

VTPP Quarterly

A Newsletter From Virginia Tech Pesticide Programs

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Pesticide Exposure vs. Heat Stress

Stephanie Blevins Wycoff – Extension Associate

Anyone working with or near pesticides (e.g., pesticide handlers, pesticide applicators, and agricultural workers) should be aware of the signs and symptoms of pesticide exposure. Pesticide workers also need to recognize the signs and symptoms of heat stress since this condition can look very similar to pesticide poisoning. This article discusses the similarities and differences between pesticide exposure and heat stress and ways to prevent these conditions.

What Is Pesticide Exposure, and How Does It Occur?

Pesticide exposure is the result of pesticides getting on or in the body. This can happen to anyone that comes into contact with pesticides. However, pesticide handlers, applicators, and other agricultural workers are particularly vulnerable. Pesticide exposure can occur when safety procedures are not being followed (e.g., not washing after handling pesticides, or splashing pesticides while mixing) or proper personal protective equipment (PPE) is not being

used. Pesticide exposure can also occur through

- Accidental spills (either on yourself or on the ground).
- Entering treated areas before the restricted-entry interval has expired.
- Accidental ingestion.

Using PPE can minimize pesticide exposure through four routes of entry: dermal, ocular, inhalation, and ingestion (fig. 1).

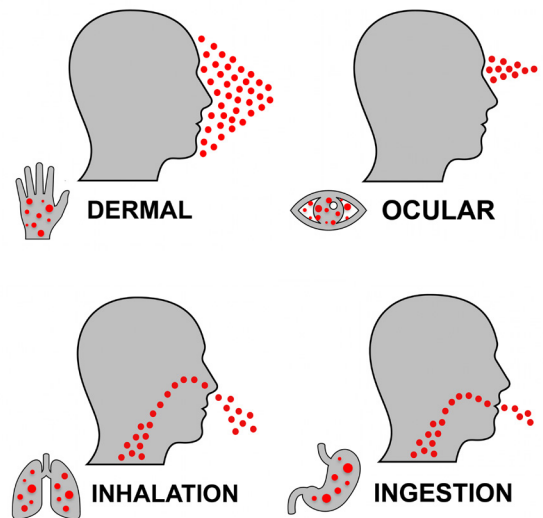


Figure 1. The four routes of exposure to pesticides.

What Is Heat Stress, and How Does It Occur?

Heat stress is an illness that occurs when our bodies become overheated. Pesticide handlers, applicators, and other agricultural workers are prone to heat stress due to the nature of their work. Heat stress can manifest as either heat exhaustion or heat stroke. Heat exhaustion can lead to heat stroke, which is a serious, life-threatening condition. The use of PPE to protect against pesticide exposure can increase the risk of heat related illnesses. That is why it is important to be aware of the signs and symptoms of both heat stress and pesticide exposure.

Pesticide Exposure vs. Heat Stress: Signs and Symptoms

When a pesticide exposure occurs, there are two types of clues to recognize: signs and symptoms. Signs, like vomiting or fainting, are visible to other people. Symptoms, such as feeling cramps or having a headache, are noticeable to the victim. There are several similarities and differences between the signs and symptoms for each condition. These are outlined in Tables 1 and 2. If pesticide exposure or heat stress is suspected, stop work immediately, remove the victim from the situation, and seek medical attention.

Table 1. Similar signs and symptoms can develop for both pesticide exposure and heat stress.

Signs and Symptoms	Pesticide Exposure	Heat Stress
Headache	✓	✓
Nausea	✓	✓
Chills	✓	✓
Fatigue (exhaustion or muscle weakness)	✓	✓
Muscle cramps	✓	✓
Dizziness	✓	✓
Severe thirst	✓	✓
Excessive sweating	✓	✓
Confusion	✓	✓
Loss of consciousness	✓	✓

Table 2. Several signs and symptoms can help differentiate between pesticide exposure and heat stress.

