Department of Pesticide Regulation

Gavin Newsom
*Governor*

Karen Morrison
*Director*

Yana Garcia
*Secretary for*
*Environmental Protection*

TO: Karen Morrison, Director, Department of Pesticide Regulation (DPR)

VIA: Madison H. Le, Deputy Director, Monitoring and Mitigation, DPR

FROM: Jag Sahota, Chief, Worker Health and Safety Branch (WHS)
Michel Oriel, Manager, Human Health Surveillance and Monitoring Program, WHS
Lucia Graham, Supervisor, Pesticide Surveillance Program, HHSMP, WHS
Jennifer Rosatelli, Research Scientist Staff, Pesticide Surveillance Program, HHSMP, WHS

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SUBJECT: Pesticide Investigation into Reported Illnesses Related to Total Release Foggers (TRFs)

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## Overview

This document constitutes staff's investigation into the Pesticide Illness and Surveillance Program (PISP) data for reported illnesses related to total release foggers (TRFs), including assessment of types and frequency of the pesticide illnesses reported, misuse of the TRF products, and the additional exposure routes that were not accounted for in prior evaluations of the risk for TRFs. The investigation supports a finding that a significant adverse impact on public health is likely based on the frequency of documented public health exposures and the nature of the exposure routes being due to misuse of the products, which has not been previously evaluated.

## Investigation of PISP Reported Illnesses Related to TRFs

Total release foggers (TRFs), also known as foggers or bug bombs, are pesticide products designed to release their contents into an enclosed area. Once activated, the canister is designed to continuously disperses a fine mist or fog into the air and they are often used indoors to kill insects. Most of the insecticide settles onto exposed surfaces and eliminates the insects that are in the open, though some of the fine mist may penetrate cracks and crevices. TRFs commonly contain pyrethrin, pyrethroids, or both. They are inexpensive, widely available, and do not require specialized training, making them a convenient pest control option for consumers. Between 2018 and 2024, TRFs averaged $11 million in annual sales[1] in California.

Despite these advantages, TRFs also pose risks. Because they release their entire contents without a shutoff mechanism, individuals may be exposed to the dispersing mist during activation or reentering the structure if it has not been properly ventilated. In addition, most TRFs on the market use flammable propellants. Thus, improper use can result in fires or

[1] Sales data generated from the Mill Assessment database on 58 TRFs whose registration status was active in 2025.

explosions, causing structural damage or injuries and illnesses to users or bystanders. A small number of TRFs are water-activated and generate fog through a chemical reaction, eliminating the need for flammable propellants. Although the user-friendly nature of TRFs appeal to consumers, improper handling can still lead to injuries for users, building occupants, and bystanders.

In 2008, the Centers for Disease Control and Prevention (CDC) published an analysis of illness and injuries related to TRFs. Based on these findings, the US Environmental Protection Agency (US EPA) required improved labels for all TRFs manufactured after September 2012 and posted outreach materials to educate consumers on proper use to reduce the risk of TRF-related illnesses. In 2018, the CDC published an updated report evaluating the impact of these labeling changes[2]. The authors determined that "no statistically significant decline in the overall TRF-illness incidence rate was found" and recommended "promoting integrated pest management and identifying better approaches for motivating users to read and follow label instructions."

The Pesticide Illness Surveillance Program (PISP) has monitored the illness data associated with the use of TRFs since the CDC's 2018 report and has included TRF-associated illness data in its annual reports. From 2018 to 2024, PISP identified 391 cases (347 separate episodes) in which TRFs were implicated, averaging 56 cases per year. Three cases involved self-harm incidents. Three (< 0.8%) cases involved water-activated TRFs, and 319 (about 82%) cases involved TRFs using a propellent. In 69 (about 18%) cases, the investigation report did not contain sufficient information to identify the TRF type (Table 1). PISP received two illness reports in which TRFs caused an explosion.

PISP is a surveillance program that relies on reports submitted by health care providers through the California Poison Control System or Local Health Officers, Federal Insecticide, Fungicide, and Rodenticide Act 6(a)(2) Adverse Effect Reports, and other entities. Although the Program depends on submitted reports that are legally required by reporters, cases are probably underreported, and the available data may not fully represent the true extent of pesticide exposures related to TRFs. The data remains the best available.

