



THE MEMPHIS DEPOT TENNESSEE

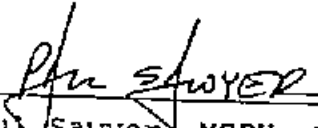
ADMINISTRATIVE RECORD COVER SHEET

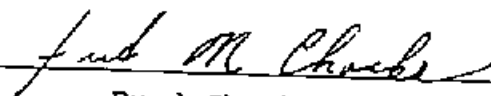
AR File Number 06

SUMMARY REPORT
ON-SITE REMEDIAL ACTIVITIES
AT THE DEFENSE DEPOT MEMPHIS

Submitted to:
Defense Logistics Agency

O.H. Materials Company


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OHM extends its appreciation to Mr. Rick Bowlus and Dr. Jack Heller of the U.S. Army Environmental Hygiene Agency; Depot Commander Col. Corlyn Troyer and his staff; and Mr. Robert Mangrum of the DRMO and his staff for their assistance and guidance in the timely completion of this project.

Special thanks go also to the U. S. Army Corps of Engineers from whose drawings of the facility the enclosed figures are adapted.

EXECUTIVE SUMMARY

Over a 13 week period, O. H. Materials Company performed remedial actions in the vicinity of Buildings 873 and 737 at the Defense Depot Memphis. Activities in Building 873 consisted of recouping approximately 60,000 gallons of hazardous and POL materials from damaged drums and organizing the recoup area in view of product compatibilities, storage requirements, and prevention of environmental damage. Personnel performed sampling in the vicinity of this building to assess potential contamination. The total cost to perform this work was approximately \$143,000. Depot personnel estimate that greater than \$205,000 of materials were saved and returned to stock for future issue. Activities at Building 737 involved removal of pentachlorophenol (PCP) and dioxin/furan contaminated substrates due to recent EPA rulings rendering PCP wastes as acute hazardous wastes. Technical personnel undertook an extensive sampling program to outline the plume of contamination to develop a cost effective excavation regime and to ascertain compliance with clean up criteria. One hundred sixty-nine samples received analysis for dioxins and furans. All wastes are stored on site with 807 drums stored in Bunker 783 and 39 roll-off containers in the vicinity of Building 737 containing 852.14 tons of contaminated soil, concrete, and metal. Total cost for this effort was approximately \$873,000 with laboratory fees accounting for about \$160,000. Personnel backfilled all excavated areas, applied gravel in selected areas, and restored the work area to a natural appearance.

1.0 INTRODUCTION

1.1 SITE HISTORY AND DESCRIPTION

The Defense Depot Memphis warehouses and distributes approximately four million line items common to all American military services and some civil agencies - primarily in the south central United States. These items include food, clothing, petroleum, electronic, construction, industrial, medical, and general supplies.

The depot, which first became operational in January, 1942, has 110 buildings on 26 acres of land approximately two miles from the center of Memphis. Twenty-six miles of railroad track and 33 miles of paved street compose the transportation arteries of the facility. Greater than \$900 million of goods are issued annually to the military via air, rail, and truck systems.

1.2 RECOUPMENT EFFORT

An environmental audit by U.S. Army Environmental Hygiene Agency personnel conducted July 8-18, 1985 revealed the presence of numerous damaged containers of notably acids, bases, solvents and cleaners in the vicinity of Building 873. This again was observed during the USAEHA spill simulation training survey August 26-30, 1985. These inspections also identified spill areas and potentially contaminated soil in an area adjacent to this warehouse building. The poor storage situation intensified to an emergency situation between these two time periods. The U.S. Army Defense Logistics Agency contracted with O.H. Materials Company to reclaim and repack-age containers of usable goods and to provide services as follows:

- o test soils and products providing analysis as needed
- o dispose (handle) of all empty containers properly after recoupment
- o neutralize decontamination product (calcium hypochlorite and chromatid lime)
- o identify, remove and dispose of contaminated soil
- o contain and remedy on-going spills as necessary
- o determine compatibility of chemicals and handle accordingly
- o analyze samples of PCP solution for PCP percentage and for specified dioxin isomers

Contractor personnel proceeded to address these concerns subsequent to the mutual agreement upon a document stating the facility's intent to proceed. Execution of this work revealed that the decontamination product specified earlier could be safely and economically repackaged rather than neutralized on-site; however, the contractor followed the remaining directives as originally set forth.

Materials recouped by O.H. Materials consisted largely of those damaged items stored in bays R5206 and R5203 of Building 873. Concomitant with activity in the building, drums and containers staged in the approximately 2 1/2-3 acres east from this bay were repackaged, sampled, or disposed as necessary. Active participation by depot property disposal personnel insured prompt removal of segregated empty drums and product slated for disposal. Depot personnel arranged for disposal by Chemical Waste Management, Inc., the facility's contracted hazardous waste disposer.

Depot personnel assisted in the recoupment effort by labeling all repackaged containers, returning them to active stock, and by repouring product. Container sizes varied from one pint sizes to 55-gallon drums. Where feasible, contractor personnel consolidated small lots of damaged product into larger containers to minimize handling. Initially, contractor personnel handled all damaged items; however, Army and contractor personnel quickly prioritized for attention a list of items in inventory which offered the greatest potential health and environmental threat. OHM handled less offensive items, such as motor and hydraulic oil only when such items presented health or environmental concern as deemed by U.S. Army and OHM technical personnel.

Army personnel identified a second area for recoupment by contractor personnel which is labelled as "Flammables Storage Area" in Figure 1. Approximately 800-55 gallon drums were recouped in this open storage area and stored as originally found. Figure 1 also details all work areas at the Defense Depot Memphis.

1.3 PCP DIP TANK BUILDING - BUILDING 737

Analysis of a sample of the liquid taken from the dip vat by DLA personnel revealed the presence of pentachlorophenol (PCP). Further analytical investigation by U.S. Army Environmental Hygiene Agency investigators of the liquid in Building 737 revealed the presence of appreciable levels of higher chlorinated dioxins and furans (e.g., penta-, hexa-, hepta-, and octa-isomers). Chlorinated dioxins and furans are contaminants often produced in the manufacture of the wood preservative PCP and other chlorinated organic compounds. Current and past research shows that these contaminants offer considerable concern due to their high toxicities and potential human carcinogenicity. The Environmental Protection Agency recently ruled upon the use, handling, and

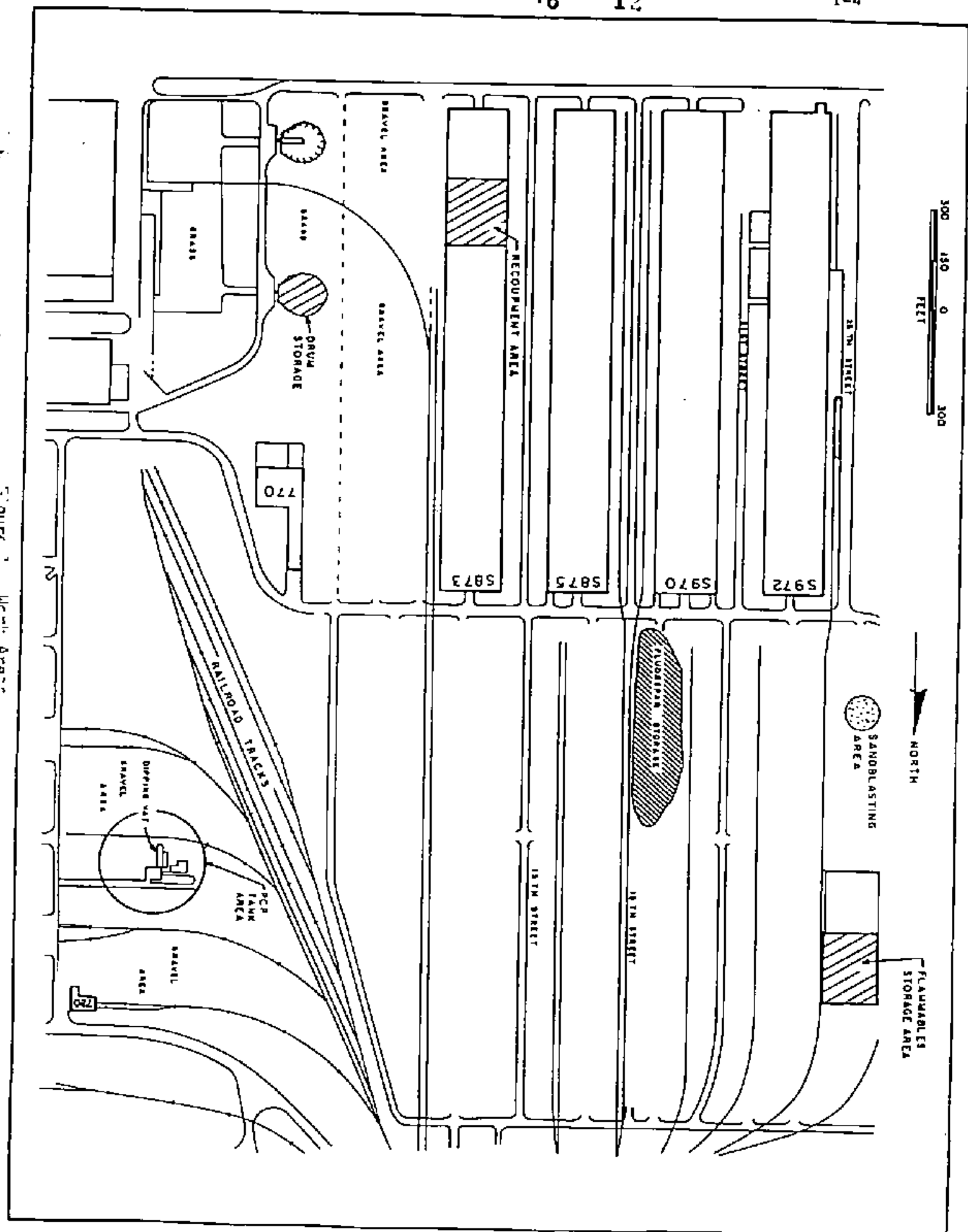


Figure 1 Military Area

deposition of PCP because of these environmental and health concerns. The EPA considers this material acutely hazardous (see rulings, Appendix A).

Depot personnel treated wood products, especially pallets, in Building 737 commencing in 1952. Treatment was effected using the product "POL-NU" which consisted of approximately 11% PCP (See next page). Use of the vat ceased on a regular basis in July, 1971 when purchase of treated pallets from suppliers became more economical. Depot personnel sought disposal of the PCP in the dipping vat in Spring, 1985 but at which time were informed by the DLA pest management staff that deposition and handling required analytical testing (see correspondence No.7).

In light of the aforementioned, DLA officials contracted O.H. Materials to remove and containerize the liquid product; sample and investigate surrounding soil, environs, and building surfaces; and remove other contaminated substrates as directed to mitigate the environmental and health hazards. U.S. Army and contractor personnel initiated an extensive sampling program to identify the extent of the contamination. The contamination was ultimately discovered to extend to depths well below the surface and required extensive excavation. During operations, the State of Tennessee Department of Health and Environment; U.S. Environmental Protection Agency; Public Health Service, Centers for Disease Control; Shelby/Memphis County Public Health Service; and City of Memphis, Division of Public Works were apprised of site developments and activities.

This report summarizes the activities of O.H. Materials Co. on site and includes discussions of the various phases of work. Included are discussions covering the level of hazard, the sampling approach and results, and discussions centering upon various phases of on-site work in the general

CHAPMAN

POL-NU

**PENTA PRESERVATIVE GREASE
ESPECIALLY RECOMMENDED**

GROUNDLINE TREATMENT

FOR CONTROL OF DECAY AND AIDS IN THE PROTECTION AGAINST TERMITES.

Extends Service Life of Standing Poles and Posts.

INGREDIENTS

ACTIVE INGREDIENTS:

Pentachlorophenol..... 9.16%
Other Chlorinated Phenols..... 2.07%
Aromatic Petroleum Derivative Solvents..... 81.34%
INERT INGREDIENTS..... 8.43%

*Equivalent to 10.66% pentachlorophenol, technical as defined by Federal Specification TT-W-570a. 100.00%

WARNING

KEEP OUT OF REACH OF CHILDREN!

Hazardous if inhaled if swallowed or absorbed through skin. Causes skin irritation. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling with plenty of soap and warm water. Keep away from foodstuffs, children, pets and livestock. In case of swallowing, induce vomiting by administering emetic. CALL A PHYSICIAN. Irritation may keep away from fire and flame.

This product is toxic to fish and wildlife. DO NOT CONTAMINATE WATER BY CLEANING OF EQUIPMENT. OR DISPOSAL OF WASTE. APPLY THIS PRODUCT ONLY AS SPECIFIED ON THIS LABEL. Do not reuse container. Destroy when empty.