Signs and Symptoms	Pesticide Exposure	Heat Stress
Skin redness, blisters, rash, and/or burns	✓	
Swelling, burns, and/or stinging in eyes, nose, mouth, and/or throat	✓	
Vomiting and/or diarrhea	✓	
Moist membranes (salivation, tears)	✓	
Chest pains and/or difficulty breathing	✓	
Slow pulse	✓	
Constricted pupils	✓	
Hot, dry skin and lack of sweating		✓
High body temperature		✓
Dry membranes (dry mouth, no tears)		✓
Fast pulse		✓
Dilated pupils		✓

First Aid Procedures

In the case of pesticide exposure, be familiar with the “First Aid” section of the pesticide product label. This section gives specific instructions on how to administer first aid based on the route of exposure (fig. 2). Some labels list instructions for all routes of exposure; other labels list instructions for only a few routes. Each situation and pesticide product requires a different response. In all cases of pesticide exposure, you should seek medical treatment as soon as possible. Be sure to give the pesticide product label to a medical professional to ensure proper treatment.

In the case of heat stress, move the victim to shade as soon as possible. Splash the victim’s skin with cool water, especially the face, neck, hands, and forearms.

FIRST AID

If Swallowed: Immediately call a Poison Control Center or doctor. Do not induce vomiting unless told to by a Poison Control Center or doctor. Do not give any liquid to the person. Do not give anything by mouth to an unconscious person.

If on Skin or Clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a Poison Control Center or doctor for treatment advice.

If in Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a Poison Control Center or doctor for treatment advice.

NOTE TO PHYSICIAN: This product contains a cholinesterase inhibitor. Atropine is antidotal. 2-PAM may also be given in conjunction with Atropine. May pose an aspiration pneumonia hazard. Contains petroleum distillate.

Have the product container or label with you when calling a Poison Control Center or doctor, or going for treatment.

Figure 2. An example of the instructions you might find in the "First Aid" section of a pesticide product label.

If feasible, a cool bath can also help decrease body temperature. Remove any PPE or excess clothing that is making the heat stress worse. Provide cool water for the victim to sip. Remain calm, keep the victim calm, and call for help.

Prevention Tactics

Several tactics can be used to minimize pesticide exposure:

- Plan pesticide applications ahead of time, and work carefully to avoid accidents.
- Use safety systems when possible, like closed mixing and loading systems and enclosed cabs.
- Choose products and packaging that make pesticide handling easier, like water-soluble packaging.
- Wear the PPE recommended on the pesticide product label.

PPE can greatly reduce pesticide exposure. You should always follow the pesticide label directions for PPE. It is also important to keep PPE clean and replace reusable items regularly.

There are also several tactics that can be used to avoid heat stress:

- Take frequent breaks, and drink plenty of water and/or sports drinks to stay hydrated.
- Use fans, and take advantage of shade whenever possible.

- Plan pesticide applications when environmental conditions are favorable. High temperatures, humidity, and sunlight create unfavorable conditions and can increase the chances of heat stress. If conditions are unfavorable, stop work and wait to resume when conditions improve.
- Understand that PPE can increase the risk of heat stress. Adjust work schedules so that tasks requiring PPE can be accomplished during the coolest part of the day.

For further information on pesticide exposure and heat stress, please refer to the following resources:

- Managing Pesticide Poisoning Risk and Understanding the Signs and Symptoms – Nebraska Extension Publications: <https://extensionpublications.unl.edu/assets/pdf/ec2505.pdf>
- Heat Stress – Centers for Disease Control and Prevention and The National Institute for Occupational Health and Safety: <https://www.cdc.gov/niosh/topics/heatstress/>

Spray Nozzle Selection (Part 1 of a 2 part series)

Kathleen Miller – Extension Associate

Nozzles are a vital component of any pesticide spray application. They affect pesticide output, droplet size and distribution, and spray pattern. Pesticide applicators have two essential responsibilities:

1. Make sure a legal amount of product is applied.
2. Apply the product in a safe manner.

By knowing how to choose the appropriate nozzle for your pesticide application, you can help ensure these tasks are met.

What to Consider When Selecting a Nozzle

Successful selection of a nozzle is dependent on a variety of factors. It is important to reflect on the type of application being made, and consider how it will be influenced by the following factors:

- Type of pesticide formulation.
- Desired coverage.
- Target site.
- Risk of spray drift.
- Equipment operating pressure.

It is also important to read the product label carefully for any flow rate requirements or droplet size recommendations.