Table 1. Types of Total Release Fogger Involved in Illnesses, 2018-2024

| | **TRF Type** | | | |
|---|---|---|---|---|
| **Year** | **Water activated** | **Propellant** | **Unknown*** | **Total** |
| 2018 | 2 | 56 | 13 | 71 |
| 2019 | - | 72 | 21 | 93 |
| 2020 | - | 35 | 6 | 41 |
| 2021 | 1 | 39 | 10 | 50 |
| 2022 | - | 37 | 5 | 42 |
| 2023 | - | 40 | 6 | 46 |

[2] Morbidity and Mortality Weekly Report's (MMWR) *Acute Illnesses and Injuries Related to Total Release Foggers _ 10 States, 2007-2015.* https://www.cdc.gov/mmwr/volumes/67/wr/pdfs/mm6704a4-H.pdf

| | TRF Type | | | |
|---|---|---|---|---|
| **Year** | **Water activated** | **Propellant** | **Unknown*** | **Total** |
| 2024 | - | 40 | 8 | 48 |
| **Total** | **3** | **319** | **69** | **391** |
| **% Total** | < 0.1% | ~82% | ~18% | |

* Investigation report did not contain sufficient information to identify the TRF-type

## Data Analysis

### *Circumstances of Exposure*

Non-agricultural use insecticides can be applied with multiple types of equipment, and among them, TRF's have the highest number of reported illnesses or injuries. From 2018 to 2024, the two most common types associated with illness cases were TRFs (391, 20%) and aerosol sprays (234, 12%), with TRF-related cases occurring at roughly twice the frequency of aerosol-related cases. (Other equipment types are not considered in this evaluation.) Most TRF-related exposures occurred in the residential setting (354, 91%). Among these, 84 (24%) cases occurred in multi-unit dwellings, 102 (29%) in single family homes, and 168 (47%) could not be determined. Applicators and bystanders accounted for 259 (73%) of the 354 residential cases (Table 2). A smaller number of cases occurred in non-residential settings such as crop processing facilities, offices, retail and service establishments (31, 8%). The use of TRFs in these non-residential settings is against most label instructions. There were six (1%) cases where the location of exposure could not be determined.

Because a large proportion of the TRF-related cases occurred in residential settings, detailed information and patterns on exposure circumstances are most apparent in this setting. Applicators accounted for 127 (36%) of the 354 residential cases. Nearly half of the applicators were exposed while activating the TRF (53, 42%). Twenty-seven (21%) of the 127 applicators reported attempting to leave the structure immediately after activation but still inhaled the mist. The episodes and cases described in this memo illustrate common exposure circumstances and are not intended to be comprehensive. In one episode, a woman set off a TRF in her bedroom. As she was leaving, personal belongings blocked her pathway which delayed her exit. She inhaled the mist and developed symptoms.

Thirty-seven (29%) of the total residential applicators (127) were sprayed directly in the face during activation. Although labels generally instruct the user to tilt the sprayer away from the face, the labels reviewed were not always clear that the spray discharges upward. In one episode, a man commented that he followed the instructions on the label and thought the mist would be released on the sides of the canister, not upwards. Since he was unaware of the direction the mist would be released, he positioned the nozzle towards his face and activated the TRF. He was sprayed directly in the face and immediately felt symptoms.

Another group of applicators (21, 17%) mistook the TRF for an aerosol spray can and were exposed while attempting to use it as a spot spray. In one episode, a woman activated a TRF thinking it was an aerosol can and was exposed to the mist for about 10-15 minutes while trying unsuccessfully to turn it off. In another episode, a woman was cleaning when she touched a TRF canister, accidentally setting it off. Thinking it was a spray, she took it to the restroom to try to empty it. When she realized that it would not stop, she left the room.

