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Col M Thacker

Tab D

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Disposal of Herbicide Waste
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An on-the-ground survey of the herbicide drainage area at Bien Hoa Air Base was conducted and the problem was discussed with LTC Dennis, Commander 12th Air Commando Squadron (RANCH HAND), on 6, 7, and 14 April 1967.

The area of interest is on the western edge of the airstrip and drains into a marsh which empties into the Dong Nai River which in turn flows into the Nha Be River and finally into the South China Sea.

The area of concern currently is part blacktop, part gravel and part sand or soil. It would appear that if the entire area were paved with concrete (not blacktop) and sloped to direct the spillage, wash water and rain into the marsh creek, this would dispose of the herbicides with little or no hazard to desirable vegetation or fish. The creek is fed by waste water from Bien Hoa Air Base and considerable dilution of herbicides would occur along the way to the sea. The Dong Nai River where the creek empties into it is about seven feet deep and about one-quarter of a mile wide. This large volume of water would dilute the herbicides, rendering them innocuous.

In the aircraft filling area, where spillage occurs and aircraft can be serviced, are flushed daily with large volumes of water, no herbicide buildup would occur in the waterways mentioned above or in the soil.

The problem as originally posed envisioned moving the location of the RANCH HAND spray planes to the east end of the airstrip where drainage would carry the herbicides into a stream which flows through a fish hatchery. Currently it is planned not to change the location of the spray planes. However, in the event that a change in location is made at some later date and herbicide disposal should become a problem either at Bien Hoa or Da Nang, there are three disposal methods that may be considered.

1. Excavate an area about one-half to one acre in size and create a pond to hold the spilled herbicide, wash water and contaminated rain runoff. The herbicides in the shallow pond water will gradually be decomposed by ultraviolet light and microbial action. In addition, there will be gradual seepage of the diluted herbicides

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and decomposition products into the subsoil where they will no longer constitute a hazard to fish or vegetation. The shallow pond technique is widely used in the chemical manufacturing industry to dispose of wastes. Both WHITE and ORANGE are readily decomposed by the ultraviolet light in sunlight. They are also decomposed by soil-borne micro-organisms.

2. A second disposal method would involve digging a deep, broad trench or ditch into which the waste waters would drain. ORANGE being heavier than water would settle and would be covered by a layer of water. WHITE and BLUE being water soluble would be diluted by wash water and rain and would leach into the subsoil. ORANGE would also leach out, but presumably at a slower rate. If it were desired to slow the rate of diffusion of WHITE and BLUE into the subsoil, one could place agricultural lime in the bottom of the trench. This would form the less soluble calcium salts of 2,4-D, picloram and cacodylic acid and retard their leaching rates.

3. A third method is to cause the waste material to drain into a large reservoir or cistern and then dispose of it through a large drainage field similar to a septic field used in sewage disposal. The drainage field could be near a perimeter or between landing strips where vegetation control was desired.

In general, all three methods involve getting the herbicide wastes below the surface of the soil to prevent runoff in surface water. The herbicide BLUE, Phytar 560G, poses less of a problem than ORANGE or WHITE, since it is strongly adsorbed on the surface of soil particles and is thereby rendered inactive. There are no chemical decontamination procedures for inactivating ORANGE or WHITE.

The following information on the toxicity of 2,4-D for fish may be of interest.

$LD_{50}$ concentration for catfish and minnows is 2000 ppm and for sunfish 1000 ppm. The upper safe limit ($LD_0$) for minnows is 1500 ppm and for sunfish and catfish, 500 ppm.

One part per million (1 ppm) is equivalent to 2.7 pounds of material per acre-foot of water; thus the amount of 2,4-D required to kill 0% of the catfish in a pond, one acre in surface area and one foot deep is (2.7 x 2000 x 1) or 5,400 pounds.

Attention should also be devoted to reducing the amount of spillage which occurs principally when the herbicides are being transferred from the 55-gallon drums into the 500-gallon tanks. A foot valve in the bottom of the pipe which is inserted into the 55-gallon drum would minimize herbicide drainage when the pipe is removed.

Careful handling of the "empty" drums will also minimize spilling; the 1 to 4 quarts of herbicide remaining in them.