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Maj Shalkem
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Proposed Reclamation Procedures

For NCBC Gulfport, MS

Although there are many potential options for the decontamination of an area exposed to TCDD residuals¹ data provided in USAFA-TR-76-18² suggest that one of the most feasible options would be soil incorporation/biodegradation. To support this option, the following information is provided from USAFA-TR-76-18².

1. TCDD may persist in the environment for long period of time (greater than 12 years) when initially present at high concentrations on the soil surface. Data presented in USAFA-TR-76-18² indicate that TCDD is degraded by soil microorganisms, especially in the presence of other chlorinated hydrocarbons. (An estimated half life for TCDD in the presence of 2,4-D and 2,4,5-T herbicides is now considered to be 300 days)^{2,3}
2. TCDD accumulates in the tissues of rodents, reptiles, birds, fish and insects when these organisms are exposed to TCDD contaminated soils, but the levels of TCDD in the tissues of these organisms apparently do not exceed the levels of TCDD found in the environment.²
3. Rodents, reptiles, birds, fish and insects apparently tolerate, i.e., based on no observed deleterious effects in field studies, soil levels between 10-1,500 ppt TCDD.⁴
4. TCDD appears to be degraded by the ultra-violet light present in sunlight.⁵
5. Movement of TCDD in the abiotic portions of the environment can occur by wind and/or water erosion of soil particles, but leaching by water alone does not appear to occur.^{3,4,6}
6. TCDD appears to bind readily to activated coconut charcoal and may not be readily released or degraded in the environment when bound to charcoal.²

General Recommendations

In locations where accidental TCDD contamination covers significant geographical area, e.g., many hectares, an in situ biodegradation program may be most effective in reducing levels of TCDD residues. Incorporation of organic material, lime, and fertilizer to enhance microbial activity may be advantageous. The biodegradation site may be tilled so as to expose residue to sunlight and for aeration. Watering of the site is recommended to reduce wind movement of contaminated particles and to enhance biodegradation. In locations where a limited area has been exposed to accidental contamination of TCDD, the top 0-15 cm of soil should be removed and taken to an isolated area where biodegradation procedures can be conducted. Similar treatments should be applied to these plots as would be for an in situ program. Protective clothing should be worn by all site personnel. The contaminated clothing should be incinerated at an approved incinerator. Following use, all equipment should be rinsed with an organic solvent (e.g., diesel fuel) to remove TCDD residue. The solvent containing TCDD residue may be collected in activated coconut charcoal and either incinerated or placed in an approved sanitary landfill, although if a sufficiently isolated land area is available, biodegradation may be feasible.

It should be noted that some TCDD residue may remain in a contaminated site for many years (in our studies, detectable levels of TCDD have been found in soils 12 years after contamination). However, research on the ecosystem at Test Area C-52A, Eglin AFB, Florida, has indicated that many organisms (e.g., rodents, reptiles, and birds) do have an apparent tolerance to low levels of TCDD. Since TCDD does not biomagnify in the food chain and because it is adsorbed in the soil and does not leach, in those areas having soil residues below 1ppb, further efforts to decontaminate the area may not be practical. These areas should, however, be fenced and posted for a few years to prevent unnecessary livestock and human exposure.

Specific Recommendations

For the site at NCBC we would recommend isolating the site by exclusion (e.g., fencing) and subsequent soil incorporation of organic matter (any readily available organic matter should be suitable, e.g., peat, cotton hulls, secondary sewage sludge or grass clippings, hay or leaf compost). Any highly contaminated soil (10,000 ppm) should be either dispersed into adjacent soil or diluted with uncontaminated soil. For soil near water or for soil that may be readily leached and/or eroded, the incorporation of activated charcoal, and subsequent streambank stabilization would be recommended. Where possible, all drainage ditches should be filled in with uncontaminated soil. At the time the site is being prepared (i.e., at the time of tilling and soil incorporation) the site should also be planted to desirable native or introduced grasses. In particular, those grasses that have rhizomes or stolons, and form dense sod would be the best species to use for ground cover. Mixtures of thin paspalum, Paspalum setaceum; bahia grass, Paspalum notatum; common carpetgrass, Axonopus affinis; and pineywoods dropseed, Sporobolus junceus might be ideal since they are mat formers and at maturity are less than 1-2 feet in height. These grasses should withstand the initially high soil concentration of herbicide residue. A residue and ecological monitoring program should be in effect for at least 2-3 years. The site could probably then be used for open storage.

