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A Guide to Hazardous Lawn Care Chemicals

34-43 minutes

Homeowners use numerous chemical compounds to improve and maintain their lawns. When used properly, most of these chemicals have a tolerable impact to humans, pets, and the environment. However, there are several lawn care chemicals that can present significant health and ecological effects that homeowners should be aware of to reduce dangers to themselves and the local community.

This guide is intended to inform homeowners of known or potential hazards based on data collected from published scientific studies, regulatory organizations, and manufacturers. Sources are cited and can be found at the bottom of the page for further reading.

Hazard ratings are based on the potential acute and long-term impact to humans and the environment based on the presence of evidentiary information from credible sources. The reason(s) for these ratings are listed for reference.

How to Find the Active Ingredients

The Environmental Protection Agency (EPA) along with other federal and state government organizations manage proper labeling practices for pesticides and other hazardous materials. These regulations were originally founded to protect professional workers and inform them of proper use, hazardous chemicals, and adequate levels of protection.

Information about products including composition, acute dangers, toxicity, and others can be found by searching for the product name + “SDS” in Google. A safety data sheet (SDS) is required for any product containing hazardous materials and are widely available online, or at the point of sale (ex. Home Depot). Conduct additional research about pesticides via these scientific and regulatory links.

Understanding Risk

The EPA and other regulatory organizations work to understand and categorize the health and environmental risks of all hazardous

chemicals. When considering the human health impact of a pesticide the EPA will focus on exposure, dosages, and the various routes of entry.

Understandably, a large amount of their focus is on the impact of repeated (chronic) exposures on workers.The typical homeowner will have a much lower exposure frequency to these chemicals which can make a substantial difference in outcomes.

It's worth noting that the current status of chemicals is subject to change, and the vast majority of studies focus on the effects of substances by themselves. Chemicals often have altered behaviors when they are combined with others. A chemical may be toxic at 100mg/kg by itself, but may be lethal at the same dosage if it is combined with other chemicals. Likewise, the inverse is possible as well.

Granular Inorganic Fertilizers

Basic granular fertilizers are relatively safe for humans to use and handle. Granular fertilizers that also contain "weed control" herbicides for undesired plants require a bit more precaution as many of the added chemicals are hazardous or toxic. Inorganic fertilizers do present a substantial risk to the environment if used improperly, and indirectly to humans as well.

Common Products

- Scott's Lawn Builder
- Scott's Green Max Lawn Food
- Vigoro Lawn Fertilizer

- Bayer All-in-One Weed & Feed
- Sta-Green Fertilizer

Hazard Rating | ★ ★ (Low)

Reason for Rating

Impact to environment and humans post-use, specifically the effects of runoff and ground-water contamination on humans and the regional ecosystem. Presence of hazardous chemicals in many consumer products.

Active Ingredient(s)

Various Nitrogen / Phosphorus / Potassium Compounds
Urea, Methylurea, Ammonium Sulfate, Potassium Sulfate, etc.

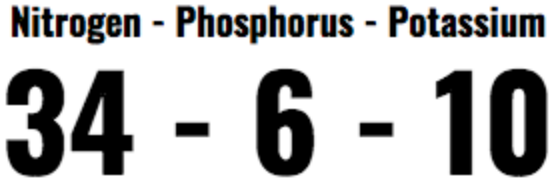
Additive Chemicals for Weed and Pest Control

- Atrazine (Herbicide)
- Aldicarb (Insecticide)
- Bifenthrin (Insecticide)
- Indaziflam (Herbicide)
- Penoxsulam (Herbicide)
- Dicamba (Herbicide)

About Granular Fertilizers

Most residential lawn fertilizers are rated using the NPK system. The term “NPK” is simply a combination of nitrogen (N), phosphorus (P), and potassium (K) elemental ids. The label allows

for quick identification of the fertilizer's chemical composition, expressed as a ratio by weight/mass using the format below.



The majority of residential fertilizers are high in nitrogen, which is an important building block for chlorophyll, amino acids, and other vital components of plants. Fertilizers marketed as "starter" mixes will contain substantially more phosphorus to aid root development. These elements are also useful to algae.