MANUFACTURED BY **CHAPMAN CHEMICAL COMPANY** MEMPHIS, TENNESSEE 38109

EPA Reg. No. 1022-78-1

EPA Reg. No. 1022-46

APPLICATION TO POLES

POL-NU can best be applied to poles by using the CHAPMAN POL-NU BANDAGE MAKER and POL-NU pump. For application to deep checks in poles or timbers, fill a caulking gun with POL-NU and apply. Any grease equipment that will handle No. 2 cup grease will work with POL-NU.

Excavate the soil away from the poles to a depth of about 18 inches. Give brush the pole surface in narrow adhesion to the groundline surface. It is also desirable to have the groundline surface directed toward the center of the pole. Holes should be plugged with bent plugs or treated wood plugs. If decay is present in the center of the pole, consideration should be given to its early replacement or stubbing.

POL-NU will penetrate wet wood. It is not necessary to have excavated poles exposed in order to dry out. POL-NU should be applied in a 4 inch thickness. Where any BANDAGE MAKER is applicable up to 3/4 of an inch.

Bands may be prepared to cover groundline areas of poles in bands 18 to 22 inches in height. The POL-NU BANDAGE MAKER produces a 22 inch band of POL-NU. A Template for POL-NU should be applied to cover the pole surface 4 inches below the last evidence of decay and 3 inches above the groundline. More than one bandage may be used in special cases where the pole area to be covered spans a height greater than 22 inches, such as on billboards, etc.

OTHER USES

These structures are built with unpreserved woods that are susceptible to decay, carpenter ants, and powder post beetles. They exist a need for preservation of these poles. POL-NU can be used to preserve on sills, headers, joists and on re-rotted railroad tie surfaces. It would be especially valuable in places where condensation is likely to gather and if placed where and grain wood built against concrete or masonry. Covering is needed as in the case of wood in ground contact. Since a reservoir of preservative is then at the wood surface, POL-NU can also be applied to the groundline area of fence posts and pilings following the same general procedures outlined for treating poles.

NOTICE

Neither the manufacturer nor the seller makes any representation or warranty, express or implied, concerning this material, except that it is of standard quality. Neither shall be held responsible in any manner for any personal injury, property damage or other loss resulting from handling, use, storage, or use of this material. Buyer assumes all risk of loss and/or handling of this material when sold and/or shipped. Handling is contrary to label instructions.

chronological order in which it was performed. Also included is a section outlining health and safety provisions for personnel, a discussion of the possible future fate of stored materials, and descriptions of the current sites.

2.0 DISCUSSION OF HAZARD

2.1 PHASE I - RECOUPMENT AREA - BUILDING 873

Performance of an inventory of materials on the site by OHM and depot personnel revealed a large quantity of various sizes of containers of products in poor condition which are considered hazardous materials. From the standpoint of health danger to personnel and compromise of the environment, the situation demanded immediate and thorough actions. In this light, the Defense Logistics Agency contracted with O.H. Materials Co. to repackage damaged and leaking containers and rearrange the recoupment area in view of product compatibility/incompatibility as mentioned in the Introduction.

The materials inventoried included acids, bases, oxidizers, solvents, pesticides, greases, oils, flammables, and water reactives. The reader is directed to review the complete list presented in Table 1. A particular hazard of concern by U.S. Army Environmental Hygiene Agency and OHM technical personnel centered around the storage of many containers of incompatible materials in a haphazard manner. Rupture or spillage of incompatible materials with subsequent mixing can produce fire and/or heat and trigger a major incident. Personnel observed acids with bases, acids with flammables and solvents, oxidizers with flammables, and solvents with corrosives stored haphazardly throughout Building 873. Pesticides stored in Building 873 offered the potential for toxic exposure in the event of a fire or simply from leakage from damaged containers.

Army and contractor personnel determined that a substantial future hazard to the environment and depot personnel presented itself in the form of vapors and spilled materials from damaged and leaky drums if left unattended. The fate of

spilled hazardous materials ultimately leads to contamination of air, soil, and/or water sources. Although the warehouse had provision for some containment, spillage could readily flow to adjacent outside storm drains through entry ramps. Depot personnel had stored many drums in the unsurfaced storage lot on the east side of the warehouse thus offering tremendous potential of soil and water contamination.

Finally, OHM personnel observed gas powered fork lifts and vehicles traversing storage areas containing flammable solvents and liquids. Incidental sparks from this equipment in the presence of vapors from such materials offered the potential for explosion and fire.

Depot Personnel were observed smoking cigarettes when passing through this area going to their respective work areas from parking lots. Security as well as depot vehicles were observed by OHM personnel to frequently travel through the storage aisles and flammables area.

An inspection of Material Safety Data Sheets included as Appendix B reveals that many of these substances require special protective gear for personnel in the event of a spill in recouping operations. Furthermore, special actions are required to deal with materials which are spilled to alleviate environmental damage. Adherence to an orderly operating policy in recognition of these special precautions was strikingly absent in depot personnel handling substances in the recouplement area.

2.2 PHASE II - PCP DIP TANK AREA - BUILDING 737

The discovery of chlorinated dioxin and chlorinated furan tainted pentachlorophenol in Building 737 led U.S. Army and OHM personnel to respond to the situation in view of recent EPA directives and plan an effort to remove and contain the

contamination. Dioxins, one of the most toxic classes of substances known to man, elicit immediate concern to all persons involved in their handling and management due to their potential carcinogenicity. Furans, although less publicized, also present considerable concern. Hence, OHM commenced a clean-up of the PCP dip vat area to sequester the contaminated substrates and restore the area at the direction of U.S. Army representatives.

Dioxin contamination of PCP liquid does not ordinarily contain the most notorious of the dioxin family; namely, 2, 3 7, 8 - tetrachloro-dibenzo-para-dioxin (2,3,7,8-TCDD). This particular isomer of dioxin has been shown by researchers to offer the greatest potential of this chemical family for carcinogenicity. Except for traces, this substance was not found on the site and then only in a few samples. The levels found were extremely low levels not warranting specific clean-up action. However, analytical results showed the presence of high levels of more highly chlorinated dioxins including the penta-,hexa-,hepta-, and octa-isomers. Although these forms are less potent as carcinogens, they do offer a risk which is addressed by the Environmental Protection Agency.

Principals for the clean-up based the decision for remedial action at this area upon recent EPA directives previously mentioned. The reader is directed to Appendix A which contains the Federal Register, Vol. 50, No. 9 for Monday, January 14, 1985 which on page 1980 states that

.....the principal basis for listing the PCP wastes as acute hazardous wastes is the presence of substantial concentrations of HxCDD's (hexachloro-dibenzo-dioxins) and HxCDFs (hexachloro-dibenzo-furans) and of PCP, which has potential chronic systemic effects.

The document cites research efforts which examined the problems surrounding these contaminants and concludes that

the potential toxicity of HxCDDs at the levels found in PCP are of regulatory concern and that these wastes contain significant concentrations of potent carcinogens. These wastes therefore meet the criteria of 40 CFR 261.11 (a)(2), justifying the listing of these wastes as acute hazardous wastes.

Another document by the EPA included in Appendix A discusses risk assessment of the various forms of dioxin in comparison to the most highly toxic form - 2, 3, 7, 8 - TCDD (See "Chlorinated Dioxins Workgroup Position Document, April, 1985"). Tables I and II of this document show relative toxicities of various forms of chlorinated dioxins and furans. The reader is directed to examine analytical results in light of these relative toxicities.

3.0 OVERVIEW OF SAMPLING APPROACH AND RESULTS

3.1 RECOUPMENT AREA - VICINITY OF BLDG. 873

Technicians sampled unknown drums in the recoupment area on a limited basis. Generally, due to attached paperwork and drums markings, identity of the contents was distinct. The OHM project chemist performed quick spot tests of organic liquids to determine chlorinated compounds (Beilstein Method). Drums identified as inorganics were often neutralized on site by depot personnel. When wastestreams were identified, depot personnel transferred them to the property disposal area for disposal per the depot's contract with Chemical Waste Management, Inc.

Upon direction of U.S. Army and State of Tennessee Department of Health and Environment representatives, the project chemist constructed a sampling grid of the area east of Building 873 to ascertain the presence of any possible contamination (See Figure 2). Each grid consisted of the measurements of 75' x 75'. Personnel composited nine discrete samples from each grid to form a representative sample from each grid area. Tables 2, 3, and 4 report the results of PCB, Ep toxicity for metals, and pesticide testing, respectively. For Tables 2 and 3, samples from Row F did not receive analysis due to the absence of any notable PCB or metals contamination in previously analyzed grids.

Table 4 reveals the presence of aldrin, alpha-BHC, delta-BHC, endrin, heptachlor, endosulfan, DDT and the latter's metabolites. This contamination is, however, in surficial material and exists below levels requiring clean-up action.

The parameters which received scrutiny were chosen after investigation of past storage history of Building 873.

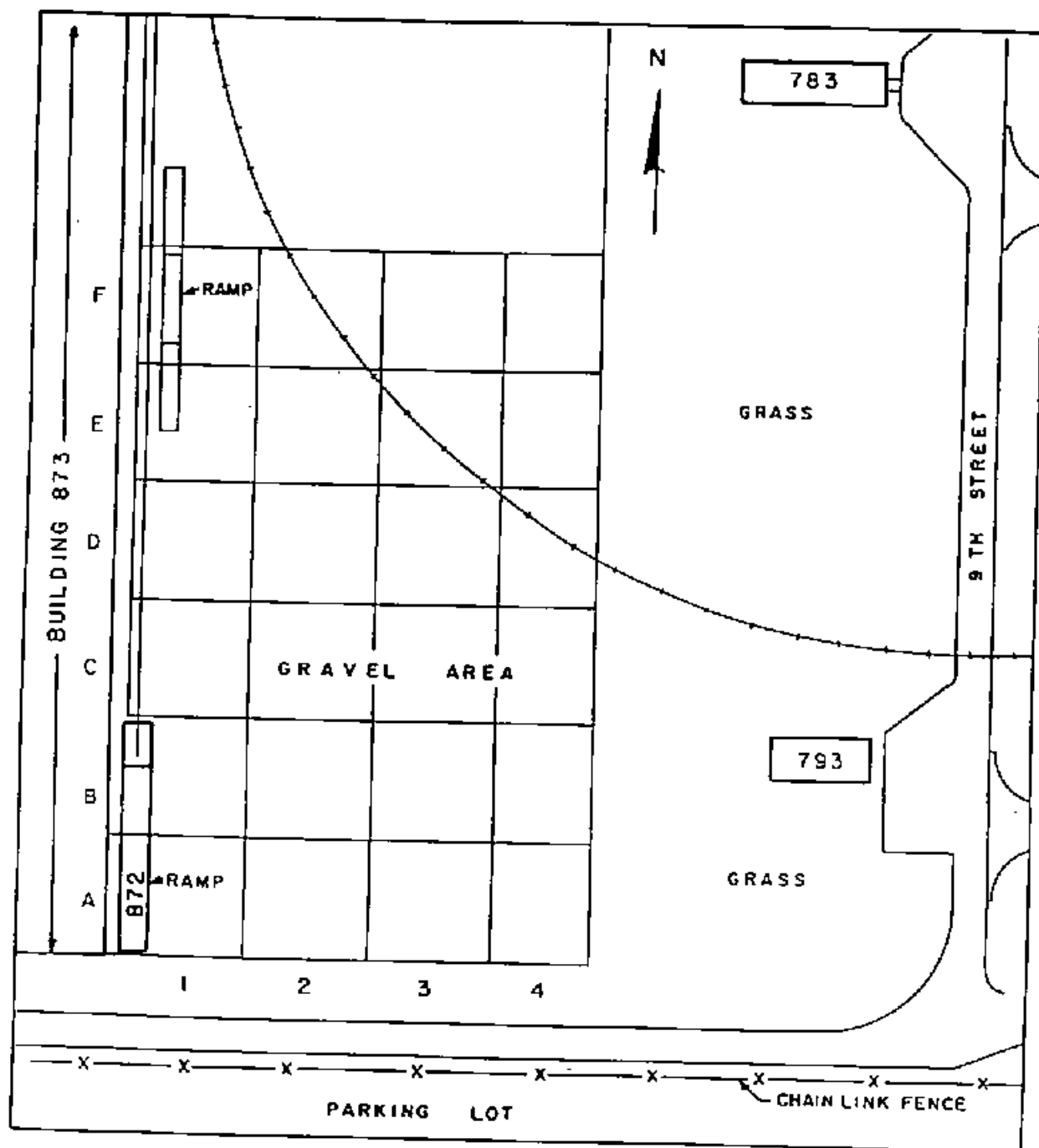


Figure 2. Sample Grid of Area East of Building 873

Confinement of various forms of contamination to surficial soil indicates numerous spills of limited quantities in outside storage areas.