1. Rawls, R. L., and D. A. O'Sullivan. Italy seeks answers following toxic release. Chem Engr News 54(35:27-35, August 23, 1976.
2. Young, A. L., C. E. Thalken et al Fate of 2,3,7,8-tetrachloro dibenzo-p-dioxin (TCDD) in the environment: Summary and decontamination recommendations. USAFA-TR-76-18, Department of Chemistry and Biological Sciences, United States Air Force Academy, Colorado 1976.
3. Personal Communications, with Professor A. Giovanardi, Director, Institute of Hygiene, University of Milan, Italy. Dioxin Conference, Department of Chemistry and Biological Sciences, USAF Academy, Colorado, 80840 9, 10, 11 June 1977.
4. Young, A. L., C. D. Thalken, and W. S. Ward. Studies of the ecological impact of repetitive aerial applications of herbicides on the ecosystem of test area C-52A, Eglin AFB, Florida. AFATL-TR-75-142, Air Force Armament Laboratory, Eglin AFB, Florida, 1975.
5. Crosby, D. G., and A. S. Wong. Environmental Degradation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Science 195 (4284):1337-1338, 25 March 1977.
6. Young, A. L., E. L. Arnold, and A. M. Wachinski. Field studies on the soil persistence and movement of 2,4-D, 2,4,5-T and TCDD. Appendix G Department of the Air Force. Disposition of Orange Herbicide by incineration. Final Environmental Statement, November 1974.

14 June 1977

MEMO FOR RECORD - Solid Waste Disposal

A meeting was held with Mr James Scarbrough, Reg IV EPA Atlanta, Mr Curtiss Garner, St of MS Board of Health and Mr James Masony Harrison County, Board of Health, Maj Thalken, Maj Birch and Lt Col Gokelman regarding the disposal of the dunnage from the Herbicide Orange project.

Mr Scarbrough requested that we give him samples of both the wood and the oil sorb used in the facility. He requested these after having been given a tour of the site and shown all the material which is to go the landfill. To comply with his request, Mr Garner selected several pieces of wood which he wanted samples of and two barrels of oil sorb from which he wanted samples. The samples were collected with a duplicate set for the AF. Maj Thalken will bring them to the EPA Lab in Bay St Louis tomorrow.

After discussion, Mr Scarbrough agreed that the only way to dispose of this material is by landfill. He further stated that he would like us to try and use the NASA landfill if possible and if the geological report was satisfactory. He further stated that if we went to a private landfill, that EPA would have no jurisdiction and would be a matter of negotiation between ourselves, State of MS and the private contractor.

He also agreed in the meeting that incineration was not a practical method of disposal because of the many problems involved. When asked what he would do with the results of analysis of the samples, he did not give a specific answer.

JOHN J. GOKELMAN, Lt Colonel, USAF, BSC
Monitoring Division

Statement of Work (SOW)

1. General: This SOW provides for the service of a commercial landfill agency approved specifically by the State of Mississippi Solid Waste Regulatory Agency for the landfill of wastes from storage of Herbicide Orange at NCBC Gulfport, MS.

2. Scope of Work

a. Item #1. Use of state approved landfill site for approximately 300 cubic yards of waste material as identified in paragraph 4 below. Such landfill to be accomplished in such a manner to meet all requirements of the State of MS.

b. Item #2. Arrange for and accomplish the loading of the waste materials at NCBC Gulfport, MS, transport to the contractor's landfill site and accomplish all landfill tasks.

3. General Description of Waste and Safety Precautions

a. General - The waste products consist of wood and containers of all hydrocarbon materials which may have come in contact with the Herbicide Orange while in storage or during dedrumming plus drums of waste residue from redrumming.

b. Amount of Contamination - The wood items identified in paragraph 4 which constitute approximately 290 cu yards of the 300 to be landfilled vary in contamination from zero to items where the herbicide soaked into portions of the wood. The contaminated materials packaged in the 55 gallon, 20 gallon and 14 cu yd metal box were more heavily contaminated with the herbicide by direct contact during dedrumming. The drums of sludge and contaminated wastes include herbicides and other residues.

c. Potential Danger in Waste Handling -

The herbicide Orange contaminated waste do not present a hazard in handling, using normal precautions. When handling the items identified, normal leather work gloves may be worn. Following handling, the gloves should either be washed or disposed of in the landfill.

In the event the drums of sludge and waste material (items 4h) are damaged or otherwise leak, any spillage should be absorbed with oil sorb or sand and the absorbent material disposed of in a container to be added to the landfill material. Areas of contact should be washed following any skin contact with any spilled materials.

4. Specific Waste Description

- a. 1 ea - 14 cu yd metal box containing dirty coveralls, boots, respirators.
- b. 25 - 55 gallon barrels containing contaminated oil sorb.
- c. 8 - 20 gallon barrels containing oil sorb.
- d. 5 cu yds assorted metal scrap (pipes, rollers, etc)
- e. 10 - 25 foot lengths 4" flexible hose
- f. 1 drum - Dowtherm A, contaminated
- g. 2 drums - Motor and diesel oils
- h. 8 drums - Mixed sludge and waste herbicide materials
- i. 290 cu yds - Assorted lengths of scrap lumber

