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Modeling a 1,3-Dichloropropene Application at Shafter, CA on January 21, 2018

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Introduction

The department of Pesticide Regulation (DPR) has been monitoring ambient air for multiple pesticides including 1,3-dichloropropene (1,3-D) as part of the Air Monitoring Network (AMN) since 2011. A high 1,3-D concentration of 50.5 ppb ($229.1 \mu\text{g}/\text{m}^3$) was measured at the Shafter monitoring site location during a 24 h sampling period starting on January 22, 2018. The 1,3-D concentration of 50.5 ppb was the highest concentration measured in all ambient air monitoring studies conducted by DPR. Although this 24 h concentration did not exceed DPR's acute human health screening level of 110 ppb, it led to exceedance of DPR's subchronic human health screening level (3.0 ppb) on a 90 d rolling average basis. Therefore, Air Program staff conducted an evaluation of this detection using available pesticide application use data obtained from DPR's Pesticide Use Reporting (PUR) database and from Notice of Intent (NOI) records obtained from the Kern County Agricultural Commissioner's Office. Based on the available data, a 1,3-D application reported on January 21, 2018 was determined to be the likely source of the January 22, 2018 1,3-D detection. Computer air dispersion modeling using AERMOD was used to simulate the 1,3-D application and determine if the sampled concentration could be estimated by the model using application and available meteorological data.

1,3-D Application

Application information retrieved from DPR's PUR database is listed in Table 1. The location of the air monitoring sampler and the agriculture field is shown on Figure 1. The field area is approximately 50 acres (ac). About half of the field area was treated with 1,3-D on January 21, 2018 and the application rate was 297 lbs/ac.

Table 1. Application Information retrieved from DPR’s PUR Database.

PUR use_no	56642
Application Date	1/21/2018
Application Start Time	1600
Active Ingredient Amount (lbs)	7431.40
Treated Area (ac)	25
Field Fumigation Method Code	1206



Figure 1. Location of the monitoring site and agriculture field where the application was conducted on January 21, 2018.

Meteorological Data

Meteorological files for AERMOD modeling were processed by AERMET View™ using the surface data from the meteorological station WBAN 23155 (Bakersfield Meadows Field) and the upper air data from the meteorological station WBAN 23230 (Oakland Metropolitan Airport). Land characteristics were produced by AERMAP for the area around the application field using the coordinates (35.51, -119.26) as the center point. The wind rose graph showed that the wind direction was blowing from the East during the 48 h period of January 22, 2018 to January 23, 2018 (Figure 2). Wind speeds were lower than 4 m/s for the two days and 66.7% hours had low wind speeds between 0.5 and 2 m/s.

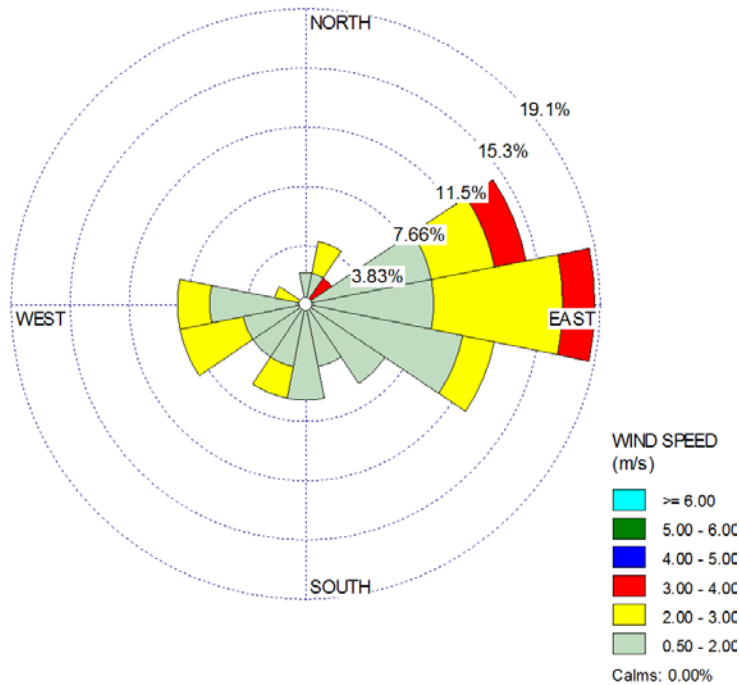


Figure 2. Wind rose for the data of station WBAN 23155 (Bakersfield Meadows Field) on January 22, 2018 to January 23, 2018.

AERMOD Configuration

A potential 25 ac source shape close to the monitoring site was examined since the actual 25 ac application area was unknown to Air Program staff (Figure 3). The flux profile of soil #5 developed by HYDRUS modeling for Field Fumigation Method Code 1206 (Brown, 2018) was used for this modeling simulation since this flux profile produces the highest fumigant mass loss. The HYDRUS result was developed for a nominal rate of 100 lbs/ac and has units of $\mu\text{g}/\text{m}^2\text{s}$. It was accordingly converted to a flux profile with units of $\text{g}/\text{m}^2\text{s}$ and an application rate of 297 lbs/ac starting at hour 17 on January 21, 2018. One receptor was set at the Shafter sampling site location with height of 3 m to match the monitoring site configuration (Figure 3). A uniform grid of receptors is also used to output contour plot. Air monitoring began at 11:59 and lasted for 24 hours so the modeling period is from hour 13 of 1/22/2018 to hour 12 of 1/23/2017. The average concentration is the output for this 24 h period.