Granular Fertilizer Hazards and Prevention Tips

- Causes eye irritation
- Wash hands thoroughly after handling
- Use proper settings on spreaders
- Be aware of added chemicals on fertilizers with additional features like pest-control, weed control, etc.
- Limit usage and follow soil demands if possible

Potential Hazards of Granular Fertilizer

Rainfall and excessive watering carry off a substantial amount of nitrogen and phosphorus that originated from fertilized lawns. In fact, the EPA states that, "nutrient pollution is one of America's most widespread, costly and challenging environmental problems, and is caused by excess nitrogen and phosphorus in the air and water." (EPA, 2018)

An excess of nitrogen and phosphorus feed algae and lead to an overgrowth event known as a “bloom.” Certain types of algae can lead to toxic water conditions for fish known as a “red tide” or “brown tide” depending on the algae type. In extreme cases, the algae can completely overwhelm the aquatic ecosystem and cause a dead zone due to a lack of available oxygen.

Potential Hazards of Atrazine

Atrazine is a herbicide used in many lawn care products to control weeds. Exposure to atrazine in drinking water has been shown to correlate with higher incidences of intrauterine growth retardation (IUGR) during pregnancy. (Munger et al. 1997) A peer review of atrazine studies also found, “that atrazine, and perhaps other co-occurring herbicides in drinking water, is associated with an increased prevalence of SGA, but not preterm delivery.” (Ochoa-Acuña et al. 2009)

Atrazine Record in the US National Library of Medicine Toxicology Data Network

Potential Hazards of Bifenthrin

Bifenthrin is a botanical insecticide used in many lawn care products. It acts on the nervous system and causes paralysis in common pests such as fire ants. It is rated as very highly toxic to fish and aquatic life by the EPA, so precaution should be taken to avoid runoff and minimize usage of the product if insects are not a problem.

Bifenthrin also exhibited negative behaviors on the human endocrine system, and presented “... significant concern with

respect to maternal-fetal health." (Zhao M et al, 2014)

Bifenthrin Record in the US National Library of Medicine Toxicology Data Network

Potential Hazards of Indaziflam

Indaziflam controls weeds by inhibiting cellulose biosynthesis. Indaziflam and its metabolite fluoroethyldiaminotriazine (FDAT) have a similar chemical structure to other -azine chemicals, such as atrazine above, but the EPA believes they are sufficiently dissimilar to group together.

Overall, indaziflam appears to be one of the safer herbicides on the market to both humans and the environment. It did show a unique toxicity to dogs, particularly affecting their nervous system when chronically exposed through the skin (Eigenberg, 2008) or diet. (Jensen, 2007) Take care to not overuse this product on lawns where dogs reside to reduce exposure, or consider a safer alternative.

Indaziflam is also known by the trade names Marengo and Specticle.

Potential Hazards of Penoxsulam

Penoxsulam has a relatively low toxicity across the board compared to other herbicides. Testing did reveal a propensity for dogs and female rats to develop stones in the bladder which caused urinary tract damage, but only through chronic exposure to elevated dosages. The EPA may conduct further testing to analyze its effects on the endocrine system.

EPA Report on Penoxsulam

Potential Hazards of Dicamba

Dicamba is a selective herbicide in the benzoic acid family used to control broadleaf lawn weeds. In testing it was shown to be severely irritating and corrosive to eye tissue in rabbits regardless of being washed or not. (Thompson, 1984) While the amount of dicamba is very low compared to agricultural usage, precaution should be taken to avoid getting any of it in the eyes, mouth, or throat.

