Article 16

Technical Note #106 from Watershed Protection Techniques. 3(1): 613-616

Diazinon Sources in Runoff From the San Francisco Bay Region

Diazinon is a common broad spectrum insecticide that is widely applied by homeowners and pest control professionals alike. In California alone, diazinon is contained in over 200 different pesticide formulations. The primary use for diazinon is for general insect control, with the most common targets being ants, fleas, ticks, grubs and spiders. It is often the insecticide of choice to deal with fire ant problems in the South.

There are several reasons why watershed managers are concerned about the use of diazinon. To begin with, diazinon is highly toxic to aquatic life at exceptionally low levels. Toxicologists have found that diazinon causes mortality in the popular bioassay organism, *Ceriodaphnia dubia* (water flea) at exposure levels as low as 300 parts per trillion. In addition, diazinon is very soluble and therefore very mobile in the urban environment. Although it eventually breaks down in the environment, diazinon has a half-life of about 40 days in surface waters. In addition, diazinon is typically sprayed as a concentrate on a spot basis near foundations, driveway cracks, sidewalk crevices and other impervious surfaces.

Given these factors, it is not surprising that researchers are frequently finding diazinon in stormwater and dry weather flows in urban streams, particularly in the South (Schueler, 1995). Diazinon has been detected in urban streams in Sacramento, CA (O'Connor, 1995) Atlanta, GA (Hippe *et al.*, 1994) and Dallas-Fort Worth, TX (Brush *et al.*, 1996). In each case, diazinon was detected in nearly 90% of all stream samples. In the Texas study, the mean runoff concentration of diazinon at 11 residential catchments was a whopping 1,800 ng/l (parts per trillion).

Until recently, our understanding of the sources and pathways of diazinon in urban watersheds has been very sparse. A much clearer picture, however, has recently emerged from a comprehensive research effort in the San Francisco Bay region. The study team included James Scanlin, Tom Mumley, Revita Katznelson, Val O'Connor and many other colleagues. The study team has progressively traced diazinon sources to increasingly smaller watershed units. The team investigated diazinon at the regional scale, and then proceeded to urban watersheds, and even smaller subwatersheds. From there, they continued to trace diazinon through individual storm drain outfalls, to street gutters and finally, to individual homes. In addition, the team profiled how diazinon is actually used in residential areas, through surveys and retail sales statistics. Taken together, the story of their search is both interesting and very disturbing.

The story begins with how diazinon is actually used. Scanlin and Cooper (1997) started by checking statistics on retail sales of diazinon, which are required under California's extensive pesticide reporting system. For the California and the Bay region, Scanlin and Cooper estimated that 0.04 lbs. of active diazinon was applied outdoors per person each year in the San Francisco Bay area. As such, it was the leading insecticide used in California, in terms of retail sales of active ingredient. The primary reason cited for applying diazinon was general insect control (about 80%), with some additional use to control garden pests (20%). About half of the diazinon was applied to structures, and half applied to lawns and landscaped areas. Diazinon users were roughly split between homeowners and pest control companies. Users applied diazinon as a liquid concentrate about 65% of the time, and as granules about 34% of the time.

Concern about diazinon in the Bay area was initially prompted by a series of toxicity tests conducted by Steve Hansen and others the early 1990s. Of 130 runoff samples from Bay area creeks, 22% caused mortality in *Ceriodaphnia dubia* within 48 hours, and further testing revealed that diazinon was the primary cause (Katznelson and Mumley, 1997). Consequently, a synoptic study was undertaken in 1995 to monitor diazinon, and 167 urban creek samples were collected around the Bay. Potentially toxic levels of diazinon were found in 27% of the storm samples (Table 1). The study concluded that diazinon was a widespread problem in many urban creeks, and also suspected that chlorpyrifos, another insecticide frequently found in creek runoff, might also be a problem.

The next chapter of the story involved extensive diazinon sampling across the San Francisco Bay region. New sampling methods made it easier to detect diazinon at both lower levels and lower cost. The study team compiled hundreds of samples, and detected diazinon in rainwater, urban runoff, dry weather flow, creek sediments, wastewater effluent, and even the waters of