The project chemist also took samples of sandblasting material found in the depot sandblasting area south of the flammable storage area and north of Street G, from one suspected PCB transformer, and from drums of oil and water during this phase of operations. Results are given in Table 5. Results indicate that the transformer and one oil drum contain PCB greater than 50 ppm (considered "PCB Contaminated"). Water results are below action levels; however, trace contamination (5.1 ppm) was present in the soil sample. Clean-up efforts were coordinated with the regional EPA. Sandblasting material (Sample 61) received testing for EP toxic metals and was negative throughout. No further testing was performed on the sandblasting material after this sampling date (9/14/85).

3.2 PCP DIP TANK AREA - BUILDING 737

Sampling investigation of the PCP Dip Tank Building No. 737 commenced in August, 1985 when U.S. Army Environmental Hygiene Agency personnel obtained a sample of the liquid PCP contained in the 5500 gallon vat. Subsequent analytical results of this sample, which OHM arranged shortly after arrival on site, are shown as sample 3057-7 in Table 6. Results reveal the presence of high levels of the highly chlorinated isomers of dioxins and furans. U.S. Army personnel implemented shortly thereafter a sampling regime of the dip vat building and environs with performance by OHM to ascertain the extent of this contamination.

A total of 169 samples were analyzed for isomers of dioxins and furans. Initial samples taken received analysis for but one isomer of dioxin, tetrachloro-dibenzo-p-dioxin. Due to the considerable concern relative to the toxicity of this

particular isomer compared to the other forms, this was selected as an "indicator" compound and to achieve a rapid turnaround time from the laboratory.

Prior to full scale remedial activities at Building 737, U.S. Army and OHM technical personnel examined the possibility of utilizing an on-site dioxin lab to achieve rapid turnaround and cost savings. However, the low sample load encountered at project start led investigators to appropriately discount this approach and opt for sending samples to a fixed station laboratory.

3.2.1 VICINITY OF DIP VAT BUILDING

Correspondence with facility personnel by OHM and U.S. Army Environmental Hygiene Agency representatives revealed that PCP liquid had in past years been mixed with waste oil and sprayed on depot grounds for dust control.

Figure 3 shows six areas suspected of receiving this mixture with sample points used for making a composite of each area. Results from Table 7 (Sample 69) show that Area 2 contained TCDD at a 5.6 ppb level (the EPA clean-up level for residential areas is 1 ppb). Further sampling of Area 2 is shown in Figure 4 and the area is further broken down into six grids. Results in Table 7 (Samples 114-125) showed the presence of TCDD but this time at amounts below action levels. Additionally, quantitation of other dioxin isomers and furan isomers proved positive. U.S. Army representatives, in consultation with State and Federal officials, ultimately decided to gravel the area in light of the initial TCDD quantitation.

Sample No. 3057-72 (Table 7) taken of sediment at the drainage outfall between Gate 9 and Perry Road was analyzed for TCDD. This isomer was non-detectable. Pest Monitoring and

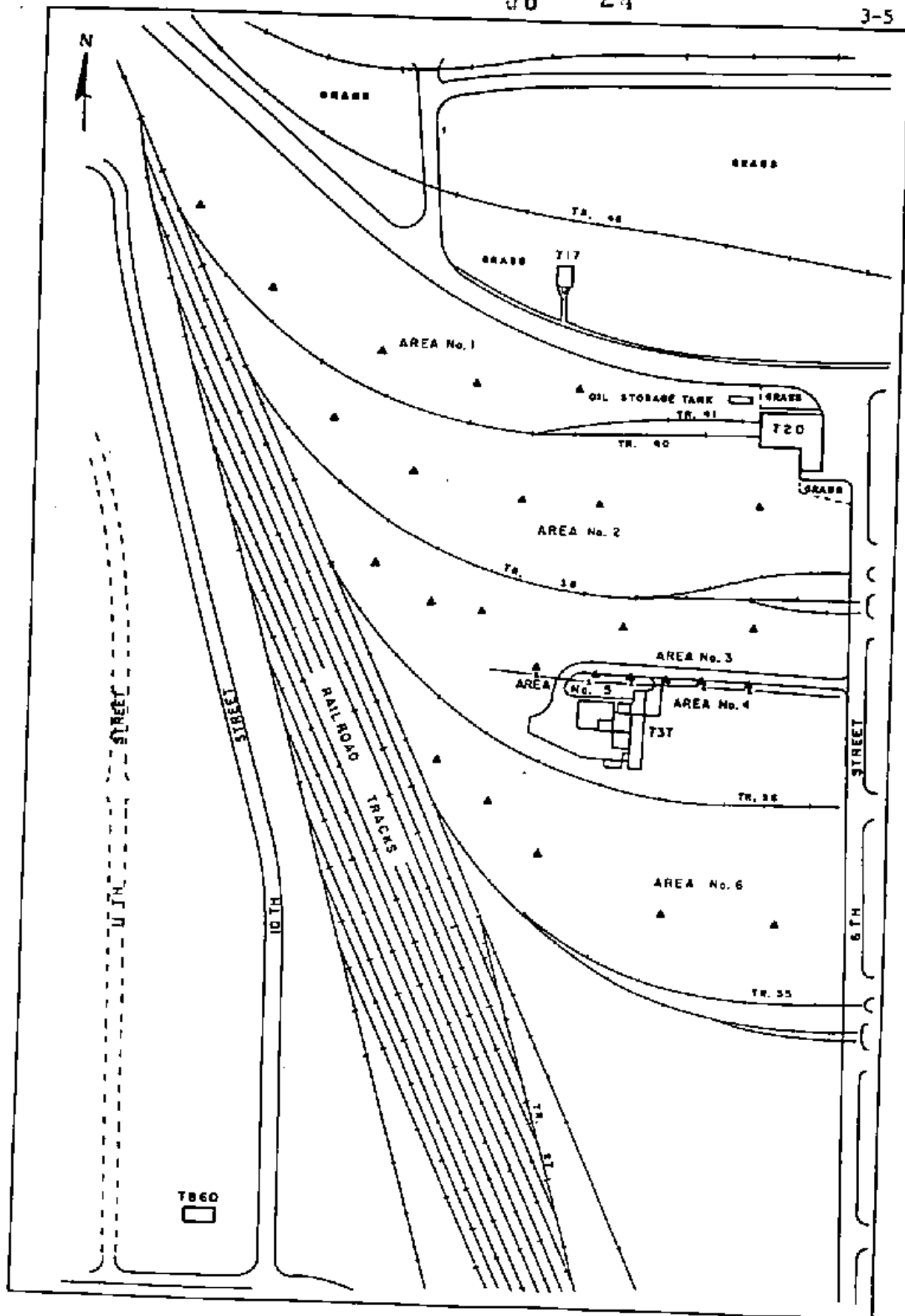


Figure 3. Sample Points of Gravelled Areas.

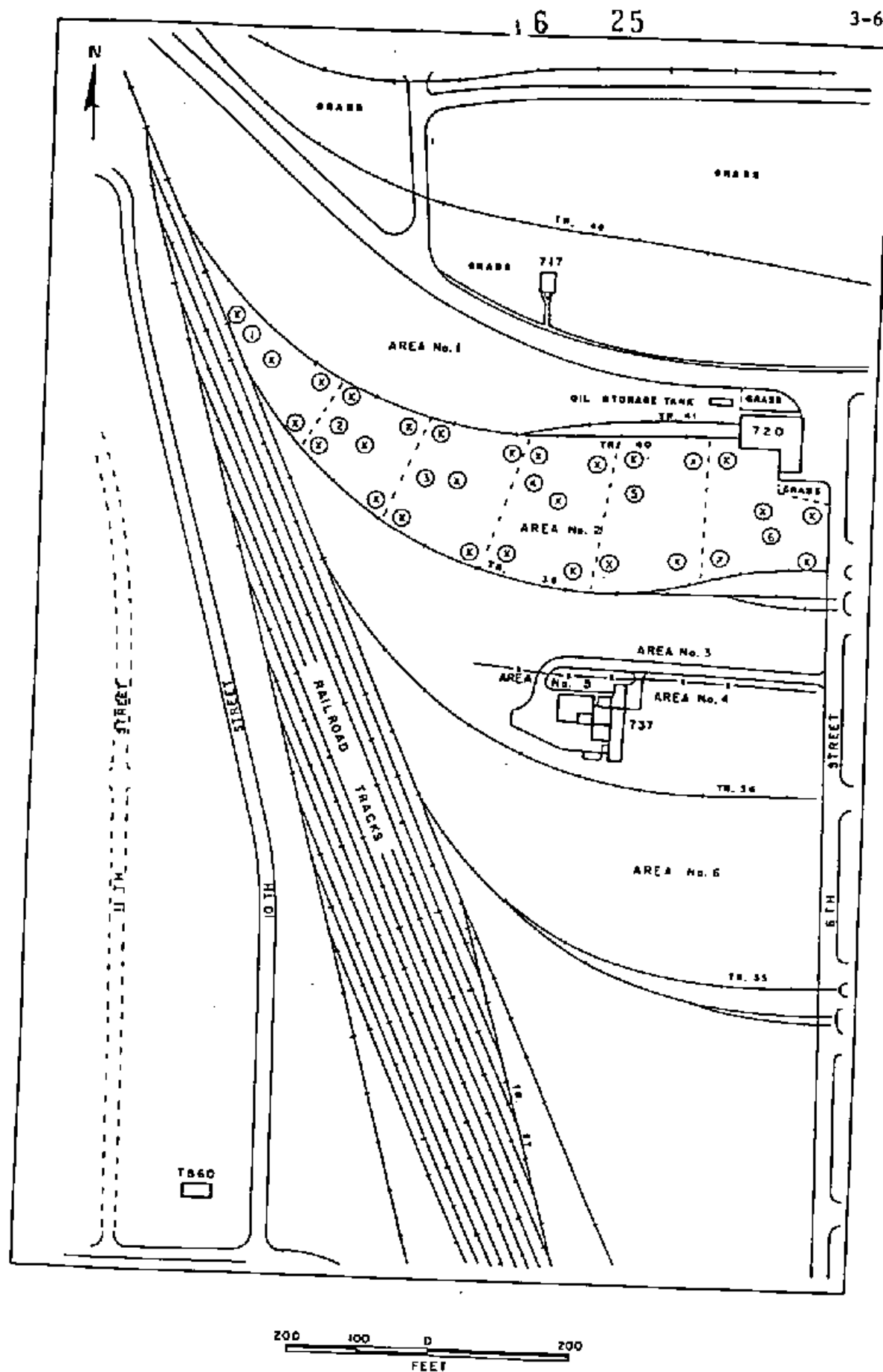


Figure 4. Additional Sampling of Gravel Area No. 2

Pest Management Division personnel of the U.S. Army (USAEHA) assisted in this sampling effort.

3.2.2 SAMPLING INSIDE DIP VAT BUILDING

Sampling methodology within the dip vat building centered upon quantitation of surficial contamination to ascertain the need of possibly disposing of the entire structure. Results of this phase of sampling are given in Table 8. Technical personnel obtained samples of concrete, concrete block, wood, and wipe samples of various surfaces to determine the extent of contamination. Results show that contamination appeared widespread throughout the structure. Despite efforts to decontaminate these surfaces, the entire structure and contents were removed and stored for disposal (see Section 4.0).

3.2.3 DEPTH SAMPLING IN BUILDING 737

Samples taken of soil under the dip vat after the latter's removal showed the presence of contamination (See Table 8, samples 172, 173). Excavation in the vicinity of the PCP Storage Tank indicated contamination through the presence of discolored soil. In order to profile the perimeter and depths of contamination in and around the building in a quick and efficient manner, OHM mobilized a portable drill rig to systematically depth sample the area. This was performed after the superstructure of Building 737 was removed.