Dicamba also has been found to be a “DNA damage agent” (Gonzalez NV et al, 2006) due to its effects on DNA in peer-reviewed studies, specifically:

> … [Dicamba] is capable of inducing DNA damage since it significantly increases the unwinding rate for liver DNA in vivo and also induces unscheduled DNA synthesis in human peripheral blood lymphocytes in vitro in the presence of exogenous metabolic activation. (US NLM Toxnet, 2018)

Dicamba Record in the US National Library of Medicine Toxicology Data Network

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Weed Killers

Roundup® Ready-to-Use Spray

Hazard Rating | ★ ★ ★ (Moderate)

Reason for Rating

Low percentage of glyphosate at 2.0% by volume. Rated Group 2A as “probably carcinogenic” based on evidence that Roundup may be linked to B-cell lymphoma in occupational exposure according to the WHO IARC (IARC, 2015), and early evidence Roundup in its final formulation may be toxic. (Mesnage et. Al, 2014)

Active Ingredient(s)

Glyphosate, isopropylamine salt (2.0%)
N-Glycine
N-(phosphonomethyl)glycine
Pelargonic Acid (2.0%)

About Roundup®

Roundup was developed by Monsanto and sold as a herbicide for consumers and agriculture. Roundup’s main ingredient, glyphosate, breaks down into aminomethylphosphonic acid (AMPA), methylphosphonic acid, and carbon dioxide.

Roundup® Hazards and Prevention Tips

- Causes serious eye irritation
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Roundup SDS

Potential Hazards of Roundup®

The active ingredient, glyphosate, has been rated by the International Agency for Research on Cancer (IARC) as a potential carcinogen due to "... evidence of carcinogenicity" (IARC, 2015) in US and EU studies as well as "... convincing evidence that glyphosate also can cause cancer in laboratory animals" (IARC, 2015). The IARC particularly notes that:

> Glyphosate also caused DNA and chromosomal damage in human cells, although it gave negative results in tests using bacteria. One study in community residents reported increases in blood markers of chromosomal damage (micronuclei) after glyphosate formulations were sprayed nearby. (IARC, 2015)

According to the US National Library of Medicine record for glyphosate, Roundup has shown evidence of being an endocrine disruptor in several studies. It has further toxicity in concentrated and non-standard exposure routes (ingestion, etc). (TOXNET, 2018)

Glyphosate Record in the US National Library of Medicine Toxicology Data Network

Roundup® Extended Control Ready-to-Use Spray

Hazard Rating | ★ ★ ★ (Moderate)

Reason for Rating

Lower concentration of glyphosate at 1% by volume. Rated Group 2A as "probably carcinogenic" based on evidence that Roundup may be linked to B-cell lymphoma in occupational exposure

according to the WHO IARC (IARC, 2015), and early evidence Roundup in its final formulation may be toxic. (Mesnage et. Al, 2014)

Active Ingredient(s)

Glyphosate, isopropylamine salt (1.0%)
Pelargonic Acid (2.00%)
Imazapic, ammonium salt (0.017%)

About Roundup® Extended Control

Roundup Extended Control is a long-action herbicide meant to prevent unwanted plant growth in targeted areas. Glyphosate was developed by Monsanto and sold as a herbicide for consumers and agriculture. Roundup's main ingredient, glyphosate, breaks down into aminomethylphosphonic acid (AMPA), methylphosphonic acid, and carbon dioxide. Imidazolinone herbicides like Imazapic are selective and potent herbicides used to control a wide spectrum of broad-leafed weeds and grasses in a variety of crops, including soybean, alfalfa, wheat, and barley, and in non-crop situations.

Roundup® Extended Control Hazards and Prevention Tips

- Causes serious eye irritation
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Roundup Extended Control SDS

Potential Hazards of Roundup® Extended Control

The active ingredient, glyphosate, has been rated by the International Agency for Research on Cancer (IARC) as a potential carcinogen due to "... evidence of carcinogenicity" (IARC, 2015) in US and EU studies as well as "... convincing evidence that glyphosate also can cause cancer in laboratory animals" (IARC, 2015). The IARC particularly notes that:

> Glyphosate also caused DNA and chromosomal damage in human cells, although it gave negative results in tests using bacteria. One study in community residents reported increases in blood markers of chromosomal damage (micronuclei) after glyphosate formulations were sprayed nearby. (IARC, 2015)

According to the US National Library of Medicine record for glyphosate, Roundup has shown evidence of being an endocrine disruptor in several studies. It has further toxicity in concentrated and non-standard exposure routes (ingestion, etc). (TOXNET, 2018)

Glyphosate Record in the US National Library of Medicine Toxicology Data Network

Imazapic has not been well researched at the time of this article, but has not shown indications of being carcinogenic or severely toxic.

