

Exposure Measurements of Applicators Spraying (2,4,5-Trichlorophenoxy)acetic Acid in the Forest

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Personnel normally involved with spray applications in the forest were monitored for exposure to (2,4,5-trichlorophenoxy)acetic acid (2,4,5-T). Seven members of a backpack crew, four from a tractor crew, and two 5-man helicopter crews assisted in this study. Crews followed usual spray routines with as little influence as possible from the test. External dermal and respiratory exposures were measured, and total intake of 2,4,5-T was determined from the total urine collected from each worker for a 6-day period. Analyses by gas chromatography showed that degree of exposure was related to worker's job. Greatest amounts were detected in mixers of the compound and least amounts in helicopter flagmen. Exposure to 2,4,5-T averaged 0.0005, 0.586, and 0.033 mg/kg body weight for inhalation, patch, and internal measurements, respectively. These measurements indicate that the worker excreting the highest amount of 2,4,5-T received exposure levels below those toxic to laboratory animals.

The herbicide (2,4,5-trichlorophenoxy)acetic acid (2,4,5-T) has played an important role in the forest and food-producing capability of the United States during the past 20 years (Barrons, 1969). Its effectiveness in controlling a wide spectrum of broadleaved woody plants and its rapid degradation rate when applied to soil have allowed this herbicide to become widely used (Altom and Stritzke, 1973).

Research from animal feeding trials indicated that 2,4,5-T was fetotoxic and possibly teratogenic in mice when doses were administered in excess of 20 mg kg⁻¹ day⁻¹ (Roll, 1971). Fetotoxicity in rats was shown when 2,4,5-T levels of 25-150 mg kg⁻¹ day⁻¹ were used (Sparschu et al., 1971). On the basis of data such as these, on public reaction to stated effects of 2,4,5-T used in Viet Nam, and on localized public concern, the potential for 2,4,5-T to adversely affect human health has been questioned. The presence of trace levels of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), a highly toxic byproduct of the manufacturing process of the 2,4,5-trichlorophenol used to make 2,4,5-T, has also caused concern. Recent improvements in manufacturing technology have decreased the TCDD content in 2,4,5-T. Levels of TCDD in 2,4,5-T have dropped from 32 ppmw (late 1950's) to 2 ppmw (late 1960's) to 0.1 ppmw (early 1970's) (Young et al., 1978) to levels routinely below 0.01 ppmw (Fisher, 1977). Continuing concern over the implications of 2,4,5-T use in the United States was instrumental in its being placed on the list of compounds to be examined under a process initiated by the Environmental Protection Agency (EPA). This process, Rebuttable Presumption Against Registration (RPAR), was designed to allow a fair assessment of benefit-risk data before decisions regarding the future use of a compound are issued. The EPA RPAR Position Document 1 (*Federal Register*, 1978) pointed out a gap in the data on hand. The EPA had estimated that backpack sprayers receive approximately 7.0 mg/kg exposure, but actual amounts of 2,4,5-T received by 2,4,5-T applicators in forestry and other agricultural operations had not been directly measured. Our studies were designed to determine the levels of exposure occurring to field workers applying a low volatile ester formulation of 2,4,5-T during typical forestry applications.

MATERIALS AND METHODS

Field Operations. A single batch of ESTERON 245

herbicide (Lot MM-09447-76) was used for all of the studies. This product contains 4 lb of 2,4,5-T acid equivalent per gallon formulated as propylene glycol butyl ether ester. All workers included in crews of the following spray operations were monitored in these tests: backpack, tractor mist blower, and helicopter (both raindrop nozzle and microfoil boom). The low volatile ester was applied by backpack at a rate of 1.6 lb/A (acid equivalent basis) in 10 gal of water. Both the mist blower and helicopter operations used 2 lb/A in 10 and 5 gal of water per acre, respectively. Although ESTERON 245 is not labeled for mist blower application, permission was granted by the EPA to allow consistency in these studies.

Seven crew members, a mixer-supervisor, and six applicators made up the backpack team. Two of the applicators in this crew were females. The mist blower operation included a supervisor, two tractor drivers, and a mixer. Each of the two helicopter crews was made up of a pilot, a mixer, a supervisor, and two flagmen. Thus, a total of 21 workers, selected from a group who normally do this type of work in the area, were monitored in the study. Prior to this spray program, each worker filled out a form which provided personal information regarding his vital statistics and history of any previous involvements with 2,4,5-T use. Workers were selected who indicated that they had not worked with 2,4,5-T for 2 weeks prior to the study. Worker spray habits and routines, for the most part, did not include wearing gloves or special protective clothing. The typical attire for members of the spray crews included long trousers, shirt (long or short sleeves) and cloth sneakers, leather shoes, or field boots. Photographs of each worker and his spray attire were made immediately prior to the spray operation. All crew members wore hats except four members of the backpack crew.

In addition to the normal supervisory staff, additional support personnel were on hand to assist with data forms, attach monitors, record data, and transport samples collected. Research personnel involved with sample collection were instructed not to alter, make suggestions for, or interfere with normal spray habits or routines of the workers.

Potential Exposure Tests. To provide an estimate of 2,4,5-T ester exposure occurring via the respiratory tract, each worker wore a portable air pump which drew a known volume of air through a resin column (XAD-2) which trapped 2,4,5-T (Johnson et al., 1977). Approximately 6-7 L of air/h was monitored for 2,4,5-T as it was pulled through the resin. To serve as a control, two functioning air monitors were positioned in a nontreated field during

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