Exposures also occurred when residents did not leave the home after activation or reentered the home shortly afterwards to retrieve belongings or pets. These individuals were aware that a TRF had been activated but may have underestimated the speed in which the mist would disperse or the potential health risks. Residents who reentered within minutes of activation may have believed they could briefly enter and exit without adverse effects. Those who chose to remain inside the structure typically isolate themselves in another room with the door closed; not realizing the mist could move through hallways, vents, or gaps under doors, resulting in unintentional inhalation exposure.

Bystanders, defined as individuals not involved in the application, accounted for 132 (37%) of the 354 residential cases. These included individuals unaware a family member applied a TRF in the home and enter during an active application or before aeration is completed, tenants unaware of an application, emergency responders responding to an incident involving TRFs, and children who accessed TRFs. Of the 132 bystanders, 44 (33%) were exposed to TRFs during an active application. In one episode, a man set off multiple TRFs throughout the home without knowing his niece was in her room. She awoke feeling ill and noticed a pesticide odor. The woman rushed outside and called for emergency transport to the hospital. Another 41 (31%) individuals were exposed to TRFs post-application.

Landlords applied TRFs in 13 episodes which resulted in 17 illnesses. Under SB 328, landlords are required to provide written notification to tenants before applying pesticides themselves and to inform tenants in adjacent units when using TRFs, aerosols, or broadcast applications that could reasonably affect neighboring tenants. Of the 13 episodes, landlords provided notice in six, no notice was given in four, and in three episodes the investigation reports did not contain sufficient information to determine whether notice was provided. In one episode, a maintenance worker at an apartment complex treated a 400-square foot unit with six TRFs. The tenant returned to the unit five hours later and shortly developed symptoms. When the investigator entered the unit six days after the treatment, he noticed a lingering odor. It was determined that the worker did not turn off the pilot light prior to application and applied the TRFs above the label rate. Two police officers were exposed to TRFs while responding to an explosion at an apartment complex after the tenant forgot to turn off the pilot light prior to activating multiple TRFs in the unit[3].

[3] 2019-Los Angeles County

It was reported that two toddlers were sprayed with TRFs after they were able to pick up a TRF canister post-application. In one episode, a family was picking up canisters after they treated their home for fleas and bedbugs, when a 3-year-old grabbed a TRF canister. According to his grandmother, the TRF still had some products in it and sprayed the child in the face. In the other episode, a woman noticed a cockroach on a television and placed the television in a large plastic bag along with an activated TRF. The next day she opened the bag and aired out the room, without removing the TRF canister. Later, her 14-month-old entered the room and pressed the button on the TRF, and a little spray hit his face.

Fifteen (11%) of the 132 total bystanders reported illnesses after they were exposed to TRFs even though there was no intended application. Eight of the fifteen were exposed when the TRF accidentally activated (Table 2). In one episode, a man jokingly threw a TRF canister towards his wife to catch. The woman was unable to catch the canister, and it hit the wall and activated, spraying her in the face.

Table 2. Circumstances of Exposure for Applicators and Bystanders in the Residential Setting.

| Activity | Type of Exposure | | | | | Total |
|---|---|---|---|---|---|---|
| | Direct Spray/Squirt | Spill/Other Direct | Off-site Movement | Residue | Other[†] | |
| Applicator | | | | | | |
| During activation | 30 | 22 | - | - | 1 | 53 |
| Leaving after activation | 5 | 20 | 1 | - | 1 | 27 |
| During active application | 2 | 20 | 1 | - | - | 23 |
| Post-application | - | 3 | - | - | - | 3 |
| Unknown | - | 5 | - | - | 16 | 21 |
| Bystander | | | | | | |
| During active application | - | 32 | 25 | - | 6 | 63 |
| Post-application | 2 | 1 | - | 41 | - | 44 |
| No intended application | 3 | 11 | - | - | 1 | 15 |
| Unknown | - | - | - | - | 10 | 10 |
| **Total** | **42** | **114** | **27** | **41** | **35** | **259** |

[†] Other exposure includes multiple exposures, other, unknown exposure types.