Imazapic Record in the US National Library of Medicine Toxicology Data Network

Roundup® Max Control 365 Ready-to-Use Spray

Hazard Rating | ★ ★ ★ ★ (High)

Reason for Rating

Rated Group 2A as “probably carcinogenic” based on evidence that Roundup may be linked to B-cell lymphoma in occupational exposure according to the WHO IARC (IARC, 2015), and early evidence Roundup in its final formulation may be toxic. (Mesnage et. Al, 2014) Risks of acute symptoms due to addition of diquat dibromide.

Active Ingredient(s)

Glyphosate, isopropylamine salt (1.0%)
Imazapic, ammonium salt (0.08%)
Diquat Dibromide (0.04%)

About Roundup® Max Control

Roundup Max Control is a concentrated, long-action herbicide meant to prevent plant growth in targeted areas. Imidazolinone herbicides like Imazapic are selective and potent herbicides used to control a wide spectrum of broad-leafed weeds and grasses in a variety of crops, including soybean, alfalfa, wheat, and barley, and in non-crop situations. Glyphosate was developed by Monsanto and sold as a herbicide for consumers and agriculture. Roundup’s main ingredient, glyphosate, breaks down into aminomethylphosphonic acid (AMPA), methylphosphonic acid, and carbon dioxide. Diquat is a contact herbicide that produces

desiccation and defoliation.

Roundup® Max Control Hazards and Prevention Tips

- Causes serious eye irritation
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Roundup Max Control SDS

Potential Hazards of Roundup® Max Control

The active ingredient, glyphosate, has been rated by the International Agency for Research on Cancer (IARC) as a potential carcinogen due to "... evidence of carcinogenicity" (IARC, 2015) in US and EU studies as well as "... convincing evidence that glyphosate also can cause cancer in laboratory animals" (IARC, 2015). The IARC particularly notes that:

> Glyphosate also caused DNA and chromosomal damage in human cells, although it gave negative results in tests using bacteria. One study in community residents reported increases in blood markers of chromosomal damage (micronuclei) after glyphosate formulations were sprayed nearby. (IARC, 2015)

According to the US National Library of Medicine record for glyphosate, Roundup has shown evidence of being an endocrine

disruptor in several studies. It has further toxicity in concentrated and non-standard exposure routes (ingestion, etc). (TOXNET, 2018)

Glyphosate Record in the US National Library of Medicine Toxicology Data Network

Imazapic has not been well researched at the time of this article, but has not shown indications of being carcinogenic or severely toxic.

Imazapic Record in the US National Library of Medicine Toxicology Data Network

Diquat dibromide has not shown indications of being carcinogenic, but it does have the potential for acute symptoms if inhaled including irritation of the mouth, throat, and lungs, cough, and chest pain. Long exposures to concentrated, liquid diquat dibromide can cause chemical burns to skin. (Manoguerra, 1990) Symptoms from overdoses of diquat dibromide range in severity and consistency.

Diquat Dibromide Record in the US National Library of Medicine Toxicology Data Network

Bayer-Advanced Season Long Weed Control

Hazard Rating | ★ ★ ★ (Moderate)

Reason for Rating

Isoxaben classified as “C - Possible Human Carcinogen” due to a statistically significant, increased incidence of benign liver tumors in animal testing. (EPA OPP, 1989) Dicamba also has been found to be a “DNA damage agent” (Gonzalez NV et al, 2006) due to its

effects on DNA in peer-reviewed studies.

