Columbia Environmental Research Center
Publication Brief

Photoenhanced Toxicity of Fire-Retardant Chemicals

In the United States and Canada, forest fire managers and fire control agencies use a wide variety of chemicals to fight wildland fires. Such chemicals may be used in relatively pristine areas potentially inhabited by endangered, threatened, or sensitive aquatic species. Long-term fire retardant formulations are intended to persist as a combustion barrier after evaporation of the aqueous component. But the environmental effects of the remaining components are not well known. Information presented in the present publication provides a reference that can be used to judge the toxicity of expected field concentrations. Test results reveal the first reported data on toxicity of fire-retardant chemicals to amphibians.

Aerial application of fire-retardant chemical on a wildland fire.

In this publication, evaluation of the interactive effects of fire-retardant chemicals and ultraviolet light consisted of the following:

- Six fire chemicals studied.
- Acute toxicity tests using organisms: juvenile rainbow trout (*Oncorhyncus mykiss*), Southern leopard frog tadpoles (*Rana sphenocephala*), and boreal toad tadpoles (*Bufo boreas*).
- Ultraviolet-B irradiance applied during exposures represented natural sunlight in relevant habitats of the western U.S.
- All test organisms showed sensitivity to some formulations in the presence of ultraviolet light.
- Amphibian habitats may be at most risk of contamination by fire chemicals; photoenhancement of fire-retardant chemicals can occur in a range of aquatic habitats and may be of concern even when optical clarity of water is low.
- Cyanide appears responsible to the photoenhanced toxicity of fire retardants tested.
- Presence of free cyanide in certain retardant formulations may be the most toxic component of diluted runoff.

The environmental impact resulting from the use of fire-retardant chemicals will be specific to the event and the site. Toxicity data on fire retardant chemicals are not predictive of environmental effects in the absence of information on the environmental persistence of these chemicals, their binding affinity with soils and surface substrates, the amount applied, and dilution ratios of the watershed to which they are applied.

Keywords---fire retardant chemicals, ultraviolet radiation, sodium ferrocyanide, yellow prussiate of soda

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