Figure 5 shows the locations of borings performed in this area. Results are given in Table 9 which references the grid location shown in the aforementioned figure. Using these data, OHM technical personnel developed a depth and perimeter profile of the contamination for use in planning excavation activities (See Figure 6). Using a target clean-up criteria figure of 200 ppb total dioxins and furans established in consultation with state and federal authorities, Figure 6

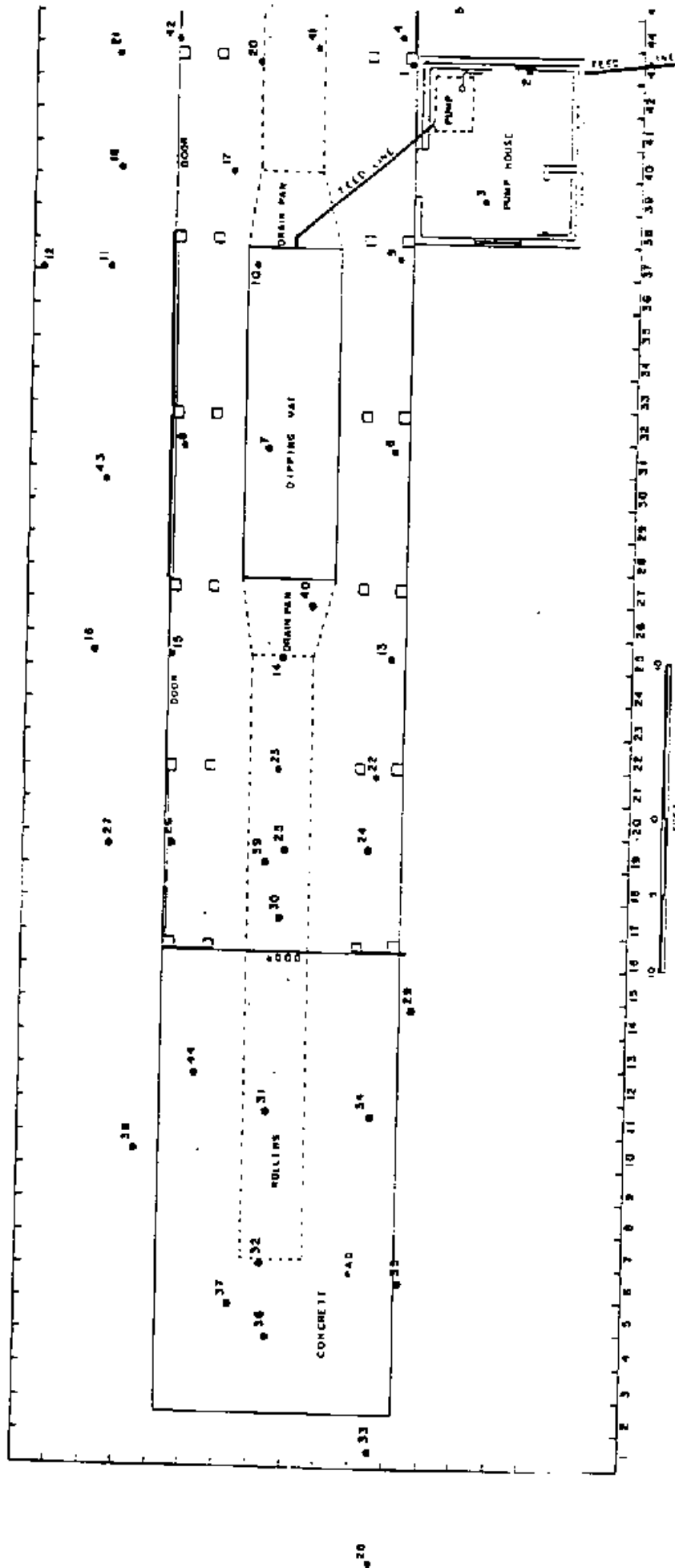


Figure 5. Borehole Locations in Building 7.

Figure 5.
Soil Contamination Profile - Building 731

reveals heavy contamination in the vicinity of the dip vat and under the drain pan.

Figure 7 presents a longitudinal cross section of Building 737 showing borings taken along this axis and the extent of contamination at various depths. Borings did extend as deep as 27' and did not reach the water table at an estimated 37'. See Appendix C for methodology of taking samples utilizing a "split spoon" technique.

During the drilling operations, personnel examined soil cores at one-foot intervals. To limit costly and unnecessary analytical expense, samples were not taken when the soil was clearly discolored with the brown PCP product. Drilling ceased when a clean sample without odor was obtained (odor of PCP is discernable well below recommended TLV).

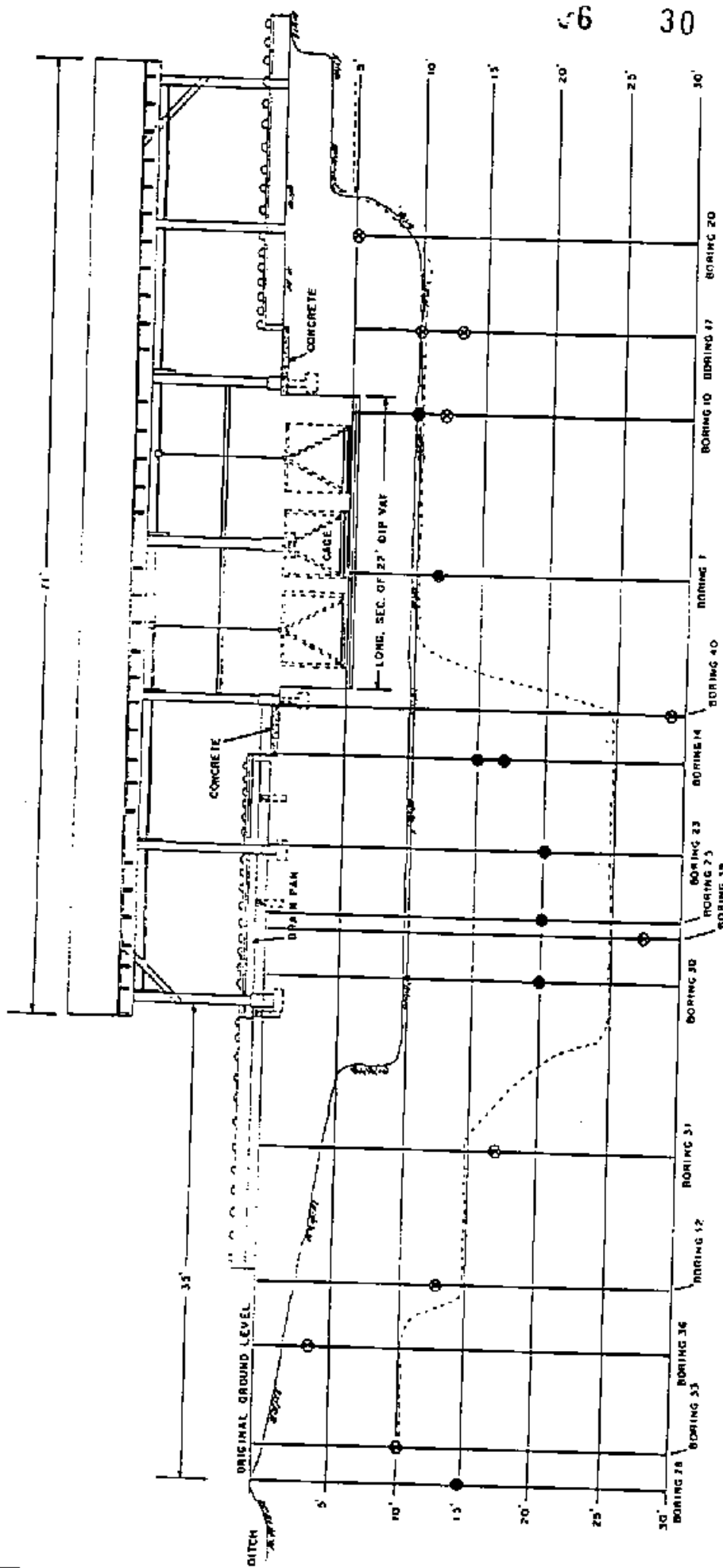
3.2.4 VICINITY OF PCP STORAGE TANK

Although the integrity of the storage tank was sound, contamination had leaked from poorly fitted joints in piping leading to the dip vat building. Sampling of soil in these areas confirmed the paths of the contamination which ensuing excavation removed. As noted in Table 10, four sources of soil removed from this area with trace contamination were returned to the excavation.

3.2.5 SAMPLES DURING CLEAN-UP PROCESS

To monitor the clean-up effectiveness of methods employed in the decontamination of Building 737 and the storage tank, chemists undertook an extensive sampling methodology to aid these operations. Surfaces which were sandblasted or hydroblasted received sampling. Table 11 presents results with a description of each sample taken. Despite a very high percentage reduction in contamination present on cleaned

NORTH



RED SAMPLE POINTS > 200 PPB TOTAL DIOXINS AND FURANS
 BLUE SAMPLE POINTS < 200 PPB TOTAL DIOXINS AND FURANS
 ----- THEORETICAL CONTAMINATION LIMITS (SEE FIGURE 6)

Figure 7.
 Longitudinal Cross-Section of
 Building 737 Showing Extent
 of Contamination

surfaces (as high as 99%+), analytical results showed that trace but detectable levels of dioxins and furans remained. These results led to the decision by Army representatives to retain all cleaned but slightly contaminated concrete and salvageable items in storage on site.

3.2.6 SAMPLES-MISCELLANEOUS AND OF EXCAVATED SOIL STORED ON SITE

Table 6 lists results from analysis of PCP free liquid from the vat, sludge at the bottom, of sandblasting sand used to decontaminate the building and PCP storage tank, and of water treated on site.

Table 12 presents results of composite sampling requested by the DLA (Environmental Office) of 27 roll-off containers used to store excavated contaminated soil. Results of this sampling will be used for determining ultimate disposal.

3.2.7 SAMPLING METHODOLOGY

Appendix C contains protocols applied by OHM personnel for obtaining various types of samples. In addition to this protocol, field blanks were obtained and submitted at regular intervals. The EPA approved laboratory responsible for the bulk of analyses, York Research Consultants of Denver, Co., maintains a rigorous Quality Assurance/Quality Control procedure for all dioxin analyses. All laboratory reports are presented in Appendix D for inspection as is a list of laboratories used.

4.0 DISCUSSION OF ON-SITE OPERATIONS

4.1 PHASE I - RECOUPMENT IN WAREHOUSE BUILDING 873

O. H. Materials handled and repackaged assorted solvents, cleaners, acids, bases and reactives housed in Warehouse Building 873 and in the adjacent storage yard on the east side commencing 9/4/85 and ceasing on or about 9/26/85. These products were poured or repackaged in DOT approved containers when required. Personnel performed the repackaging operations with personnel protective measures specified in the Material Safety Data Sheets for the product or from other safety information available (see Selected Material Safety Data Sheets, Appendix B). Generally, most of the repackaging was performed under cover in Warehouse Building 873 in sections R5206 and R5203 to utilize existing facilities and equipment and to provide a safe working area with minimal discomfort to personnel. The OHM chemist supervised the repackaging effort, recorded materials that were repackaged, and identified materials which qualified for repackaging. This was performed in close association with depot personnel responsible for this area and in coordination with the Item Manager DGSC (Richmond, VA.).

In the course of this operation, OHM personnel arranged the recoupment area of Warehouse Building 873 in Sections R5206 and R5203 to provide an organized and safe work area for future recoupment activities by depot personnel. This involved housekeeping, separating incompatible and damaged containers which may react if combined, moving storage racks to define the area, and establishing a product handling line to expedite operations. OHM personnel based layout on consideration of the flow direction of liquids if spilled; proximity to eyewash, shower, and faucet; established travel routes of forklifts; and distances to the newly re-established storage racks. At the conclusion of the repackaging of each line of

materials/liquids, empty containers were promptly dispatched to the designated property disposal personnel.

The storage yard adjacent to Warehouse Building 873 on the east side housed a number of containers whose contents were unknown and which required sampling for adequate disposal. As mentioned in Section 3.1, these containers were separated into organic and inorganic wastestreams for disposal by Chemical Waste Management, Inc. Waste acids and drums were neutralized on site and oil products were culled for disposal. Quantities of waste acids and bases were retained by depot personnel for future neutralizations. Products were also repackaged in this area. At project completion, this area was totally free of stored materials and was sampled in a grid manner to document the existence of any spilled hazardous materials.

Contractor personnel repackaged approximately 40 different products in this effort. Depot personnel assigned to the recoup area prepared the final inventory list of materials repackaged as described in Table 1. OHM and depot personnel combined handled approximately 60,000 gallons of materials of which an estimated 11,000 gallons can be attributed to depot personnel. See Weekly Summaries, Section 5.0, for a description of quantities handled by week by OHM.

Various types of equipment were necessary for the successful completion of this phase of work. The following listing shows notable pieces of equipment which were utilized and a brief description:

- o Pollution Control Truck - contains a wide complement of equipment needed for emergency response including hand tools, hoses, pumps, sink with running water, sampling equipment, protective clothing,

respirators and supplied air devices, emergency safety equipment, hand power tools, generator, and lighting.

- o Explosion Proof Barrel Pumps - used extensively for transferring flammable liquids to new 55 gal. containers.
- o Personal Protective Gear - includes chemical resistant splash suits, gloves, hard hats, face shields, cartridge respirators (full-face protection), supplied air respirators, rubber boots, and expendable paper and plastic items.
- o Forklifts - these were rented to facilitate the timely movement and rearrangement of palletized items as installation lifts were neither safe, functional, nor available.
- o Generator and Floodlights - allowed operations to proceed in evening and night hours to hasten operations in these cooler time periods.
- o Blackmear Pump - a centrifugal pump which technicians utilized for drum transfers.

