment.

5) What pesticides are banned for residential-area lawn-care use, possibly with exceptions similar to those envisioned for Safe Grow, by the Provinces of Ontario and Quebec?

The proposed ordinance is less inclusive than most other programs. For example, the Canadian regulations ban all cosmetic use (including on ornamental plants and trees and food gardens), not only lawns. The Ontario ban includes 108 pesticidal ingredients and hundreds of products. Connecticut bans all pesticides (cosmetic or not) for lawns in daycare centers and K-8 schools.

6) Does the invocation of the Precautionary Principle as a justification for Safe Grow impose a duty on the City of Takoma Park to take further protective steps in areas unrelated to Safe Grow? Should the precautionary principle be invoked as the policy basis for this ordinance?

The US has a variety of regulatory policies for protection of human health and the environment. Even within the same agency, policy bases for different regulations differ from each other. The precautionary principle in the form adopted by the American Public Health Association is a viable basis for this particular ordinance. Another possible basis is promotion of sustainability which is already a City goal and is closely linked with environmental health and the precautionary principle. Regardless, this ordinance is intended as a preventative measure. In other words, like seat belts, water purification, or flu vaccines, it is intended to prevent harm to public health and the environment.

7) Can we create a list that would ban carcinogens and/or endocrine disruptors?

Because of research gaps, such a list would potentially exclude many pesticides that haven't adequately been studied. In addition, this would exclude pesticides with other human health effects, health effects on companion animals or environmental impacts. Basing the ordinance on a list of approved safe pesticides would eliminate these problems.

TECHNICAL SUPPORT DOCUMENT

ANSWERS TO QUESTIONS FROM CITY COUNCIL AND CITY ATTORNEY

Paul C. Chrostowski, Ph.D., QEP[1]

July 5, 2013

1) What gaps are there between EPA & Maryland pesticide regulations and the protections envisioned by the Safe Grow Zone ordinance?

EPA regulates pesticides through the Federal Insecticide Fungicide and Rodenticide Act (FIFRA)[2]. It focuses on registration (approving for use), use restrictions, labeling, and disposal of un-used pesticides. Maryland Department of Agriculture (MDA) regulates pesticides at the state level. MDA focuses on schools, applicator training and education in addition to state level enforcement of EPA regulations. Both EPA and MDA are very strong on product approval and labeling, agricultural and commercial use (golf courses, nurseries etc), but fairly weak on residential use. Montgomery County Public Schools has an integrated pest management program that is approved by the MDA. This program is substantially more stringent than what is being proposed for this ordinance. Whenever EPA approves a pesticide it conducts a human health and ecological risk assessment that assesses the health risks to people or the environment that could be exposed to the pesticide. The approval is based on the behavior that is assessed. For example, EPA will conduct a detailed analysis of how a pesticide applicator will be exposed to the material throughout the workday. They will then limit the use based on this assessment. Again with the worker, if the risk assessment shows that he or she can absorb the pesticide through the skin, EPA could require the use of nitrile gloves which would be on the label and the material safety data sheet (MSDS). It would then be a FIFRA violation if the worker did not use these gloves.

It should be noted that EPA decisions regarding pesticides are often controversial and under attack by environmental activists or the pesticide industry. The classic example of this regards DDT which was only banned in 1972 after the Environmental Defense Fund (EDF) sued the federal government and several states. This was a full 10 years after Rachel Carson exposed the dangers of DDT in *Silent Spring*. In the present day, the Natural Resources Defense Council (NRDC) has recently petitioned EPA to strengthen the regulation of 2,4-D which is a subject of this proposed ordinance.

One potential problem is that not every exposure scenario can be assessed. For example, a toddler repeatedly crawling through the lawn and putting things in his or her mouth; a dog on a walk stopping and chewing on a bunch of grass; repeated applications of a pesticide by different parties; applications

---

[1] A brief professional biography of the author may be found after page 11 of this report.

[2] EPA is not the only agency that regulates pesticides in the United States. FDA has partial authority over pesticides in food and personal care products, NOAA has partial authority over pesticides in the marine environment. USDA conducts research on pesticides in agriculture. OSHA regulates pesticide exposure by workers. ATSDR and the National Toxicology Program conduct research regarding health effects of pesticides.

of more than one pesticide with synergistic effects in the same area; using more than specified on the label, etc. All of these could result in un-anticipated adverse impacts. Uncertainty is common in risk assessment. The identification and mitigation of uncertainty in risk assessment is well known and has been the subject of several reports by federal agencies including the EPA, Office of Science and Technology Policy and National Academy of Sciences.