US EPA IRIS Document for Isoxaben

Active Ingredient(s)

2,4-D, dimethylamine salt (4.73%)
Isoxaben (2.63%)
Mecoprop-p, potassium salt (1.10%)
Dicamba, potassium salt (0.52%)

About Bayer-Advanced Season Long Weed Control

Bayer SL Weed Control Hazards and Prevention Tips

- Causes serious eye irritation
- Causes irritation of the airways if inhaled
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes, separately when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

Potential Hazards of Bayer-Advanced Season Long Weed Control

Isoxaben classified as “C - Possible Human Carcinogen” due to a statistically significant, increased incidence of benign liver tumors in animal testing. (EPA OPP, 1989) Dicamba also has been found to be a “DNA damage agent” (Gonzalez NV et al, 2006) due to its effects on DNA in peer-reviewed studies. Mecoprop-p and 2,4-D

are both chlorophenoxy compounds which:

> In animals, chlorophenoxy compounds have been shown to demyelinate peripheral nerves, depress ribonuclease synthesis, uncouple oxidative phosphorylation, and increase hepatic peroxisomes. They are also moderately irritating to skin and mucous membranes.

Mecoprop Record in the US National Library of Medicine Toxicology Data Network

2,4-D Dimethylamine Record in the US National Library of Medicine Toxicology Data Network

Spectracide Weed Stop for Lawns

Hazard Rating | ★ ★ ★ (Moderate)

Reason for Rating

Dicamba has been found to be a “DNA damage agent” (Gonzalez NV et al, 2006) due to its effects on DNA in peer-reviewed studies. Mecoprop-p and 2,4-D are both chlorophenoxy compounds which have shown to cause nervous system damage in animal testing.

Active Ingredient(s)

2,4-D, dimethylamine salt (7.59%)
Mecoprop-p, dimethylamine salt (1.83%)
Dicamba, dimethylamine salt (0.84%)

About Spectracide Weed Stop for Lawns

The product is a mixture of several active ingredients including

chlorophenoxy compounds 2,4-D and Mecoprop-p, and the benzoic acid compound Dicamba. All of these chemicals are active herbicides and combined to provide a broader effectiveness on weeds.

Spectracide Weed Stop Hazards and Prevention Tips

- Causes serious eye irritation
- Causes irritation of the airways if inhaled
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes, separately when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Spectracide SDS Resource

Potential Hazards of Spectracide Weed Stop for Lawns

Dicamba has been found to be a “DNA damage agent” (Gonzalez NV et al, 2006) due to its effects on DNA in peer-reviewed studies. Mecoprop-p and 2,4-D are both chlorophenoxy compounds which:

> In animals, chlorophenoxy compounds have been shown to demyelinate peripheral nerves, depress ribonuclease synthesis, uncouple oxidative phosphorylation, and increase hepatic peroxisomes. They are also moderately irritating to skin and mucous membranes.

Mecoprop Record in the US National Library of Medicine Toxicology

Data Network

2,4-D Dimethylamine Record in the US National Library of Medicine Toxicology Data Network

Insect Killer

Bayer-Advanced Tree & Shrub Insect Control

Hazard Rating | ★ ★ (Low)

Reason for Rating

Imidacloprid showed genotoxicity to human hepatoma cells (Bianchi et al, 2015)

Active Ingredient(s)

Imidacloprid (0.74%)
Clothianidin (0.37%)
Potassium Chloride (1.69%)
Ammonium Phosphate (2.28%)

About Bayer-Advanced Tree & Shrub Insect Control

The product is a mixture of two main insecticides belonging to the neonicotinoid family. It targets pests that commonly attack trees and shrubs. The active ingredients are relatively safe compared to many other chemicals found in lawn care due to the mechanism of action.