Figure 3. Diagram of modeling source and receptor

Modeling Results

The contour plot shows that the distribution of 24 h average concentrations is consistent with the wind direction pattern (Figure 4). The average concentration at the monitoring site over the 24 h modeling period was estimated as 47.8 ppb ($216.9 \mu\text{g}/\text{m}^3$), which is close to the Shafter monitoring results of 50.5 ppb. Therefore, we concluded that the 1,3-D application that took place on January 21, 2018 was likely responsible for the measured 1,3-D 24 h air concentration at the Shafter sampling site location on January 22-23, 2018.

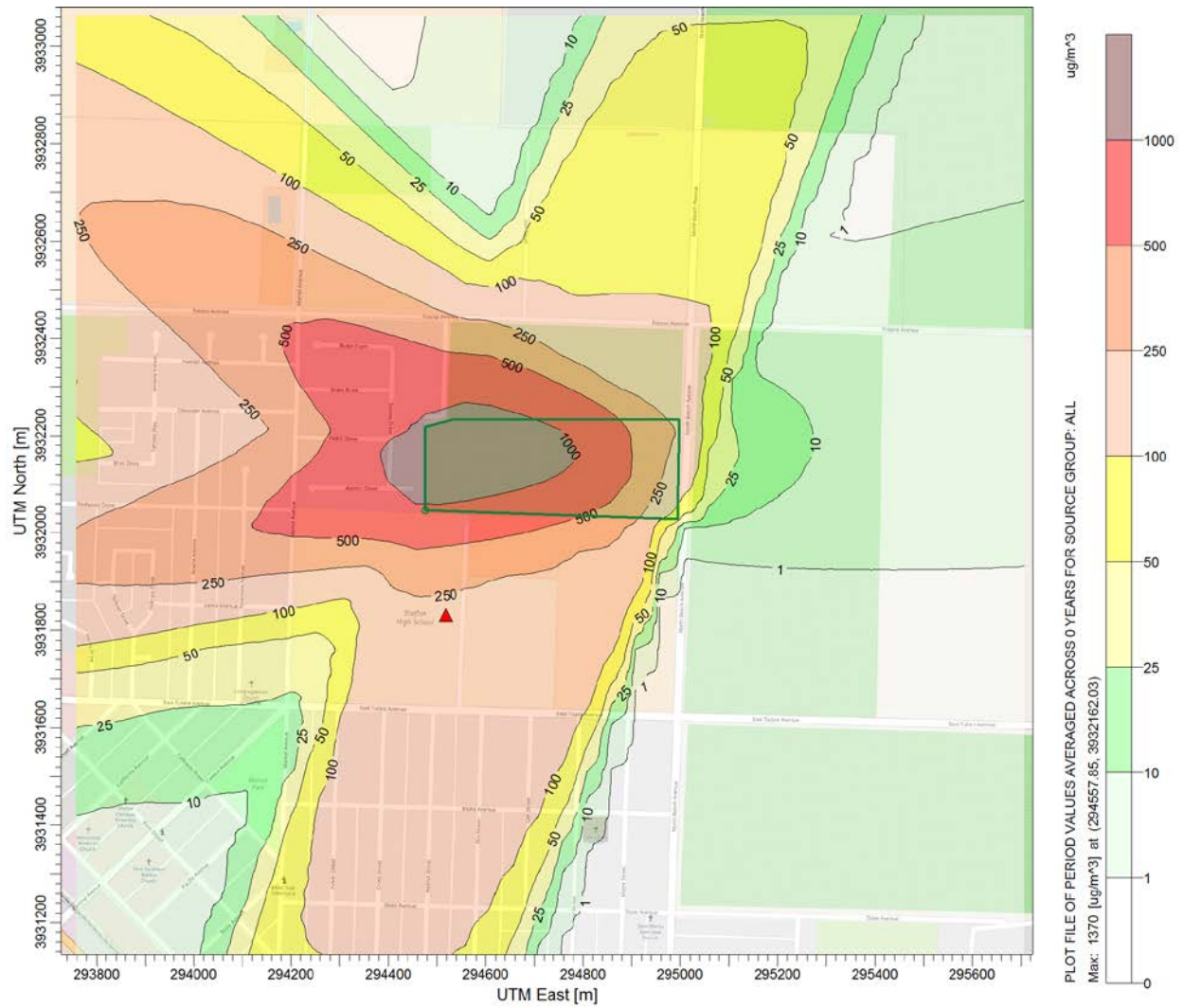


Figure 4. Average concentrations around the suspected 1,3-D treated area over the 24 h sampling period of January 22 – 23, 2018.

Reference

Brown, Colin. (2018). Estimation of 1,3-dichloropropene flux by application method under California use conditions using HYDRUS 2-D.