2, 4-D can be used as an example[3]. 2,4-D is associated with hematologic (blood), hepatic (liver), and renal (kidney) toxicity in humans and a wide range of toxic responses in aquatic life. EPA last assessed 2,4-D in 2005[4] in a document called a reregistration eligibility decision ("RED") and in separate risk assessment documents[5]. A re-assessment of this type is conducted every 15 years. One uncertainty surrounding 2,4-D is that a substantial amount of relevant research has been published since this assessment which could impact our understanding of the environmental effects and behavior of 2,4-D. This chemical is the subject of a significant amount of research since it was a component of the military defoliant known as Agent Orange used in Vietnam. Since EPA closed its RED, over 17,000 potentially relevant scientific articles have been published according to the National Library of Medicine's TOXNET data base. Even a casual perusal of the abstracts of these publications reveals a large amount of toxicological information that is relevant to human health and ecological risk assessments for 2,4-D[6]. Thus, one uncertainty in the current status of 2,4-D is the inability to incorporate recent science. The dependence of risk assessment on scientific research reflects many other uncertainties. For example, 2,4-D, dicamba, and triclopyr are awaiting completion of sufficient research to determine if they have carcinogenic potential. Dicamba and fluoroxypyr have no chronic toxicity data for honeybees. This may be critical given the fact that chronic exposure to pesticides has been associated with honeybee colony collapse disorder[7]. This discussion of these uncertainties should not be considered to be comprehensive. The uncertainties associated with all the pesticides discussed herein would fill several volumes.

EPA uses a metric called the "margin of exposure" or MOE to evaluate the safety of a pesticide. If the MOE for a particular combination of receptor (worker, resident, child, fish) and exposure scenario (inadvertent ingestion, dermal contact, inhalation) exceeds the value of 1,000, then the situation is thought to have an acceptable level of risk. In the RED, EPA has assessed a toddler playing outdoors for 2 hours following an application of 2,4-D according to the label with an MOE of 1,100, thus this situation is considered to be safe. If the toddler plays in this area for 3 hours rather than 2, the MOE will be approximately 730 and the situation will be considered to be unsafe. According to EPA's Exposure Factors Handbook, two hours (120 minutes) per day of outdoor play is between the 50th percentile (54

[3] 2,4-D is used here because it is first in the list in the proposed ordinance. Similar issues can be raised with all the pesticides on the list, but a detailed analysis is beyond the scope of these questions. 2,4-D is far from eh most toxic chemical on the list. That designation goes to bifenthrin which EPA has designated as a possible human carcinogen.

[4] EPA 2005. Reregistration Eligibility Decision for 2,4-D. EPA 738-R-5-002.

[5] EPA. 2005. 2,4-D. HED's Revised Human Health Risk Assessment for the RED Revised to reflect public comments.

[6] For example: Tayeb, W. et al. 2012. Biochemical and histological evaluation of kidney damage after sub-acute exposure to 2,4-D in rats: involvement of oxidative stress. Toxicol. Mech. Meth. 22:696-704.

[7] Johnson, Renee. 7 January 2010. Honeybee Colony Collapse Disorder. Congressional Research Service.

minutes per day) and the 75th percentile (147 minutes per day) for children ages 1-4. This exposure assumption is at best protective of somewhat less than 75% of the population of children in that age group. EPA's Exposure Factors Handbook[8] also notes that on average, people identified as Hispanic and Asian by the US Census play outdoors more than people identified as White or Black. This raises an uncertainty regarding environmental justice. Similar considerations apply to most exposure scenario-receptor combinations evaluated by EPA. If any of the assumptions (for example 2 hours, more than 2 applications per year) are exceeded, the MOE can change substantially. Thus exposure assessment is a second area of uncertainty.

Taking a second exposure factor – the amount of soil inadvertently ingested by a young child while outdoors, the 2,4-D risk assessment assumes 100 mg/day. The Exposure Factors Handbook recommends 200 mg/day (95th percentile) for normal children and 1,000 mg/day for children with pica. The ingestion rate of 200 mg/day is the standard default exposure factor used in Superfund residential scenario risk assessment which makes it twice as conservative for this parameter as the risk assessment for 2,4-D. If the Superfund ingestion rate were to be used in the 2,4-D risk assessment, the MOE would be in the unsafe zone. Further, if a child exhibited mouthing behavior, pica, or geophagia[9] the use of 100 mg/day would be even less conservative.

A third exposure factor is body weight. Toxicological principles are based on the fact that the dose (and risk) decreases as the body weight increases. In the 2,4-D risk assessment, EPA assumed that a toddler weighs 15 kg (33 lbs). The Exposure Factors Handbook notes that the average weight for a child 6-12 months is 9,2 kg (20 lbs); for a child 1-<2 years is 11.4 kg (25 lbs) and for 2-<3 years is 13.8 kg (30 lbs). Looking at the underlying data distributions, we see that the assumption of 15 kg is protective of <5% of the population from 6 months to 2 years and 25% of the population from 2-<3 years. Thus the assumption of 15 kg is not conservative for any age group that would conventionally encompass the definition of a toddler.

One could go down the entire list of exposure factors used in the 2,4-D risk assessment and perform a similar analysis. When several exposure factors are combined the uncertainty and degree of conservatism is propagated through probabilistic principles. The conclusion would be that most of the exposure factors used are closer to the central tendency than the high end[10] and that this risk assessment is not especially conservative.