Bayer T&S Insect Control Hazards and Prevention Tips

- Causes moderate eye irritation

- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash saturated clothes, separately when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Bayer-Advanced Tree & Shrub Insect Control SDS

Fungicide

GardenTech Daconil® Fungicide

Hazard Rating | ★ ★ ★ (Moderate)

Reason for Rating

Rated Group 2B by the WHO IARC as “possibly carcinogenic” based on sufficient evidence in experimental animal testing. (IARC, 2018) The EPA also rated chlorothalonil as, Group B2 “likely carcinogenic to humans.” (EPA, 1999)

US EPA R.E.D. Facts Document for Chlorothalonil

Active Ingredient(s)

Chlorothalonil (29.6% by Volume)
2,4,5,6-tetrachloroisophthalonitrile

About GardenTech Daconil® Fungicide

Daconil is a broad-spectrum fungicide to control leaf spots, rust, blights, fruit rots, mildews, scab, molds on vegetables, fruits, roses, shrubs, trees and ornamentals. It's active ingredient, chlorothalonil, was first registered in 1966 for usage on turfgrass.

GardenTech Daconil® Fungicide Hazards and Prevention Tips

- Causes serious eye irritation
- Causes irritation of the airways if inhaled
- Wear protective eye/face protection
- Wash hands thoroughly after handling
- Wash clothes, separately when done to avoid further exposure
- Avoid spraying on windy days and stay upwind
- Clean equipment after use

For more details and classifications view the Daconil SDS

Potential Hazards of GardenTech Daconil® Fungicide

The active ingredient, chlorothalonil, has been rated by the International Agency for Research on Cancer (IARC) and EPA as a possible carcinogen due to animal testing results. Chlorothalonil is extremely toxic to fish and aquatic life, care should be taken to avoid spraying it before large rainfall events or excessive lawn watering.

Organic Materials

Manure

Hazard Rating | ★ (Very Low)

Reason for Rating

Manure contains a number of pathogens that can cause significant illness through contact and exposure to runoff.

Active Ingredient

Animal Feces (100%)

About Manure

Organic fertilizers such as animal manure have been used for thousands of years to return nutrients to fields and improve crop yields. They also can present issues due to the amount of bacteria present.

Manure Hazards and Prevention Tips

- Wear disposable gloves when handling manure
- Thoroughly wash off with warm, soapy water after handling manure
- Avoid handling manure if you are sick or have a weakened immune system
- Clean any equipment or surfaces that come into contact with manure
- Wear a mask when moving manure from place to place
- Work manure into the ground to prevent runoff and reduce the growth of pathogenic bacteria
- Work manure first into a compost pile to reduce the bacteria count

Potential Hazards of Manure

Rainwater and excess watering of manure laden ground can have a significant effect on waterways and the animals supported by those waterways due to the presence of pathogens such as *E. coli.* and *coliforms*.

Household Compost

Hazard Rating | ★ (Very Low)

Reason for Rating

According to a study on cold composting (small scale composting) bacterium such as *Clostridium perfringens*, *E. Coli*, *Fecal Coliform*, *Enterococci*, and *Streptococci* can be widely found in compost. (Cornell WMI, 2004)

Active Ingredient

Organic Waste and Roughage (100%)

About Household Compost

Composting is a great way to recycle household organic waste back into your lawn or garden. However, it also can become a factory for harmful bacteria if conditions are not optimal.

Household Compost Hazards and Prevention Tips

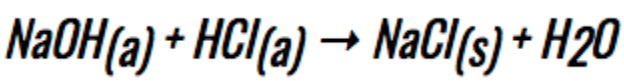
- Wear disposable gloves when handling compost
- Thoroughly wash off with warm, soapy water after handling compost

- Avoid handling compost if you are sick or have a weakened immune system
- Clean any equipment or surfaces that come into contact with compost
- Wear a mask when moving compost from place to place
- Allow compost to age for at least a year before use (if possible)
- Ensure your compost pile is reaching sufficient temperature (55°C / 130°F for at least 4-hours)

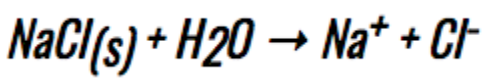
  For more in-depth information regarding composting and the science behind it, check out the Cornell Composting Science Guide

Why So Much Salt?

The chemicals used in agriculture often start as strong acids or bases. These reagents are combined in a neutralization reaction to provide a much safer end product with a wider range of attributes: a salt. An easy example is turning sodium hydroxide and hydrochloric acid (two strong, hazardous liquids) into common table salt, heat, and water.