Concurrent with the recoupment activities, sampling was performed on a transformer and drums suspected of containing PCB dielectric fluid and of a sandblasting area on the depot property. The transformer and drums were located in the Property Disposal storage area and the sandblasting area was located approximately 600' south of the flammables storage area.

Upon completion of recoupment activities in the Warehouse Building 873, attentions focused upon remedial activities in

the vicinity of Building 737. The depot-supplied office trailer was removed and placed near the work area of Phase II - the PCP vat clean up area.

4.2 PHASE II - REMEDIAL ACTIVITIES AT BUILDING 737

Assessments and sampling of the pentachlorophenol (PCP) dipping vat area by U. S. Army Environmental Hygiene Agency personnel in July, 1985 with results reported on 9/12/85 determined that dioxin (dibenzo-para-dioxin) contamination was present at this site (see Table 6). As an addendum to the in-force work contract, DLA representatives contracted O. H. Materials to identify, remove, and containerize contaminated substrates to preclude further environmental contamination and eliminate any possible threat to human health.

The following sections describe phases of this work and are presented in the general sequence in which they were performed.

4.2.1 REMOVAL OF LIQUID PENTACHLOROPHENOL FROM DIP VAT

Sampling efforts determined that the PCP remaining in the dipping vat contained high concentrations of hexa-, hepta-, and octa-substituted furans and dioxins. Hence, Army Environmental Hygiene Agency representatives, in consultation with OHM technical personnel, decided immediately to remove and containerize this liquid in the open vat as it represented what was believed to be the vast majority of contaminants at this site (see Figure 8 for location of dip vat and work areas).

OHM technicians utilized electric and air driven pumping equipment to remove the liquid. Personnel pumped the product to polyethylene lined, 55 gal. 17C drums. Drums were staged on pallets on the east side of the building before their

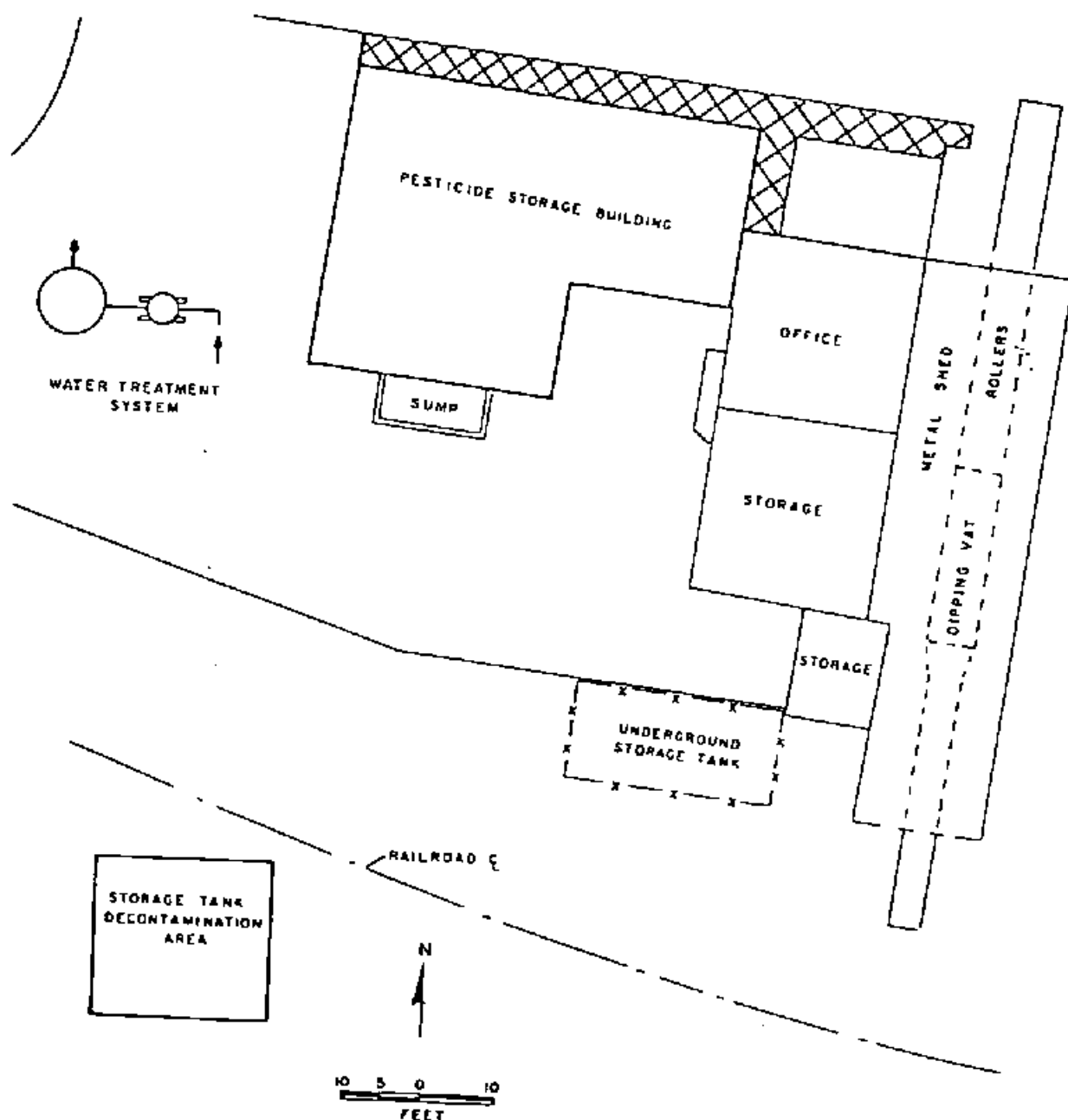


Figure 8. Layout of Building 737 Work Area.

ultimate storage in Bunker 783. Contractor personnel shoveled non-pumpable sludge at the bottom of the vat and lifted out the material with buckets for drumming. Numerous wood fragments and sticks of debris also were removed. After completion of all pumping, the rubber hoses used for transfer were discarded and drummed due to the uncertainty of their complete decontamination. Likewise, the site foreman discarded personnel protective gear which was rubber or synthetic. Technicians removed a total of 50 - 55 gal. drums of PCP liquid and sludge for storage in Bunker 783.

4.2.2 DECONTAMINATION OF BUILDING AND CONTENTS

With gross contamination removed and sequestered off site, decontamination of the building interior and contents commenced. This was achieved by sandblasting and hi-pressure washing. A meeting held late September, 1985 with representatives of EPA, DLA, DTDHE, OHM, Defense Industrial Plant Equipment Center (DIPEC), and Shelby/Memphis County Public Health Service resulted in directives to approach the decontamination in this manner.

Sampling indicated the presence of low levels of contamination on rollers and other metal surfaces in the building. Visible contamination remained on the metal sides of the dip tank after completion of pumping but appeared amenable to removal by sandblasting. Wipe sampling and chip sampling of concrete and wood surfaces also showed low level contamination, probably from vapors from the heated PCP vat over the course of many years of wood treating operations.

Personnel secured both open ends of the building by enclosing it with 6 mil polyethylene film. All surfaces were sandblasted in the enclosed building, and individual pieces were removed and staged outside for clean-up sampling. Generally, the sandblasting removed the vast percentage of the

contaminants; however, Army representatives decided to further decontaminate failing pieces to achieve a surface level of 0 ng/m². This was attempted by high pressure utilizing a 3,000 psi water laser and was done on metal and concrete surfaces. In conjunction with this effort, technicians installed a water treatment system to treat contaminated wash water with activated carbon. Personnel established a wash area on the concrete pad on the north end of the building.

Personnel decontaminated surfaces systematically utilizing field proven techniques. However, minute traces of contamination remained on many pieces after these thorough efforts (see Table 11). U. S. Army and State of Tennessee representatives determined that all materials, both those subjected to decontamination and those articles not treated as such, must remain stored on site pending future EPA rulings on disposal.

4.2.3 DISASSEMBLY OF BUILDING 737

Upon completion of sandblasting and clean up sampling activities, the wooden superstructure was disassembled for disposal. Personnel cut the roof in approximately 6-8 ft. sections utilizing partner saws, chain saws, and assorted hand tools. Operators utilized the Caterpillar 225 excavator on site to lift cut sections to the ground.

This piece of equipment was also used to crush the wooden pieces of the structure for containerization in roll-offs placed on site. Workers removed intact asbestos shingles used as siding on each gable which were put into roll-off containers and were not subject to airborne release. Personnel removed all miscellaneous items from the building and after decontamination, placed them also in roll-off containers.

Rollers used in the treatment process were cut up and stored in roll-offs as were sections of pipes and I-beams in the building. Due to heavy contamination of some rollers, these were placed in drums and not subjected to decontamination processes.

4.2.4 WATER TREATMENT

Workers erected a water treatment system consisting of a 12,000 gallon portable pool with vinyl liner, 2-inch submersible pumps, medium capacity carbon cell, and associated piping on the concrete pad on the west side of the PCP dip tank area. The sump located adjacent to the pesticide storage building (see Figure 8) was utilized as a holding basin until an adequate quantity of wash water was retained for treatment.

To collect water generated in the building and on the concrete wash bay, OHM dug a sump in the ditch on the north side of the dip tank building. The sump, which was located at a point for natural drainage, was double-lined with six mil polyethylene film to prevent seepage. Water was then pumped to the larger sump located behind the pesticide storage building.

Personnel charged the cell with 2204 pounds of carbon to give an adequate reserve capacity to treat wash waters of an unknown contamination level. Also in the course of treating wash waters from the decontamination process, personnel treated all pesticide contaminated water in the sump. Sample results of the treated water held in the portable pool were negative. Disposal of 8,000 gallons of carbon filtered water to the Publicly Owned Treatment Works (POTW) was arranged with the City of Memphis Public Works Department (see Correspondence Nos. 23 and 24). Upon completion of water treatment

activity, technicians removed 27 drums of contaminated carbon for storage on site.

4.2.5 REMOVAL OF PCP STORAGE TANK

Sampling of the approximately 12,000 gallon PCP storage tank indicated the presence of oily liquid in the tank. However, after excavation of the tank was completed, inspection of the vertical vent pipe over the west end of the tank which had been sampled revealed it to not be connected to the tank. Although not connected, this pipe was full of product. When results were received, technicians excavated the tank to ascertain the presence of any possible leakage. Leakage was found and further soil excavation commenced (see Section 4.2.6).

The structural integrity of the tank, which had 3/8" walls, proved sound. Leakage was discovered at joints in the piping connecting the tank to the dipping vat. Investigation at the beginning of the excavation showed six joints loose and leaking under the pump house, between the pump house and tank, and between the pump house and dipping vat. Connections elbowing up into the dipping vat were non-leaking.

Excavation of the tank proceeded using a Caterpillar 225 tracked excavator. A ramp on the west end leading down into the excavation was created for access (see Figure 10). Due to the size and weight of the tank, OHM personnel utilized the facility crane to lift and place the exposed tank in the decontamination area (see Figure 8). Excavation of the area also called for the removal of the concrete supporting chocks and associated metal straps for disposal.

Personnel employed cutting torches and partner saws to breach the tank. Prior to cutting, the atmosphere within the tank

was tested for explosion potential and found within safe limits.

A layer of hardened PCP material varying from six to eighteen inches was manually removed from the interior of the tank and drummed. Sandblasting of the tank interior commenced only after a temporary structure built of wood and 6 mil polyethylene film was constructed around the tank to contain sandblasting material. Subsequent to sandblasting, personnel used forklifts to carry each piece to the washing pad for a final hi-pressure wash before storage in the on-site roll-off containers. Due to the high manpower requirement needed to attempt to decontaminate the 4" piping connecting the tank of the dipping vat, supervisory personnel opted to cut and drum these pieces.

Upon completion of sandblasting of the tank pieces, personnel disassembled and drummed the wood and plastic containment building. Sandblasting sand was likewise drummed. Operations required 1080-100 pound bags of sand to blast the storage tank and associated pieces.

4.2.6 EXCAVATION OF PCP DIP TANK BUILDING AND STORAGE TANK SOILS

Based on ongoing sampling results received during project performance, OHM excavated soils in a calculated and methodical manner. Aiding the excavation was the discovery that many affected areas were readily identified due to the discoloration of soil from the dark brown liquid. Technical personnel implemented a sampling program to define the limits of contamination in the PCP dip tank building utilizing a drill rig with depth sampling per a sampling grid. OHM and U. S. Army personnel evaluated this information to plan excavation strategy (see Section 3.0) and also received input from EPA, Army and State sources. Personnel targeted a clean up level

of 200 ppb of total dioxin and furan isomers; however, contamination believed to range to 27 feet below grade was found at the north end of the building and removal was not necessitated per consultation of the U. S. Army, Region IV EPA, and the State of Tennessee Department of Health and Environment (see Figure 7).