A person doesn't need to be a professional risk assessor to evaluate some of these assumptions. Many Council members either have had or currently have young children. You could ask yourself if any of the children in your experience up to the age of 3 ever play outside for more than 2 hours per day, ever have explored the world by putting objects in their mouths, or have weighed less than 33 pounds. If the answer is yes, than these children might not be protected by the assumptions in the 2,4-D risk assessment.

---

[8] EPA 2011. Exposure Factors Handbook. 2011 Edition. EPA/800/R-080/062F.
[9] Geophagia is habitual eating of dirt or clay. It may be cultural or due to poor nutrition or illness.
[10] See EPA 1992. Guidelines for Exposure Assessment. EPA/600/Z-92/001 for definitions of these terms.

Perhaps the biggest gap in this assessment is that it does not evaluate chronic (log-term) exposure. Thus, one must believe that a child will have only short-term contact with the residues and not play outside in treated areas for the long term. This may be acceptable for pesticides that break down rapidly, however, 2,4-D has a field dissipation half-life of 59.3[11] days and there is a potential for longer term exposure, especially with multiple applications. Other EPA-run programs like Superfund and the Resource Conservation and Recovery Act are more conservative in that risk assessments under these programs include sub-chronic and chronic exposures. The degree of risk acceptance is a decision for risk managers rather than risk assessors. I find it unlikely that many parents would accept a degree of conservatism that would not protect as many children as possible.

The third example considered here is that EPA has not evaluated all potential receptors or scenarios. According to a discussion in the RED, 2,4-D is highly toxic to dogs. However, dogs were not evaluated quantitatively in the assessment. Thus, one has no way of knowing if the instructions on the approved label are safe for dogs or other pets. Additionally, EPA declined to require a chronic toxicity study for the impacts of 2,4-D on estuarine/marine invertebrates. Since Takoma Park is part of the vulnerable Chesapeake Bay watershed, such a study would have been highly relevant to our understanding of the potential impact of 2,4-D application to local critical environments[12]. In the 2,4-D risk assessment, EPA did not consider the possibility of chronic exposure for any receptor. Thus, receptor selection is a third source of uncertainty.

What we call "off-label" use is an additional particular problem. All of the discussion above is based on an assumption that the labels will be strictly followed. The labels are highly detailed (2,4-D and Speed Zone labels available on request) and people often do not take the time to adequately understand everything on the label (language is also a problem -- note that one of these labels has only one sentence in Spanish and nothing in any language but English; the other label is entirely in English). In addition, anyone handling a potentially hazardous chemical should also read the MSDS which is even more detailed (available on request). Failure to thoroughly read and understand these documents can result in over-application, inappropriate application, hazardous exposure, and inappropriate disposal of unused material.

The label restricts the amount and number of applications of the pesticidal ingredient. For example, in the RED, 2,4-D is limited to an application rate of 1.5 1b ae[13]/acre twice a year. If, inadvertently or intentionally, 2,4-D is applied at a greater rate or more frequently, the assumptions in EPA's risk assessment will be invalidated. Also, if 2,4-D applications are too close together, these conditions could be exceeded. The field dissipation half-life of 2,4-D is 59.3 days. An initial application at 1.5 lb ae/acre

---

[11] Walters, J. Environmental Fate of 2,4-D. California Department of Pesticide Regulation.

[12] NOAA, rather than EPA typically assesses impacts to invertebrates in marine and estuarine sediments. Of all the pesticides discussed here, NOAA has only published toxicological criteria for carbaryl and MCPA.

[13] "ae" stands for acid equivalent. Since 2,4-D is a derivative of a phenoxy acid that can take many forms, EPA has based this limit on the parent acid compound. Understanding this concept would be a good test for any applicator. Looking at the Speed Kill label, it contains 28.57% 2,4-D, 2-ethylhexyl ester with a 2,4-dichlorophenoxyacetic acid equivalent (a.e.) of 18.95%. How much should be diluted into a gallon of water to not exceed EPA's 1.5 lb ae/acre?

will yield a soil concentration of 26 ppm using standard EPA default risk assessment assumptions of 1 cm depth and 0.65 g/mL soil density. After 6 months, this will degrade to less than 1 ppm so a second application would not increase the concentration. If a second application is conducted after only one month, however, the cumulative concentration would be 44 ppm which could result in an unacceptable level of risk. The product Speed Zone (containing 2,4-D) allows application every 2-6 weeks. This gives very little time for dissipation by biodegradation and will facilitate rapid accumulation to the point where not only would the risk assessment assumptions be exceeded but that there would likely be toxicity to non-target plant species especially woody shrubs and trees.