***Adverse Health Effects***

Individuals exposed to pesticides released from TRFs most often reported respiratory symptoms, such as coughing, shortness of breath, and throat irritation. Many also experienced general symptoms including headache, nausea, vomiting, diarrhea, and abdominal cramps (systemic). Eye and skin irritation were also common. Most of the affected individuals had more than one type of adverse health effect, with respiratory and systemic effects being the most frequently reported (Table 3). Among those who reported respiratory symptoms (318), 22 (7%) also noted having a history of asthma.

Table 3: Adverse Health Effects Reported, 2018-2024

| **Health Effects** | **Number of Cases** |
|---|---|
| Respiratory | 126 |
| Respiratory, Systemic | 136 |
| Respiratory, Systemic, Eye | 18 |
| Respiratory, Systemic, Eye, Skin | 5 |
| Respiratory, Systemic, Skin | 10 |
| Respiratory, Eye | 13 |
| Respiratory, Skin | 7 |
| Respiratory, Eye, Skin | 3 |
| Systemic | 48 |
| Systemic, Eye | 6 |
| Systemic, Skin | 2 |
| Systemic, Eye, Skin | 2 |
| Eye | 5 |
| Skin | 8 |
| Eye, Skin | 2 |
| **Total** | **391** |

Most of the individuals were evaluated by health care providers and then discharged from the Emergency Department. Eight individuals required hospitalization due to more serious symptoms. In one episode, an individual experienced severe breathing difficulties after deploying 13 TRFs in his 1,398 square foot home and was unable to exit the structure before the mist filled the space. In another episode, a man was sprayed in the face while attempting to activate a third TRF in the kitchen of his apartment, which worsened an existing medical condition.

***Label Non-Compliance***

PISP data showed that there were identified label non-compliances in 62% (243) of the 391 cases from 2018 to 2024 across all incident settings, meaning illnesses could have been avoided had the user complied with label instructions (Table 4). In 31% (123) of the cases, the investigation reports did not have sufficient information to determine whether label non-compliance occurred. In the remaining 6% (25) of cases, no label non-compliance was identified. These individuals followed the label directions but still experienced unintentional exposure, such as accidentally dropping the canister during activation or developing symptoms despite observing the required aeration time.

In residential settings, 212 of 354 cases (60%) had at least one identified label non-compliance. The most common issues identified were using an excessive amount of TRFs for the space,

misusing TRFs as a space spray, failing to provide notification for other residents of the home, and remaining or reentering the structure shortly after activating the TRF (Table 5).

The exposure circumstances for nearly all of the non-residential cases (30 of 31) were similar to those of the residential cases, such as early re-entry, use above the label rate, or other label non-compliances. Additionally, these products are labeled for residential use only. The one case without label non-compliance occurred in a retail store when a customer dropped a canister and accidentally activated it.

Table 4. Total Release Fogger Cases with Identified Label Non-Compliances, 2018 – 2024

| Year | Number of Cases | Number of Cases with Identified Label Non-Compliances | Percent of Cases with Identified Label Non-Compliances |
|---|---|---|---|
| 2018 | 71 | 45 | 63% |
| 2019 | 93 | 58 | 62% |
| 2020 | 41 | 25 | 61% |
| 2021 | 50 | 36 | 72% |
| 2022 | 42 | 25 | 60% |
| 2023 | 46 | 29 | 63% |
| 2024 | 48 | 25 | 52% |
| **Total** | **391** | **243** | **62%** |

Table 5. Types of Label Non-Compliances by Type of Activity for Residential Exposures

| Label Non-Compliance | Activity at Time of Exposure | | | |
|---|---|---|---|---|
| | Applicator | Other | Bystander | Unknown |
| Early Reentry | 4 | 26 | 9 | 3 |
| Use Above Label Rate | 7 | - | 5 | - |
| Within Reach of Child | - | - | 7 | - |
| Other Label Non-Compliance | 50 | 23 | 43 | - |
| Multiple Label Non-Compliances | 7 | 14 | 13 | 1 |
| None | 11 | - | 13 | - |
| Unknown | 48 | 7 | 42 | 21 |
| **Total** | **127** | **70** | **132** | **25** |