Prior to the discovery of the extensive contamination of soils in the building, U. S. Army representatives decided to drum all material to meet current commercial incinerator requirements. This involves packaging dioxin contaminated substrates in fiber drums for incineration. Hence, all initial excavated and disassembled contaminated substrates were handled as such. At the direction of U. S. Army representatives, contractor personnel abandoned this strategy after packaging 725 fiber drums (which were placed then in 55 gallon steel drums for storage and shipment) due to the vast amounts of contaminated materials later discovered. Subsequently, U. S. Army representatives adopted a strategy of storing excavated material by bulk in "roll-off" containers (see Section 7.0).

Sampling efforts exposed broad contamination in the vicinity of the leaking piping joints between the storage tank and PCP dipping vat. Several joints were loose enough to allow their disassembly by hand.

Figure 9 details areas where excavation of Building 737 occurred. Figures 10 and 11 show two views of the actual tank excavation with the former location of the tank included. Table 10 lists sample results for the vicinity of the tank which personnel evaluated to determine excavation dimensions. Staging of excavated soil in piles occurred on the north and south sides of the tank excavation. Those piles which did not exceed 200 ppb total dioxin and furan isomers were utilized as fill. Similarly, the soil excavated for the entry

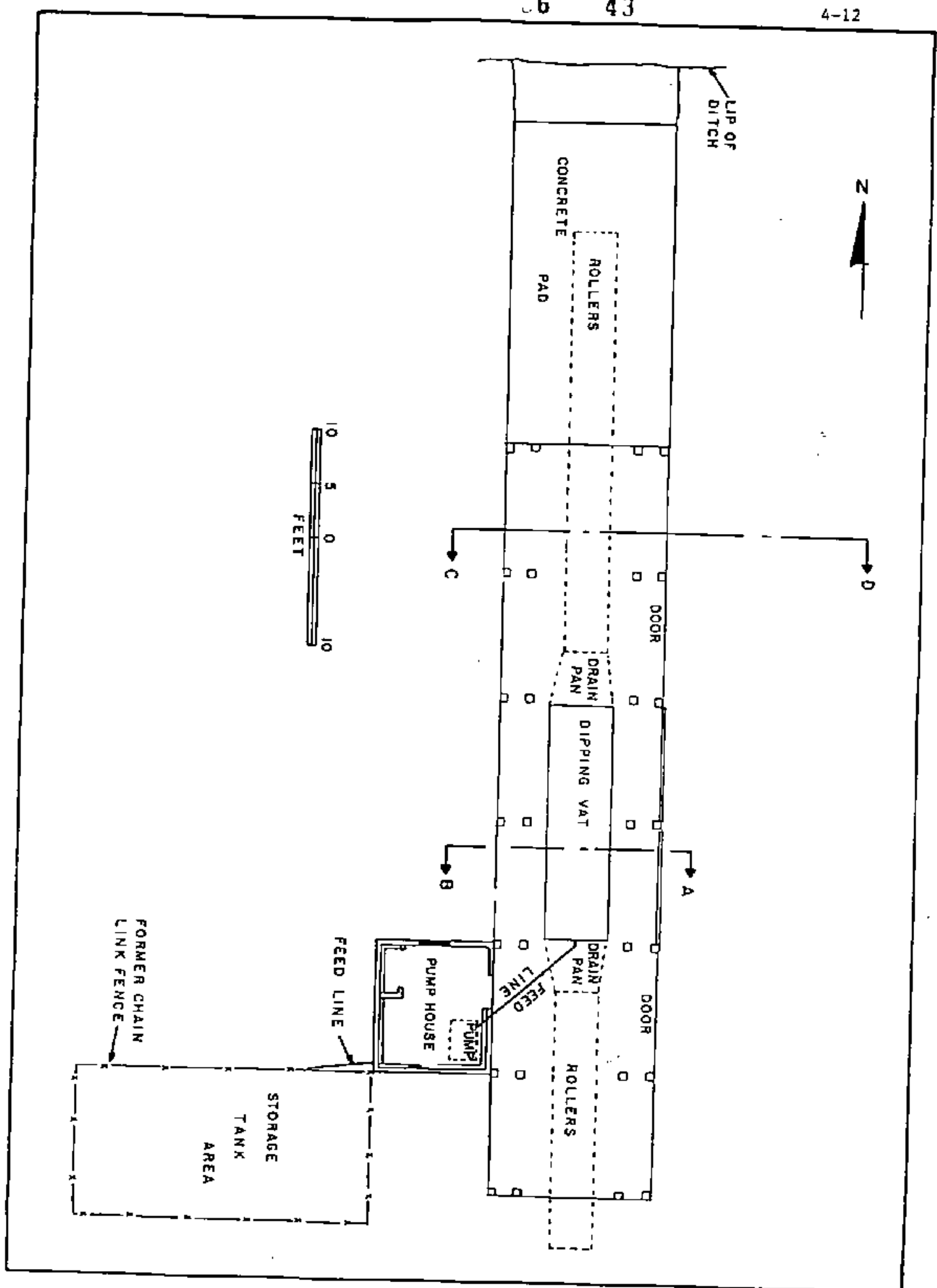


Figure 1. Excavation Activity Areas.

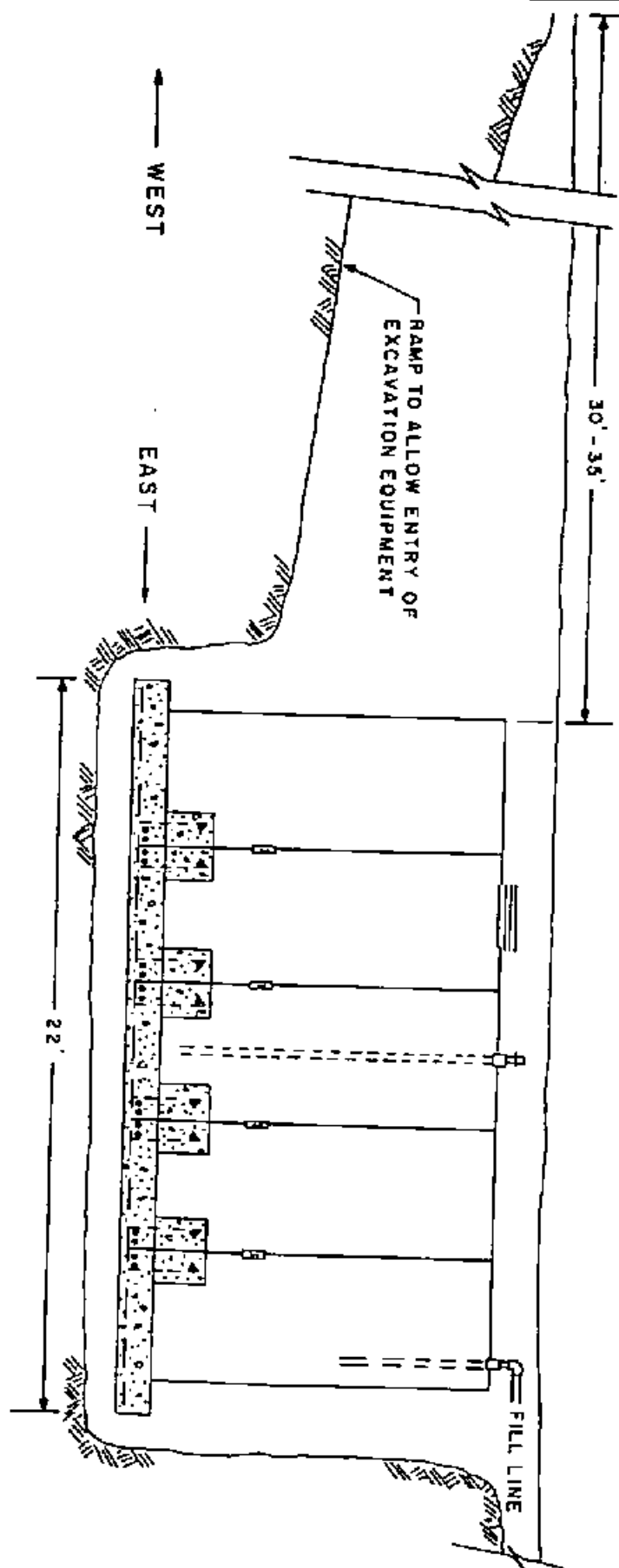


Figure 10. Longitudinal view of PCP storage tank excavation.

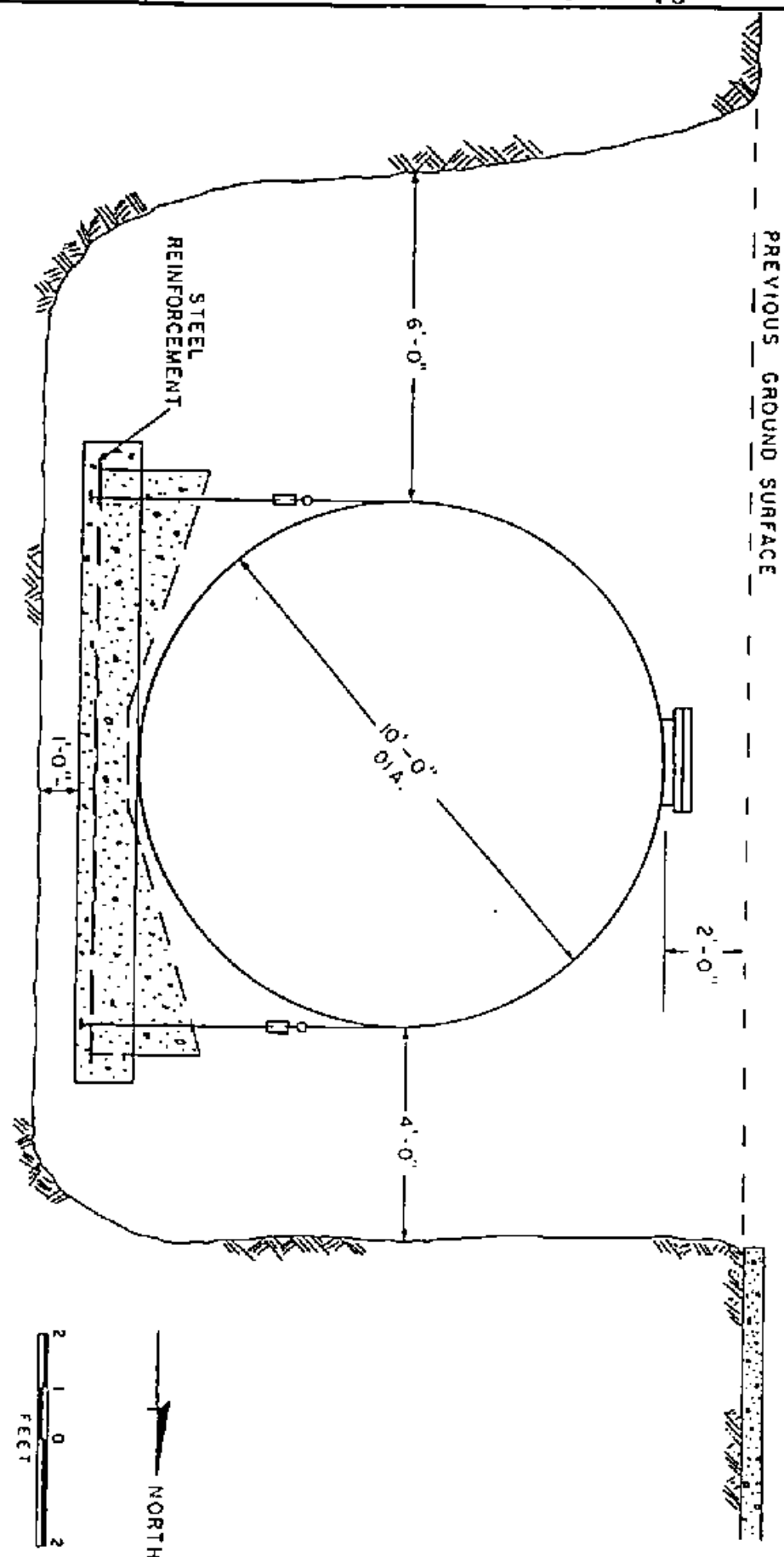


Figure 11. East-West View of Storage Tank Excavation.

ramp was returned to the excavation as it proved to be well under clean-up criteria.

Figures 12,13,14,and 15 detail longitudinal, top, and cross-sectional views of the excavation of the dipping vat tank and environs. Generally, the investigation discovered heaviest contamination under the rollers of the north end of the building which were used to remove the treated wood products. An average of two feet was removed in an approx. 15' x 27' section east of the building depicted in Figure 13 to assure the removal of any possible contamination from this heavily traveled area during dipping operations. In like manner, personnel used a backhoe to scrape and remove a limited amount of soil east of the former building as depicted in Figure 17.