EPA's risk assessments are based on individual pesticide ingredients not materials of commerce which often contain mixtures. In practice, the material purchased in a garden or hardware store may contain numerous ingredients. For example, Gordon's Speed Zone Lawn Weed Killer contains:

2,4-D-ethylhexyl ester
Mecoprop-p acid
Dicamba acid
Carfentrazole-ethyl
Petroleum distillates
Xylene

Although the individual ingredients may be present at a safe level, this specific mixture has its own human and ecological toxicity which would have to be assessed through an extremely complex process. The last two ingredients on this list are considered to be "inert" because they lack pesticidal activity. This does not mean that they are non-toxic to humans or ecological receptors. It is a statutory definition in FIFRA and not a scientific one. As such these chemicals are not risk assessed by EPA in the pesticides program. The ingredient xylene, for example, is listed in PA's Integrated Risk Information System as being toxic to the nervous system. Researchers in the environmental health community have raised serious questions about the toxicity of so-called inert ingredients[14].

Current law requires neither reporting lawn care pesticide applications nor posting detailed information at application sites. A recent lawn application in Ward 1 posted a single small sign containing only the name of the company doing the application, the date, and a phone number. The name of the pesticide, amount applied, and re-entry period were not posted. Another recent application found that the worker was not using appropriate protective clothing and was also not aware of the name or nature of the pesticides he was applying.

One way to overcome these uncertainties would be for the City to support the Safe-Grow initiative. By restricting the cosmetic use of these materials, the opportunities for creating an inadvertent hazard would also be reduced. Safe Grow would not place any limits on the use of pesticides for public

[14] Cox, C & Surgan, M. 2006. Unidentified inert ingredients in pesticides: Implications for human and environmental health. Environ Health Perspect 114:1803.

or environmental health purposes. For example, it would not restrict proper application to a tree for borers or use of pest control materials for invasive species or pests, but would only affect cosmetic applications to lawns. As a final point, many people in Takoma Park grow fruits and vegetables at home and many are interested in organic gardening both for food and ornamental crops. Limiting lawn (especially spray/powder broadcast) use of pesticides will certainly help these folks stay "organic" and not be subject to drift or runoff from places where the pesticides are being applied.

2) Should the draft Safe Grow ordinance include pesticides other than those listed in the May 20, 2013 draft, and are there included pesticides that should be removed? Keep in mind that the application focus is lawns.

Probably the most sweeping cosmetic ban is in Ontario where 108 cosmetic pesticidal ingredients and many hundreds of products containing cosmetic pesticides have been banned. Note that Ontario also has a list of 64 approved cosmetic biopesticides. This list is similar to EPA's minimum risk pesticides[15].

Some jurisdictions have banned all lawn-care pesticides from places where children might be present. For example, the State of Connecticut has banned all EPA registered pesticides from laws or ornamental sites in day-care centers and K-8 schools (policy document available on request). This is a *de facto* ban of thousands of products. Connecticut allows the use of EPA's minimum risk pesticides for cosmetic purposes.

In contrast, the proposed ordinance only calls for the ban of 11 pesticide ingredients (increased to 18 in this report) and does not include a list of approved safe pesticides. There are several common cosmetic lawn care pesticides that were not included. Mecoprop-p (MCPP), MCPA, pendimethalin, carbaryl, and permethrin are good examples. 2,4-D, glyphosate, dicamba, and MCPP are by far the most common pesticides for cosmetic lawn-care use.

The list presented below includes the list in the draft ordinance plus several additional materials based on usage. This group represents the most commonly used cosmetic lawn pesticides sold on the unrestricted market or used by landscape firms. Many of them are also detected in urban streams and are relatively persistent. Inclusion on this list should not be construed to have toxicological significance[16]. Many chemicals, pesticides included, have several names. This list includes the most common name, some alternate names and the Chemical Abstracts Service (CAS) registry number. The CAS registry number is an unambiguous designator assigned to every chemical to avoid problems with alternate and multiple names. Many of these products, marked by an asterisk (*) occur as derivatives, esters, salts or related forms. Thus, 2,4-D, 2,4-D amine, 2,4-D ethylhexyl ester etc. The un-derivatized parent compound (any name containing 2,4-dichlorophenoxy acetic acid) should be used to identify the material. The last column is far from comprehensive. There are probably thousands of products containing these substances.

Common Name	Alternate Name	CAS Registry No.	Selected Products

[15] http://www.epa.gov/oppbppd1/biopesticides/regtools/25b_list.htm
[16] See householdproducts.nlm.nih.gov/index.htm for toxicology, environmental effects