Spray Nozzle Function and Components

The spray nozzle functions as an atomizing device. It separates the stream of liquid pesticide product into droplets. This atomizing effect is produced by a

pressurized boom that pushes the pesticide through the nozzle tip.

A spray nozzle is composed of several parts: the body, cap, screen (or strainer), gasket, and nozzle tip. The body attaches to the boom, while the cap secures the tip, gasket, and screen to the nozzle body. The screen is what protects the nozzle tip from clogging, and the gasket creates a seal to prevent pesticide leakage. The nozzle tip forms the spray droplets.

The size of the nozzle tip's opening (also called the orifice) influences droplet size, flow rate, and spray pattern. Droplet size and distribution determine the coverage of an application. Contact pesticides typically require finer droplets distributed across the target site, whereas systemic pesticides will be effective applied as coarser (i.e., larger) droplets. Coarser droplets are also less likely to drift from the application site. Flow rate is the volume of material released by the nozzle per unit time, typically expressed in ounces per minute. The shape of the spray released from the nozzle is known as the spray pattern. Spray pattern is chosen based on how well it suits the specific pesticide application.

Nozzle tips are made from a variety of materials (fig. 3). The type of material you select will depend on the durability the application requires. Nozzle tip materials should be selected based on the pesticide formulation's level of abrasiveness. Ceramic and hardened stainless steel nozzle tips are most resistant to wear when using abrasive pesticide formulations but are the most expensive. Stainless steel nozzle tips also have good wear life. Nozzle tips made from polymer or brass are typically the least expensive but will wear at a faster rate.



Figure 3. Nozzle tips are made from a variety of materials which determine their durability (L to R: polymer, brass, brass, and stainless steel).

Importance of Correct Spray Nozzle Selection

The nozzle you select can mean the difference between a safe and successful application and one that is dangerous and ineffective. A correctly chosen nozzle follows label requirements, increases the effectiveness of an

application, and reduces spray drift.

Incorrect selection of a spray nozzle can lead to under- or over-application of a pesticide product. Underapplication (or underdosing) may fail to control the pest. This can increase selection pressure and lead to pesticide resistance. Overapplication (or overdosing) violates the pesticide label and is illegal – remember, the label is the law! Overapplication of a pesticide can also be expensive and dangerous. Using more product than necessary will increase application costs. Additionally, overapplication can harm the site of application (i.e., plant, animal, structure, etc.) or increase the chance of harm to people and the environment. Applying a pesticide product greater than the labeled rate on food/feed crops can also lead to illegal pesticide residues, which can result in fines and the removal of the crop from the market.

In part two of our Spray Nozzle Selection series, we will focus on different nozzle designs and spray patterns, and how to choose a nozzle for a specific pesticide application. We will give specific examples and the application rate calculations used to help select the correct nozzle.

Testing Options for Pesticide Applicators

Jackie Brown – Online Education Support Specialist

There are three options for taking your pesticide applicator certification exam: testing at the Department of Motor Vehicles (DMV), testing online with Everblue, or scheduling an appointment to take the written exam. Each option is explained below.

Note: Each option offers the ability to take more than one exam at a time.

Testing at the DMV

Take your exam on a touch-screen computer at your local DMV Customer Service Center. There is no additional fee to take the exam at DMV. To find a DMV testing site, visit dmv.virginia.gov/DMVLocator/.

All applicators must submit an application to Virginia Department of Agriculture and Consumer Services, Office of Pesticide Services (VDACS-OPS) and receive a Letter of Authorization BEFORE testing at the DMV. You must bring a copy of the Letter of Authorization with you to the DMV, or you will not be able to take the exam. Upon passing the exam, you will receive a temporary certificate.

Testing Online With Everblue

After submitting your application to take an exam, you have the option to take your exam online from your home or office via Everblue's online testing portal. This option

requires an online testing fee of \$26.78 for each exam, plus a credit card processing fee of \$1.08. The exam(s) can be taken 24 hours a day, seven days a week during the 90-day authorization period. If you include an email address on your application to test, you will automatically receive an email invitation from Everblue once your application and Letter of Authorization have been processed. Computer, webcam, and microphone are required. If you provided an email on your application for certification form, you should receive an email from Everblue with further details. If you did not provide an email and wish to test online, send an email to -VDACS-OPS at opsclrt.vdacs@vdacs.virginia.gov. Upon passing the exam, you will receive a temporary certificate.