Twenty seven roll-off containers were loaded with contaminated soil and currently store 722.16 tons of material excavated in the dip vat building, around its perimeter, from sand-blasting decontamination procedures, and in the storage tank area. This amount represents the bulk of material stored in roll-offs (85%). This amount is also estimated to represent approximately 602 cubic yards of soil (based on 1.2 tons per cubic yard).

4.2.7 BACKFILLING AND GRAVELLING

Upon completion of the prescribed excavation regime, OHM obtained from the Jimmy T. Woods Company 650 yds³ of native backfill to close-out the excavation areas. Operators then graded 489 tons of crushed stone to form a cap over the excavation areas as described later.

NORTH

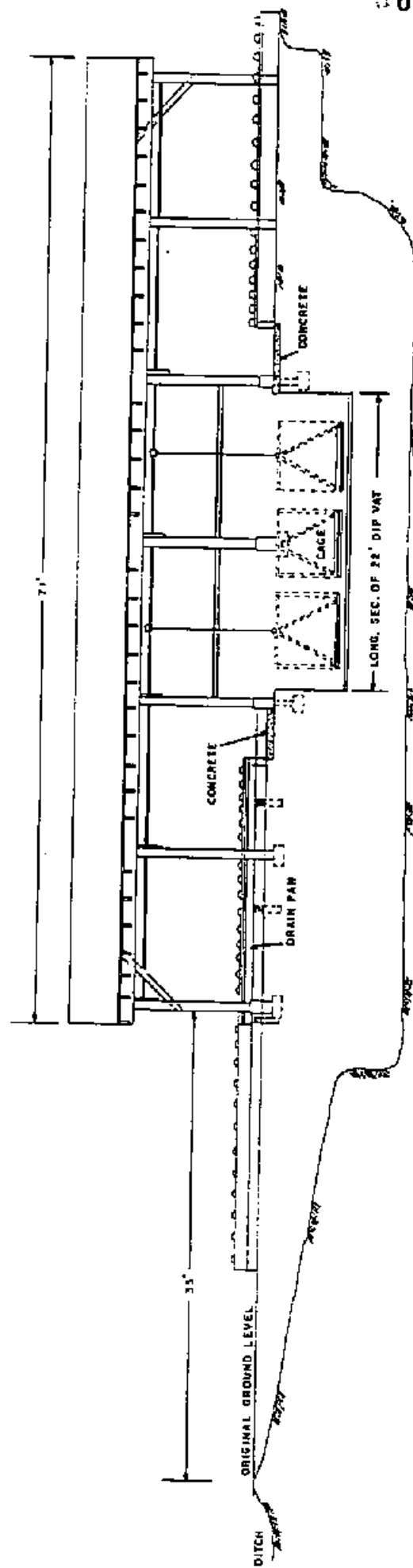


Figure 12. Longitudinal View of Building 737 Excavation

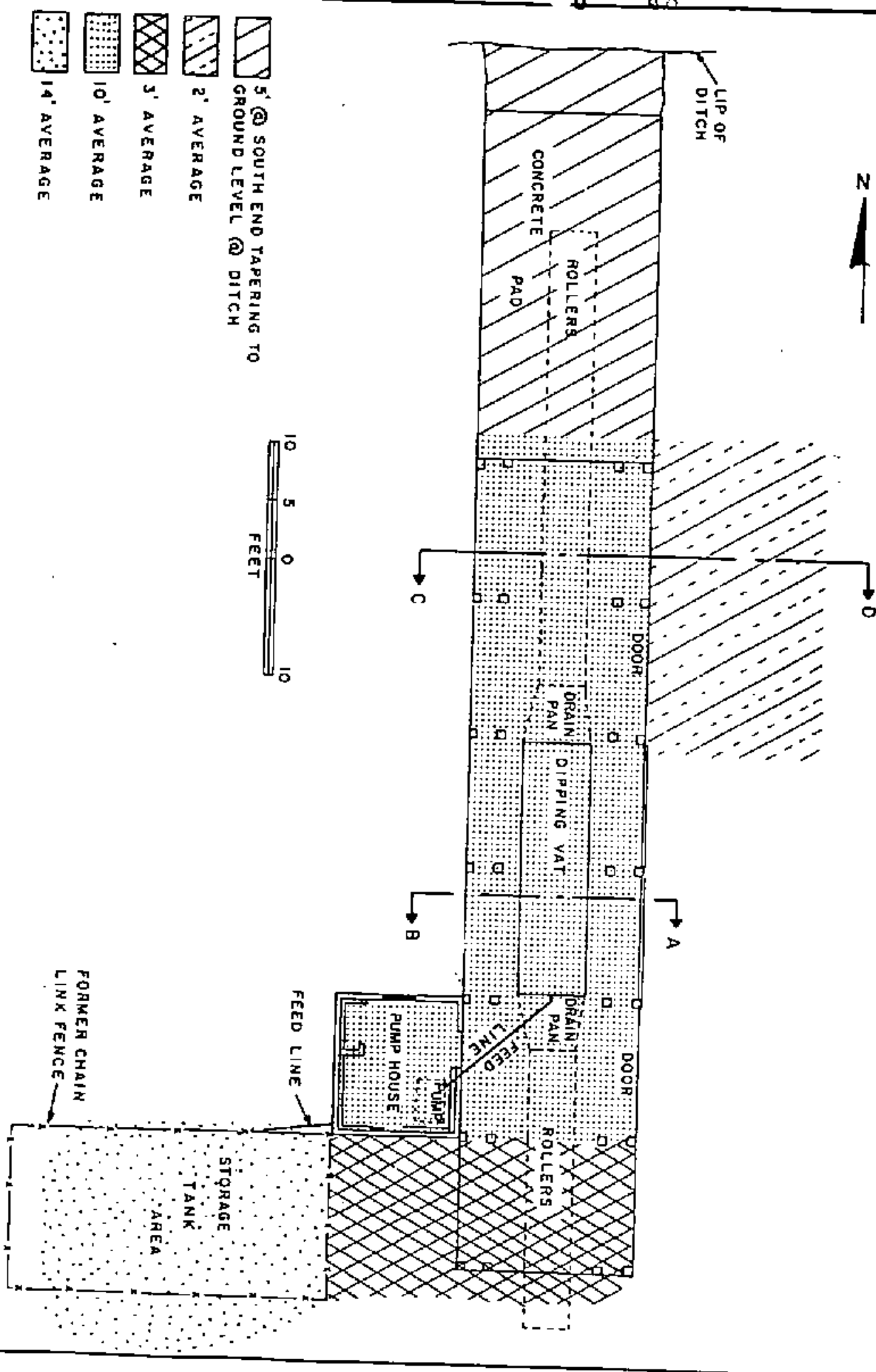


Figure 13. Top View of L. ation - Building 151.

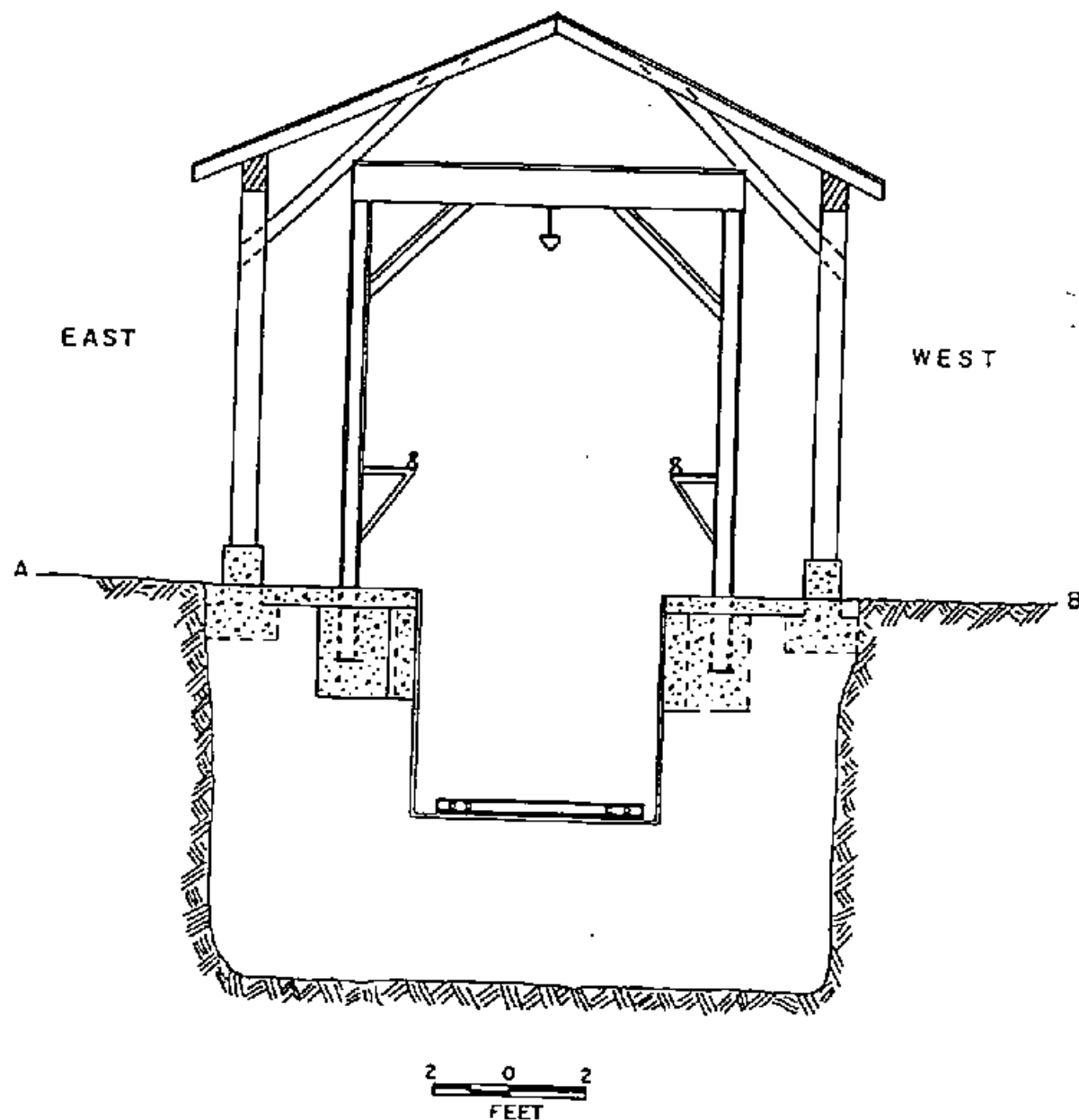


Figure 14. Cross-Section of Excavation - Building 737: A-B Axis.

16 50

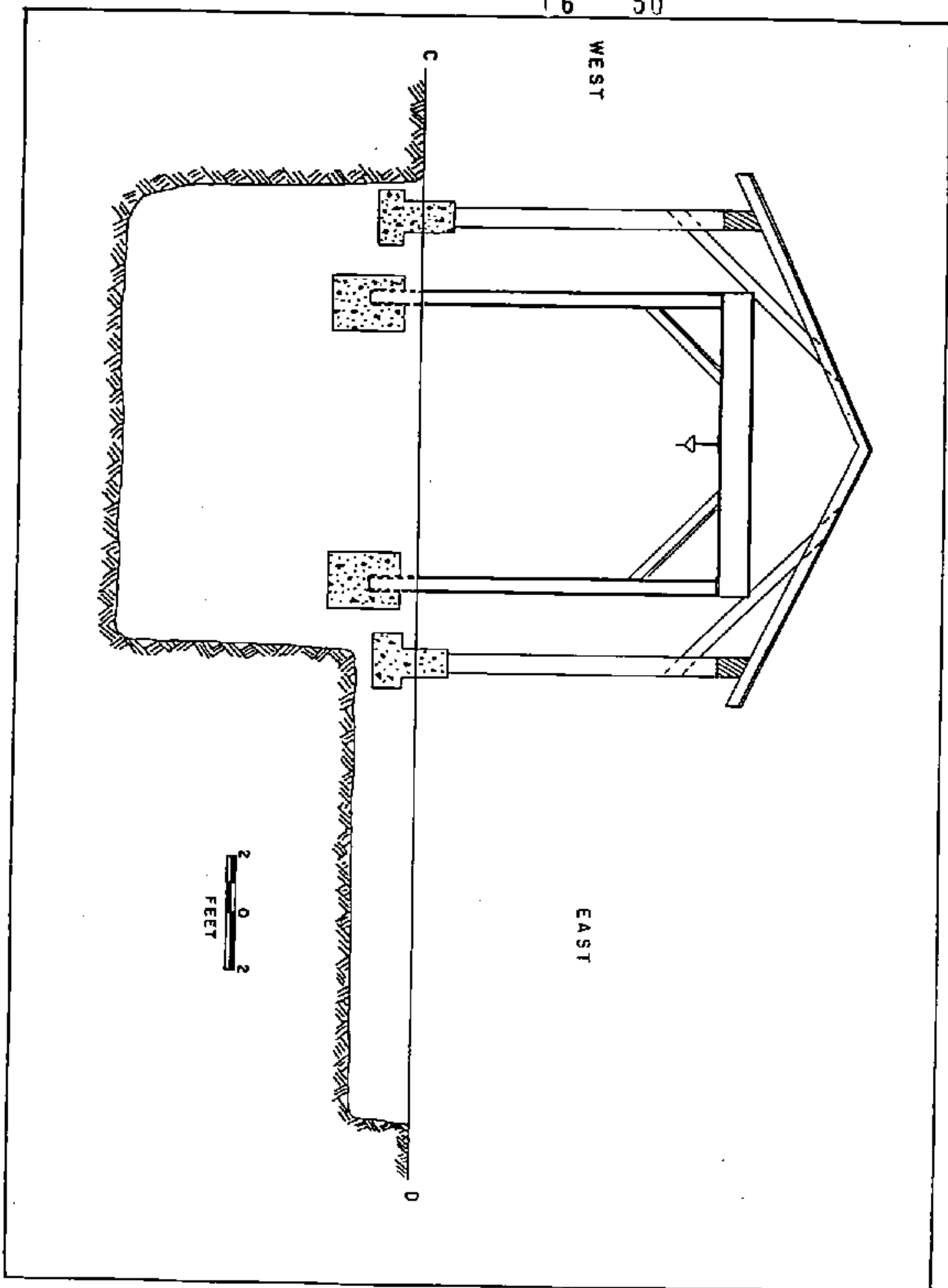


Figure 15. Cross-Section of Evaluation - Building 737 - C-D Axis.