2,4-D*	2,4-dichlorophenoxy acetic acid	94-75-7	Weed B Gon Killex, Scotts Turf Builder Weed & Feed
2,4-DD-p*	Dichlorprop-p	15165-67-0	Corasil
Bifenthrin		82657-04-3	Bifen, Masterline
Carbaryl	Naphthylmethyl carbamate	63-25-2	Sevin
Diazinon	Dimpylate	333-41-5	Scott's Turf Builder with insect control
Dicamba	Dichloromethoxybenzoic acid	1918-00-9	Oracle, Vanquish
Diquat*	Diquat bromide	85-00-7	Weedplex Pro Aquacide
Fenoxycarb		72490-01-8	Insegar, Varikill
Fluoroxypyr*	(4-amino-3,5-dichloro-6-fluoro-2-pyridynyl)oxyacetic acid	69377-81-7	Starane, Vista
Fluzifop-butyl	Fluzifop-p	7921-46-6	Fusilade, Tornado
Glyphosate*	Phosphonomethyl glycine	1071-83-6	Roundup
Imazethapyr		81335-77-5	Pursuit, Pivot
Imazipic*		104098-48-8	Plateau, Cadre
Imazipyr		81334-34-1	Polaris
MCPA*	Methylchlorophenoxy acetic acid	94-74-6	Weed'n'Feed
MCPP*	Mecoprop-p	93-65-2	Scotts Weed & feed
Pendimethalin		40487-42-1	Pendulum, Scotts Halts Crabgrass Prevention
Trichlopyr*	3,5,6-trichloro-2-pyridinyloxy acetic acid	55335-06-3	Weed B Gon Brush B Gon

Note that many products contain multiple pesticides.

It seems that Takoma Park has a great deal of flexibility here. On one end of the spectrum, it could ban all pesticides in child-contact areas like Connecticut has done. Moving further down the spectrum would be the Ontario list. It would have to be cross-checked to make sure that it is consistent with EPA registration and to eliminate cosmetic uses on plants other than lawns. A third option would be to include the other common cosmetic lawn use pesticides mentioned above or the ordinance could be left to include only the 11 chemicals that are listed in the current draft.

Another attractive alternative is to provide a list of approved pesticides rather than a list of those that would be restricted. One such list is EPA's minimum risk pesticide list (available on request). This list represents materials that are considered efficacious yet sufficiently benign as to not require formal registration. The pesticides on this list are generally recognized as safe under all conditions of use by experts in the field. EPA also categorizes pesticides as "biopesticides". These are defined as pesticidal

materials derived from natural products such as plants, animals, bacteria and minerals. Unlike the minimum risk pesticides, these materials do require a formal approval process. As of 2013, there are hundreds of biopesticides representing thousands of products. Although the lists are too long for this report, they may be found at EPA's website (http://www.epa.gov/pesticides/biopesticides/). Some of these materials are associated with some degree of risk to human health or the environment so they should be used with caution. A final alternative is Ontario's Class 11 pesticide list (available on request) which includes biopesticides and lower risk pesticides. The Ontario list contains most of EPA's minimum risk pesticides plus several of EPA's biopesticides. Entries on this list should be checked periodically to make sure that the listed biopesticides are currently registered with EPA. If this option was adopted, all pesticides not considered to be safe (EPA minimum risk, biopesticide, Ontario Class 11) would be banned for cosmetic use on lawns. Homeowners, merchants, professional applicators and lawn companies would only need to be educated regarding safe and approved pesticides.

2a) How should new pesticides be added to the list?

The original list was based on usage in Takoma Park as reflected by sales at Ace Hardware in Old Town. Many Takomans buy lawn care products at Strosniders in Silver Spring, Home Depot in Silver Spring and Brentwood, Behnke's in Beltsville ,and elsewhere. Commercial applicators and lawn services have many other sources. The revised list presented above reflects more general usage patterns to accommodate broader access to lawn care products. Since the list is based on usage, it seems reasonable to add to the list any pesticides that are found to be used in Takoma Park and not on EPA's lists of minimum use pesticides or biopesticides or Ontario's Class 11. Similarly, the list of safer alternatives could be updated as EPA and Ontario update their lists.

3) Are there means of testing lawns for any of the listed pesticides that can be conducted by a trained non-scientist and provide results sufficiently accurate for municipal-enforcement purposes? If there are, which pesticides, and please provide a brief testing description.

All EPA registered pesticides (which includes all on the list of the proposed ordinance) are required to have testing methods. These are listed in EPA's "Residue Analytical Methods Index" (www.epa.gov/pesticides/methods/ramindex.htm). City employees could readily be trained to obtain the appropriate samples (soil, vegetation), but the analysis needs to be conducted at an accredited analytical lab. Three standard screens would be applicable (standard herbicide, phenoxy herbicide and termiticide, the latter because bifenthrin is registered as a termiticide). Each analysis for each sample would cost somewhere in the neighborhood of $100 (these costs are very variable and highly negotiable. There are no reliable simple field tests for these pesticides.

4) If the City of Takoma Park were to look to the work of governmental entities with pesticide bans or restrictions similar to Safe Grow's, to guide the inclusion/exclusion of pesticides in/from the city's registry, would that be a justifiable and acceptable approach?

Reliance on the work of other entities would allow Takoma Park to learn from the experiences of others and probably assist with educational efforts. There are literally hundreds of state and municipal

pesticide bans throughout the world, however, and one would have to ensure that the regulatory situation there is compatible with that in the US. Since most of the bans are in Canada and Europe, this could take a bit of effort. Canada's federal pesticide regulations are harmonized with those in the US as a consequence of NAFTA thus Canada is probably the most fertile ground for this. The EU is quite different. For example, the EU has recently banned a large group of pesticides that affects bees. EPA has declined to follow suit creating a major divergence in policy.