Since table salt (NaCl) is soluble in water, it will dissolve into ionic elements (anions / cations).



These ions will then interact with other elements to create molecules and perpetuate the chemical cycles that benefit plants such as the nitrogen cycle. Water present in the soil and additional

water from watering or rainfall will activate this process.

Avoiding Exposure and Contamination

> “An ounce of prevention is worth a pound of cure” - Benjamin Franklin

You wouldn’t think twice about wearing a mask and Tyvek suit to handle asbestos today, but fifty years ago you could walk into a store and buy an asbestos oven mitt and think it was a great product. That’s why it is a good practice to provide a barrier between you and the product; however inert we may think it is today. Here’s some basic tips:

- Wear disposable gloves when handling materials, even dry materials
- Wear the proper type of glove for the material, strong acids and bases will require a different glove material and design than handling biologics in a hospital
- Wear an N100-rated mask or respirator when working with dusty materials
- Keep several types of replacement canisters for your respirator to suit different situations, ex. chemical fumes vs. particulates (P100s)
- Cover your skin, most lawn chemicals are water soluble which means they will dissolve into sweat
- Avoid cross contamination, change out of clothes and shoes that have been exposed to chemicals and wash them separately if possible
- Always have a close source of clean water available when using any caustic, acidic, or irritating chemical in case of contamination or

accidents

- Follow the product instructions, they are there for a reason and are often the result of extensive product testing
- Use only what you need and properly store away any remainder
- Properly dispose of any waste chemicals, it's not always convenient, but it's the right thing to do (Search for "household waste disposal" in your area)

Suitable Protective Equipment

Chemical Resistant Gloves
DuPont Tyvek Coveralls
Eye Protection
3M N100 Mask
3M Respirator
3M P100 Organic Vapor Filters for Respirator

Limitations

It takes substantial effort, time, and funding to properly study the short-term and long-term effects of a single chemical. Those single chemicals may act differently when combined with other chemicals and sold as a product. Furthermore, lab environments are purposely controlled to limit complexity and improve confidence in the results. Real world outcomes are often different due to the introduction of varied conditions. As such, it's always a good habit to treat any material as if it were hazardous and wear basic protective equipment to prevent exposure.

Research Links

US National Library of Medicine TOXNET
National Pesticide Information Center
US EPA - Pesticides
International Agency for Research on Cancer

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of Isoxaben (Memorandum from K.C. Swentzel to R. Mountfort, Peer Review of Isoxaben- Reevaluation Following the September 7, 1988 Science Advisory Panel Review. 01/04/1989)

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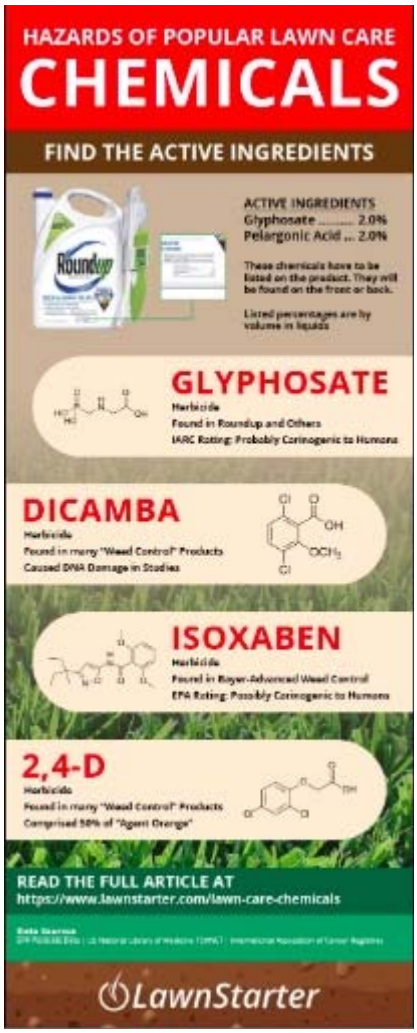
Infographic



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