Appendix K: Health Evaluation and Calculations

Calculation of Subchronic Rolling Averages

13-week Rolling Averages
In 2016, DPR eliminated the practice of using a 4-week rolling average concentration to represent a subchronic time period for 1,3-Dichloropropene (1,3-D) and chloropicrin for comparisons to subchronic screening levels and regulatory targets. This determination was based on an evaluation conducted by DPR’s Human Health Assessment Branch that looked at seasonal reference concentrations for these two chemicals. Greater details are provided elsewhere (DPR, 2016b).

Health Evaluation Methods
Pesticides can cause a variety of health effects when present at concentrations above health-protective levels. The pesticides included in the AMN were selected in part because (1) risk assessments indicate the high potential for exposure, or (2) they are high priority for risk assessment due to toxicity and/or exposure concerns. Some of the pesticides in the AMN can cause adverse effects such as respiratory illnesses, damage to the nervous system, cancer, and birth defects. Vidrio et al. (2013a) summarizes the potential health effects of each pesticide. No state or federal agency has established health standards for pesticides in air. Therefore, DPR in consultation with the Office of Environmental Health Hazard Assessment (OEHHA) developed health screening levels or regulatory targets to place the results in a health-based context.

Health screening levels are based on a preliminary assessment of possible health effects, and are used as triggers for DPR to conduct a more detailed evaluation. A measured air concentration below the screening level for a given pesticide would not be considered a significant health concern and the pesticide would not undergo further evaluation at this time. A measured concentration above the screening level would not necessarily indicate a significant health concern, but would indicate the need for a further, more refined evaluation. Vidrio et al. (2013a) summarizes more information on DPR-determined screening levels including information on deriving screening levels for each pesticide.

DPR puts measures in place based on the regulatory target to limit exposures so that adverse effects can be avoided. Exceeding a regulatory target does not necessarily mean an adverse health effect occurs, but it does indicate that the restrictions on the pesticide use may need to be modified. DPR normally establishes a regulatory target after completing a formal risk assessment of a chemical’s toxicity and potential exposures. DPR management determines a regulatory target using its risk assessment, as well as risk assessments from other agencies, pesticide use patterns, potential effects on use of alternative pesticides, and other factors. A regulatory target is based on a more comprehensive evaluation than a health screening level. Therefore, a regulatory target supersedes a health screening level (i.e., a specific pesticide and exposure duration will have either a regulatory target or a health screening level, but not both). Four of the pesticides monitored in the AMN (chloropicrin, MeBr, MITC, and 1,3-D) have regulatory targets for one or more exposure periods.
Cumulative Exposures

Cumulative exposure and risk were estimated using a hazard quotient and hazard index approach for pesticides that have a common mode of action (such as cholinesterase inhibitors). The potential risk of the measured concentrations of a pesticide in air was evaluated by comparing the air concentration measured over a specified time (e.g., 24 hours, 4 weeks, 1 year) with the screening level derived for a similar exposure (i.e., acute, subchronic, chronic). The ratio of measured air concentration of a pesticide to a reference concentration or screening level for that pesticide is called the hazard quotient (HQ). In this case,

\[
\text{Hazard Quotient} = \frac{\text{Air Concentration Detected (ng/m}^3\text{)}}{\text{Screening Level (ng/m}^3\text{)}}
\]

If the HQ is greater than 1, then the air concentration exceeds the screening level. Such a result would indicate the need for further and more refined evaluation. Similarly, the risk from multiple pesticides (cumulative risk) is evaluated using the hazard index (HI) approach, which sums of the HQs for the pesticides monitored.

\[
HI = HQ1 (\text{pesticide 1}) + HQ2 (\text{pesticide 2}) + HQ3 (\text{pesticide 3}) + \ldots (\text{and so forth})
\]

An HI greater than 1 indicates that the cumulative toxicity of the multiple pesticides should be further evaluated and that potential health impacts may have been missed by only considering the pesticides individually.