5) What pesticides are banned for residential-area lawn-care use, possibly with exceptions similar to those envisioned for Safe Grow, by the Provinces of Ontario and Quebec?

There are about 150 jurisdictions in Canada that have banned cosmetic lawn or ornamental use of pesticides (some 80% of Canada's population is covered by a local, municipal, or provincial ban or restriction). The Ontario, Nova Scotia, and Quebec bans are far more inclusive than the proposed ordinance[17]. Possibly the best model for Takoma Park is the City of Toronto. Not because Toronto and Takoma Park are in anyway similar demographically or geographically, but Toronto has a very well-thought out program of education and communications that has helped make their ban a success and has become widely relied upon in the professional environmental health community. An article from the peer-reviewed environmental health literature detailing the Toronto experience (available on request) is highly informative and underscores the necessity for both enforcement and education to ensure a successful program.

6) Does the invocation of the Precautionary Principle as a justification for Safe Grow impose a duty on the City of Takoma Park to take further protective steps in areas unrelated to Safe Grow? Should the precautionary principle be invoked as the policy basis for this ordinance?

This is a highly complex area of regulatory policy. There is no consensus definition of the precautionary principle. The ordinance proponents have included one commonly used definition; however, it has not been universally adopted. In general, the precautionary principle as applied to environmental toxicants holds that uncertainty in toxicology or risk assessment is justifiable ground for preventing exposure entirely until the uncertainty can be resolved through scientific analysis. Thus, a pesticide could be banned on the basis of scientific uncertainty.

EPA is constrained by other considerations, many of which are imposed by specific statutes. In the US, we have a variety of regulatory policies. Some of these are quite similar to the precautionary principle while others are quite different. The Clean Air Act (CAA) comes close to the precautionary principle in

[17]A good summary of the various Canadian Provincial bans can be found at: http://www.davidsuzuki.org/publications/downloads/2011/Bilan_reglementations_pesticides_2011_EN_VF.pdf

that standard setting under the CAA is based solely on human health and the environment[18]. Some regulatory programs (e.g., radiation standards promulgated by the NRC) utilize a policy known as ALARA or "as low as reasonably achievable". CDC's acceptable blood lead level is also similar to this. In setting this criterion, CDC has concluded that an acceptable blood lead level is that which occurs naturally in the absence of overt contamination. Like Superfund, FIFRA is a risk/benefit balancing statute. EPA is required to take into account economic, social and environmental costs and benefits[19]. In essence, EPA is required to balance risks of exposure to pesticides against the societal benefits of using pesticides.

Governmental entities in the US have banned hazardous substances without invoking the precautionary principle. These include PCBs (banned by Congress), DDT (banned by EPA), Saccharin (banned by FDA), and chemical warfare agents (banned by international treaty).

In the case of the proposed ordinance, the proponents appear to be moving closer to the CAA by invoking the precautionary principle. There is definitely some degree of risk associated with the use of these pesticides. Although there may not be demonstrated health or environmental effects, the ordinance is intended to be preventative in nature. The proponents believe that cosmetic non-essential uses do not convey enough of a benefit to justify the risks. As discussed in Question 1, for example, there is a finite probability of an adverse health effect from a toddler playing in an area that has been treated with 2,4-D for a period of 3 hours. If there is no perceived benefit from the cosmetic use of 2,4-D this could be considered to be unacceptable. If there is a benefit from an alternative use, such as poison ivy control, it could be considered acceptable.

The APHA definition of the precautionary principle appears to be relevant to this ordinance as it is a preventative environmental health policy. A second policy underpinning of this ordinance is sustainability, which is an objective that has been advanced many times by City government. The mitigation of toxic and/or hazardous anthropogenic substances into the environment is a commonly cited metric for sustainability (Worldwatch 2012, Rockstrom et al. 2009). Another linkage between pesticides, sustainability, and the precautionary principle has been advanced by Hernke & Podein (2011). This publication specifically deals with lawn pesticide use and concludes that application of both sustainability perspectives and the precautionary principle are useful for environmental health protection.

7) Can we create a list that would ban carcinogens and/or endocrine disruptors?

Probably the biggest drawback to this approach is that few of the chemicals under consideration have undergone the degree of testing to be classified as either potential carcinogens or endocrine disruptors. Many of the pesticides we are looking at are problematic for reasons other than carcinogenicity or endocrine disruption. For example, 2,4-D exhibits hematologic, hepatic and renal toxicity; dicamba shows maternal and fetal toxicity, diquat causes cataracts and lens opacity; glyphosate is associated

[18] See Goldstein, BD & Carruth, RS. 2003. Implications of the precautionary principle for environmental regulation in the United States. Law & Contemporary Problems 66:246.