For additional information about the enrollment process and how online testing with Everblue's AI-assisted proctoring works, you can view this video, vimeo.com/812846108/1a31ad05f3.

Written Exam by Appointment

Commercial applicators and registered technicians (RTs) can take a written exam by appointment with a local Pesticide Investigator or at a VDACS testing center. Contact the Office of Pesticide Services at opsclrt.vdacs@vdacs.virginia.gov to schedule an appointment. There is no additional fee to take the exam with a Pesticide Investigator or at a VDACS testing center.

All commercial applicators and RTs must submit an application to VDACS-OPS and receive a Letter of Authorization BEFORE making an appointment to test via written exam. You must bring a copy of the Letter of Authorization with you to your appointment, or you will not be able to take the exam.

Private applicators can take a written exam by appointment at a Virginia Cooperative Extension (VCE) office (no Letter of Authorization is needed). There is no fee to take the exam at a VCE office. To find your county Extension office, visit ext.vt.edu/offices.html.

Blast From the Past

Stephanie Blevins Wycoff – Extension Associate

Hudson Atomizer Hand Sprayer

This antique hand sprayer was used to apply small amounts of various liquid pesticides (fig. 4). It was manufactured by the H.D. Hudson Manufacturing Company of Chicago, Illinois and patented in 1955. As the sprayer was pumped, liquid pesticide was drawn up a small tube connected to the reservoir. As liquid reached the top of the tube, air pushed across the open end of the tube and produced a very fine droplet spray. This type

the tube and produced a very fine droplet spray. This type of hand sprayer was commonly used by consumers for pesticide applications around the home and garden. Interestingly, the H.D. Hudson Manufacturing Company is still in business today, producing a variety of sprayers for the lawn and garden market.



Figure 4. Hudson Atomizer Hand Sprayer, 1955.

Program Updates

VTPP Updates

Administrative Changes for Private Pesticide Applicator Exams

As a reminder, VTPP has taken over the grading of private pesticide applicator written exams. All VCE offices should mail Private Applicator Testing Application forms and their associated exam bubble sheets to the following address:

Rachel Parson % VTPP
460 West Campus Dr.
302 Agnew Hall
Blacksburg, VA 24061

Please be aware that written exams cannot be graded unless they are accompanied by a fully completed Private Applicator Testing Application form. All exam proctors should be sure to carefully review and follow the private applicator exam proctor guidelines and exam instructions. If you are not sure who in your office is listed as a proctor for the private pesticide applicator exam, please contact VTPP at 540-231-6543. All forms, guidelines, and instructions related to private pesticide applicator exam testing are located on the "Agents" page of the VTPP website: vtp.org.

For information about giving written exams to high school students, contact Rachel Parson at 540-231-6543.

If VCE offices do not have the 2022 private applicator exam booklets, or need additional private exam bubble sheets, please contact VTPP or VDACS-OPS. Do not use old exams or bubble sheets.

Options to take the private applicator exam at the DMV or online via Everblue's online testing portal are available. However, testers must submit their Private Applicator Testing Application form to VDACS-OPS in order to receive a Letter of Authorization to use either of these two options. (See Testing Options for Pesticide Applicators on page 4 for more information.)

VDACS Updates

Commercial Pesticide Applicator and Registered Technician Recertification and Renewal

VDACS-OPS is processing pesticide applicator renewals, entering recertification credits, and issuing new certificates daily. Commercial applicators and RTs whose certifications expires June 30, 2023, and who have met the recertification requirements, will have their certificates automatically renewed. Even if they do not receive their new certificates by June 30, they are considered to be "renewed." This is similar to what has been done in the past.

VDACS-OPS has also sent renewal letters to all commercial pesticide applicators and RTs whose certificates expire on June 30, 2023, reminding them that they are required to obtain recertification credits prior to the expiration date. The letters also provide information related to the removal of fees associated with applicators' renewal certification.

Applicators with questions can send an email to opsclrt.vdacs@vdacs.virginia.gov. This email box is monitored daily by multiple VDACS-OPS staff, and email is forwarded to the appropriate staff person for response.