*Improperly remaining in the application area in residential setting*:
Seventy individuals (20%) out of the total 354 cases in residential settings were exposed due to not following the label instructions requiring people to stay out of the application area. Of these, 43 (61%) individuals reentered the residence before the label recommended time, often to retrieve a pet or forgotten item such as keys or cell phones. In one episode, a woman exited her home after activating a TRF. Once outside, she saw that one of her cats was missing. She reentered the home to retrieve the missing cat. In another episode, a man activated a TRF and exited. He realized that he forgot to turn off the pilot light and reentered the home and inhaled

the mist. Twenty (29%) of the 70 cases activated a TRF and did not leave the residence immediately or knowingly remained in the structure while another member of the household activated a TRF. In one episode, a man remained in a different room with the air conditioner on after activating a TRF and smelled the vapors through the vents. In another episode, a man warned his father to leave the residence before activating a TRF, but the father refused and remained in the bedroom. The son proceeded with the application and activated the TRF and within an hour, the father felt symptoms and asked his son to call for an ambulance.

*Excessive use of TRFs for treatment area in residential setting:*
More than a quarter of the 354 residential cases involved the use of multiple TRFs (103, 29%) and may represent failure to follow the coverage area instructions on the label. Verification of this cause may or may not constitute a label non-compliance because investigation reports often lacked information on the placement of the TRFs and size of the treated area. Applicators accounted for 30 (29%) cases and were most often exposed while attempting to activate additional TRFs or reentering the structure within minutes of activation. In one episode a man set off three TRFs in the crawl space of his house to kill spiders and flies. One of the canisters fell and sprayed him in the face. As he attempted to place the fallen canister upright, he continued to inhale the mist as he exited the small space. When interviewed, he acknowledged he had not read the label because the text was too small. Twenty-three individuals (22%) were exposed to the residue of multiple TRFs used beyond the label instructions. In one episode, a couple and their roommate set off 14 TRFs inside their 1,481 square foot home and four TRFs in the crawl space, which was at least twice the label rate. They returned about four hours later to open the windows and turn on the ventilation fan. They left the home to run errands. While away, one of the residents began to experience symptoms. Later that evening, another resident developed symptoms.

## Evidence of Adverse Health Effects Related to TRFs

The PISP data shows that TRF-related illnesses consistently involved respiratory and systemic symptoms, with many individuals reporting multiple effects such as coughing, throat irritation, headache, and nausea. Eye and skin irritation occurred frequently in exposures involving direct spray. There were 385 reported individuals who were evaluated by health care providers and then discharged from the Emergency Department from 2018 through 2024. Eight individuals required hospitalization due to more serious symptoms. Illnesses affected both applicators and bystanders, including children and emergency responders, often due to early reentry, unexpected applications, or contact with lingering residues. These recurring patterns demonstrate that adverse health effects associated with TRF exposures appear consistent, predictable, and preventable. Following the Memorandum of Understanding with the US EPA on reportable episode criteria, DPR considers incidents involving pesticide-related illness or injury to be significant when they involve either a single injury requiring hospitalization (8 cases), or a single episode in which five or more individuals report illness or injury due to pesticide exposure (3 episodes; 22 cases). This standard is the definition of a serious injury or illness reportable to

US EPA under the MOU. Here, the PISP data showed several reported episodes in which TRF use lead to hospitalization for illness or injury, or events involving five or more persons. Staff concludes there have been multiple serious illness or injury events resulting from TRF use in the time period evaluated. Staff's investigation indicates that continued use of TRFs may present a risk of harm due to their design, which should be further evaluated. Thus, the evidence evaluated in the investigation would support a finding that a significant adverse impact to public health is likely to occur from the use of TRFs.

**Conclusion**

The evidence from 2018 to 2024 shows that use of TRFs are likely to present a significant and foreseeable risk of harm to human health. Most illnesses involved patterns of misuse or misunderstanding that existing labels and instructions did not prevent, including early reentry, improper activation, and use of excessive numbers of TRFs. These recurring exposures, along with the severity observed in several cases, indicate a significant adverse impact in the future is likely. Based on this investigation performed pursuant to section 6220, there is sufficient evidence to conclude that reevaluation should occur.