[19] A good overview of this may be found at Cornell's Pesticide Safety Education Program. http://psep.cce.cornell.edu/issues/eisk-benefit-fifra.aspx.

with reproductive and developmental toxicity, etc. Many of the pesticides are also toxic to species other than the pests they are targeted against. For example, bifenthrin has not been assessed by EPA, but has been assessed by the European Community (EFSA 2011). This assessment concluded that bifenthrin bioaccumulated and biomagnified in aquatic food chains, had a potential high acute and long-term risk to fish and aquatic invertebrates, and a particular high risk to bees. The report concluded that there was a high risk to non-target arthropods[20] within the treated area for representative outdoor use. Considering the link between the Takoma Park watershed and the endangered Anacostia River and ultimately Chesapeake Bay, this environmental toxicity is certainly relevant. None of these forms of toxicity are identified in any convenient list.

This approach could also have the unintended consequence of creating an inequity between cosmetic lawn pesticides and other products. For example, 2,4-D , carbaryl, diazinon, bifenthrin, pendimethalin and glyphosate have been found to be endocrine disruptors[21] and would fall under this category[22]. However, numerous other chemicals including components of plastics, flame retardants, pharmaceuticals etc. are also endocrine disruptors. Using this specific toxicological endpoint could open up a Pandora's box of requests to regulate many broad classes of chemicals.

A similar comment would apply to carcinogens. Bifenthrin and pendimethalin are listed as possible human carcinogens, but so are many other perfectly legal chemicals in commerce. There are also many ambiguities regarding classifications of carcinogenetic due to several shifts in EPA cancer risk assessment methods over the years[23]. Bifenthrin and pendimethalin are listed as possible human carcinogens (Category C), MCPP has "suggestive evidence" of carcinogenicity, carbaryl is "likely to be" a human carcinogen. This use of terminology may be confusing at best. Finally, as with other forms of toxicity, adequate study is not always available. Dicamba, 2,4-D and triclopyr, for example, are listed by EPA as not having sufficient evidence to be classifiable as a human carcinogen (Category D).

8. Is the COE aware of any circumstances where the benefits of utilizing restricted pesticides might outweigh the risks/harms caused by the pesticides not already covered by the exceptions.

This is a policy question that is beyond the scope of this research. COE may address this.

[20] Arthropods include insects, arachnids, crustaceans, and related organisms.
[21] Additionally, here is no single authoritative list of endocrine disruptors. I typically consult six different lists for this information.
[22] Mnif, W. et al. 2011. Effect of endocrine disruptor pesticides: a review. Int J Environ Res Public Health 8:2265-2303.
[23] EPA 2012. OPP Annual Carcinogen Report.

PAUL C. CHROSTOWSKI, Ph.D., QEP

CPF Associates, Inc.
7708 Takoma Ave.
Takoma Park, MD 20912
301-585-8062
pc@cpfassociates.com

EDUCATION

Ph.D. Environmental Engineering and Science, Drexel University
Philadelphia, PA (1981).

M.S. Environmental Science, Drexel University,
Philadelphia, PA (Environmental Chemistry and Health Specializations, USPHS Traineeship) (1979).

B.S. Chemistry, University of California,
Berkeley, California (American Chemical Society Certified, Honors) (1976).

Continuing professional education in environmental engineering, fate and transport modeling, toxicology, and environmental forensics.

PROFESSIONAL CERTIFICATION

Dr. Chrostowski is a registered Qualified Environmental Professional (QEP) (#02970014)

AWARDS/RECOGNITION

Recipient of 2003 Linn Enslow Memorial Award by NYWEA. Recognized for 30 years of service to ACS Environmental Division.

OVERVIEW OF EXPERIENCE

Dr. Chrostowski is a founding member of Chrostowski, Pearsall, & Foster (CPF Associates, Inc). He is an environmental chemist, health scientist, and engineer with over 40 years experience in environmental work on behalf of both government and private clients. Currently, Dr. Chrostowski's practice is focused on environmental chemistry, environmental engineering, and risk analysis. Previously, he was Director of Environment, Health & Safety programs at The Weinberg Group, Vice President and Senior Science Advisor at ICF/Clement, Senior Scientist at EA Engineering, Science & Technology, Assistant Professor at Vassar College, a consultant in private practice and a pollution control/industrial hygiene technician in industry. Dr. Chrostowski performed pioneering work in the fields of chemical environmental forensics and risk assessment. He has specialized experience in the scientific and technical aspects of federal, state, and international regulatory programs including the CWA, CAA, CERCLA/SARA, RCRA, TSCA, FIFRA, OSHA, waste management technologies and environmental assessment. In addition to EPA and OSHA programs, Dr. Chrostowski has developed expertise human and ecological risk assessment, life cycle analysis, application of multivariate statistics, and failure analysis. Dr. Chrostowski's research interests include the environmental behavior of complex mixtures,

application of quantitative management tools to environmental strategy development and evaluation, chemometrics, quantitative ecology, biomonitoring, and environmental modeling. Dr. Chrostowski is active in numerous professional societies and expert panels and has authored or co-authored over 120 publications or presentations in the environmental field. In addition to his technical work, Dr. Chrostowski has taught university-level environmental sciences and has presented expert testimony in litigation cases, regulatory, legislative, and permitting hearings and public meetings.

EMPLOYMENT HISTORY

1999-present	President, CPF Associates, Inc.
1993-1999	Director, Environment, Safety & Health practice, The Weinberg Group Inc.
1985-1993	Vice President and Senior Science Advisor, Clement Division of ICF/Kaiser
1984-1985	Senior Scientist, EA Engineering, Science & Technology
1981-1984	Assistant Professor, Vassar College
1979-1984	Consulting scientist in private practice
1976	Information Analyst, Solar Energy Information Center
1974-1976	Research technician, University of California
1970-1972	Laboratory/industrial hygiene technician, C&D Batteries
1968-1970	Laboratory/pollution control technician, Jack Frost Sugar
1964-1968	Petty Officer, 2nd Class, U.S. Navy

SELECTED PROFESSIONAL SOCIETY MEMBERSHIPS

Air and Waste Management Association
American Council of Governmental Industrial Hygienists
American Chemical Society
American Chemical Society Environmental Division
International Society for Environmental Forensics
International Society for Exposure Analysis

PUBLICATIONS

Dr. Chrostowski is the author or co-author of over 120 publications or presentations. A full bibliography and copies of publications are available on request. Selected publications/presentations include:

Durda, J. and Chrostowski, P .C. 1991. Integration of ecological risk assessment and biological assessment in risk management: The Aberdeen experience. Paper presented at 12th Annual Meeting of the Society of Environmental Toxicology & Chemistry, November 3-7, Seattle, Washington.

Chrostowski, P .C. and Durda, J. 1991. Effects of air pollution on the desert tortoise: An ecological risk assessment. Paper presented at 12th Annual Meeting of the Society of Environmental Toxicology & Chemistry, November 3- 7, Seattle, Washington.

Chrostowski, P.C.,Foster, S.A.,Durda, J.L., Preziosi, D. V. 1998. Good Ecological Risk Assessment Practices. SETAC Annual Meeting, Charlotte, NC, November 1998.

Preziosi, D., Durda, J., Chrostowski, P. 2000. Conceptual approaches for addressing temporal and spatial scales of wading bird populations and contaminant distribution. SETAC Annual Meeting.

Foster, S.A., Chrostowski, P.C., Preziosi, D.V. 2003. A Comparison of Two Mercury Environmental Fate and Transport Models in Evaluating Incinerator Emissions. 2003 Incineration Conference. Orlando, FL May 12-16.

Chrostowski, P.C. & Foster, S.A. 2004. Swimming Pool Shock Treatment. Environ Health 66:26-27.

Langmuir,D., Chrostowski, P., Vigneault, B., and Chaney, R. 2004. Issue Paper on the Environmental Chemistry of Metals. Prepared for USEPA Risk Assessment Forum, Contract #68-C-98-148.

Foster, S. Chrostowski, P.C., Pirages, S., Nealley M. 2006. Applications of the IEM-2M Mercury Fate and Transport Model in Hazardous Waste Combustion Facility Risk Assessment. 2006 Waste Management Meeting. AWMA and USEPA, Arlington, VA.

Chrostowski, P.C. & Foster, S.A.2006. Modeling exposure and risk from chemical weapons releases. Society for Risk Analysis Annual Meeting, Baltimore, MD.

Foster, S.A., Chrostowski, P.C. & Wilsey, S. 2006. The role of landfill gas emission rate calculation methods in solid waste landfill risk assessments. Society for Risk Analysis Annual Meeting, Baltimore, MD.

Foster, S.A. & Chrostowski, P.C. 2008. Comprehensive human health and ecological risk assessment of a carbon reactivation facility. SRA Annual Meeting, Boston MA.

Chrostowski, P.C. 2008. Hill's Postulates. In Jorgensen, SE & Fath, BD (Eds) Ecotoxicology. Vol 3 of Encyclopedia of Ecology, pp. 1858-1863. Oxford: Elsevier

Foster, C., Richer, P., Lynch, G., Chrostowski, P., Hoffman, B. and Militana, L. 2008. PM2.5 Ambient Air Monitoring at a Regional Solid Waste Processing and Transfer Facility. Global Waste Management Symposium, Copper Mountain, CO. September 2008.

Foster, S.A., Chrostowski, P.C., and Porter, T.J. 2011. Ultrafine Particles in Combustion Source Emissions. 2011 Annual Society of Risk Analysis Meeting, Charleston, SC (December).

Foster, S. and Chrostowski, P.C. 2012. Human Health and Ecological Impact Analysis for a New Renewable Energy Facility in Florida. Waste-to-Energy Research and Technology Council (WTERT) 2012 Bi-Annual Conference. October 18-19, 2012. Columbia University, NY.

COMMUNITY PROFESSIONAL SERVICE

Montgomery County MD Energy and Air Quality Advisory Committee
Takoma Park - Montgomery College Neighbors Advisory Committee
Science Fair judge for environmental science projects, Montgomery County, MD
Takoma Park Community Center Citizen's Advisory Committee
Takoma Park Committee on the Environment