4.2.8 CLEAN-UP OF PESTICIDE STORAGE BUILDING

Personnel utilized solvents and wiping utensils to clean the stored containers and floors of the Pesticide Storage Building (See Figure 8).

4.2.9 CONTAMINATED SOIL REMAINING IN SITU

Soil containing contamination exceeding the targeted 200 ppb clean-up level for total dioxins and furans currently remains below the 10 foot level to which excavation in Building 737 reached. With the liquid PCP removed and the "driving force" eliminated, no contamination movement is apparent. OHM and USAEHA recommend that any plans for future excavation should be referred to the depot environmental coordinator and coordinated with the Tennessee Department of Health and Environment.

5.0 WEEKLY ACTIVITY SUMMARIES

The following summaries briefly describe notable weekly activities of OHM in performance of on-site operations at the Defense Depot Memphis in the vicinity of Buildings 837 and 737.

9/4-9/7/85:

- o mobilized to site with crew of ten for recouping effort at Building 837
- o performed site survey, assessed damaged inventory, prepared site specific safety plan, established work zones
- o transferred approximately 3400 gallons of product to new containers
- o arranged analysis of liquid sample taken by U.S. Army Environmental Hygiene Agency personnel from dipping vat at Building 737.

9/8 - 9/14/85:

- o transferred and repackaged greater than 12,000 gallons of products from damaged containers ranging in size from one pint to 55 gallons
- o interfaced with officials from Shelby County and the State of Tennessee Department of Health and Environment

- o received results affirming the presence of dioxins and furans in the sample taken of PCP liquid in Building 737

9/15 - 9/21/85:

- o sampling program commences in vicinity of Building 737 to determine extent of contamination
- o excavation of the 12,000 gallon PCP storage tank at Building 737 begins
- o work continues in recoupment effort at Building 873 with approx. 12,000 gallons of product processed
- o technicians initiate removal of liquid PCP product in Building 737 by pumping to drums

9/22 - 9/28/85:

- o recoupment activities in Building 873 and flammable storage area are concluded with approximately 21,000+ gallons of products transferred and repackaged
- o utilizing excavation equipment and a crane, the PCP storage tank is removed and found to be intact
- o the OHM chemist performed sampling of the above excavation to define the limits of the contamination
- o technicians commenced sandblasting surfaces in

Building 737 and the exterior of the removed
PCP storage tank

9/29 - 10/5/85:

- o sampling continues of the storage tank excavation area to monitor clean-up efforts
- o extensive sandblasting efforts continue on the metal dipping tank in Building 737, rollers, cages, concrete, wood and exterior of the PCP storage tank

10/6 - 10/12/85:

- o the OHM supervisor directs the covering of the 3 1/2 acre area immediately north of the Building 737 work area with 6-12 inches of gravel
- o sandblasting completed on PCP storage tank and most of the rollers in Building 737
- o 55 gallon drums of contaminated substrates are moved into Bunker 783
- o technicians observe extensive PCP contamination around loose connections in feed lines formerly connecting the PCP storage tank to the dipping vat

10/13 - 10/19/85:

- o technicians cut up the PCP storage tank for sandblasting and disposal
- o removal of the metal dipping vat from Building 737 was performed by technicians to allow further

sampling. Sample results show contamination extending at least eleven feet below ground surface level

- o transport of drums containing contaminated substrates continues with a total to date of 200 stored in Bunker 783

10/20 - 10/26/85:

- o sandblasting continued on miscellaneous metal pieces contaminated with PCP/dioxin including pieces of the dip vat
- o large pieces of metal are cut up for disposal purposes
- o sections of Building 737 are prepared for dismantling

10/27 - 11/2/85:

- o the entire Building 737 is dismantled and hydroblasted for decontamination
- o a mobile drill rig is utilized to take depth samples in a grid system overlaying the former building for profiling the extent of contamination
- o heavy rains are encountered which slow drilling operations

11/3 - 11/9/85:

- o depth sampling of the vicinity of Building 737 continues

6 56

- o water generated from decontamination procedures is treated with the on-site activated carbon treatment system
- o technicians clean the adjacent pesticide storage building by wiping containers and surfaces
- o more drums of contaminated substrates are moved to Bunker 783

11/10 - 11/16/85:

- o "Roll-off" containers are purchased (39 total) and a portion are filled with cleaned metal, which due to minute contamination, is disqualified for scrap. Other containers are filled with slightly to highly contaminated concrete, wood, piping and soil
- o results from depth sampling allow excavation of contaminated soils inside Building 737
- o samples are taken from each roll-off containing soil and all roll-offs are weighed on-site.

11/17 - 11/23/85:

- o roll-offs continue to be filled with contaminated soil from Building 737 and are sampled
- o a final count is made of drums in storage
- o decontamination is performed on selected OHM equipment in anticipation of demobilization

11/24 - 11/26/85:

- o excavation completed
- o vicinity of Building 737 is backfilled with clean clay from off-site
- o gravel is spread over parking lot east of former Building 737
- o OHM personnel and equipment demobilize from site

6.0 SITE SAFETY

The OHM Southern Region Industrial Hygienist developed a site specific safety plan to cover all phases of work on the depot. The safety plan is enclosed as Appendix E.

Air quality on the site was acceptable throughout the duration of the project for both phases of work. Initial concerns that warm temperatures during Phase I would cause undue air levels of fuming and volatile materials proved unfounded. The use of fans and performing as much work as possible under cover out of direct sunlight provided excellent control. Operations personnel determined that these materials could be safely handled with no on-site air quality impairment at all times. Personnel in close contact with particularly noxious materials, such as hydrofluoric acid, did make extensive use of supplied breathing air. Air quality monitoring readings during Phase II in the PCP dip tank building, taken by depot hygienist John Tibbels during liquid removal operation, were negative (See Appendix D).

OHM operations personnel followed closely prescribed procedures for decontamination of personnel and equipment. Use of disposable personnel protective gear insured that hygienic measures were upheld and that transfer of contamination to clean areas was avoided. Heavy equipment was washed thoroughly with a hi-pressure water laser at project conclusion as were other metal tools and equipment.

Due to the uncertainty of the decontamination effectiveness of rubber or synthetic surfaces and in consideration of the particular hazards which isomers of dioxins and furans present, OHM elected to destroy and dispose of such items. This included full face respirators used on site, pump parts, rubber boots and transfer hoses.

7.0 ON-SITE STORAGE OF PCP CONTAMINATED SUBSTRATES

Due to the highly unsettled and volatile regulatory atmosphere surrounding the storage and disposal of chlorinated dioxins and chlorinated dibenzo furan contaminated substrates, U. S. Army representatives in consultation with O. H. Materials technical personnel endeavored to develop a cost effective storage plan in view of current EPA regulations. The reader is instructed to review Appendix A which contains the Environmental Protection Agency's January 14, 1985 rulings concerning the management of dioxin-containing wastes. Specific aspects of the management of these wastes are listed in Section IV of this document, "Management Alternatives and Requirements", commencing on page 1985. Special mention is made of PCP wood treatment processes on page 1987.

In keeping with the directives of the above mentioned ruling, U. S. Army officials elected to store excavated contaminated solids and debris in 20, 24 or 30 cubic yard "roll off" containment vessels, 30 gal. fiber drums encased in 55 gal. steel drums, and liquids in polyethylene lined 55 gal. drums. Thirty nine roll-off vessels are currently on site in the vicinity of former Building 737 and are tightly tarped for weather protection. The State of Tennessee Department of Health and Environment reviewed and approved this plan and granted an interim storage permit for this effort (see Correspondence, No. 21).

Liquid PCP in poly-lined 55 gal. drums and other drummed solid debris is stored in Bunker 783. This bunker is secured and is not frequented by depot personnel except for routine inspection to examine the condition of the stored drums. The area surrounding the roll-off containers has been secured and is in an area sequestered from traffic on other routine depot activities.

By competitive bid, contractor personnel obtained 30 new 24 cubic yard roll-off containers, five new 20 cubic yard ones, and 4 refurbished ones (24-30 cubic yards). All are designed with side bracing to hold in excess of 40,000 pounds. Transportation of such containers is easily accomplished by winching it onto the bed of a specially designed truck by a series of rollers. Hence, units are constructed in anticipation of repeated and heavy usage. In the absence of a qualified disposer of these wastes, U. S. Army representatives decided that bulk storage of these substrates represented the optimal approach based on the current regulations and in view of financial constraints.

Many parties believe that the atmosphere surrounding the land disposal of certain chlorinated dioxin and furan contaminated substrates derived from PCP wood treating processes will relax allowing disposal of bulked soils. Alternately, all materials could have been drummed, which is required for incineration, at considerable additional expense but which faces the jeopardy of being performed unnecessarily. The approach chosen evaluated as many scenarios as possible and presents the minimal financial exposure in an atmosphere of regulatory uncertainty.

The following table shows a breakdown of substrates stored on site with weights as indicated: (all roll-off containers were weighed on site)

'6 61

Bunker #783:

<u>Description</u>	<u>Storage Vessel</u>	<u>Numbers</u>
1. PCP contaminated solids	55 gal. 17H drum	730
2. PCP liquid and sludge	55 gal. poly-lined 17C drum	50
3. Contaminated carbon from water treatment system	55 gal. 17H drum	27
4. Miscellaneous samples	boxes	2
TOTAL DRUMS		807

(all drums stored on pallets)

Roll-Off Containers:

<u>Description</u>	<u>Number</u>	<u>Weight (Tons)</u>
Contaminated Soil	27	722.16
Concrete and Wood	8	92.48
Steel	3	22.18
Concrete Only	1	15.37
TOTALS	39	852.19

922.16
92.48
22.18
15.37

852.19

8.0 DISCUSSION OF ULTIMATE FATE OF PCP WASTES

As discussed earlier, future disposal arrangements necessitated storage of materials on site pending examination of viable alternatives.

Although a full discussion of various disposal alternatives with costs and justifications is beyond the scope and intent of this report, the following discussion presents an abbreviated listing of possible future approaches/methods. The reader is reminded that a feasibility study is in order to thoroughly assess the costs and benefits, both financially and environmentally, of various approaches.

8.1 LAND DISPOSAL

As inferred from the Federal Register, included as Appendix A, Section IV. A.1, this option is limited. At EPA's admission, this approach currently does not address long term concerns. Also in Section IV. A.1, page 1986, the EPA states:

This problem will be alleviated, as is the case at present, by the possibility of storage in tanks, containers, or enclosed waste piles at interim status facilities. Such storage will not in the short term be harmful to human health or the environment, and will reduce the pressure to permit a facility to handle these wastes immediately without a full evaluation of the facility's performance.

8.2 INCINERATION

This viable and frequently used alternative suffers from compliance difficulties. As of 1/16/86, no incinerators are available in the U.S. for routine dioxin substrate incineration. On-site test burns have been performed under the

auspices of the EPA, but these efforts are in the early development stages. Costs connected with this high efficiency incineration are extremely high (as much as \$1,000 per drum).

8.3 ON SITE PERMANENT STORAGE FACILITY

This approach offers a reasonably cost effective solution, but does not eliminate the problem, liability or inspection requirements subject to be implemented by law.

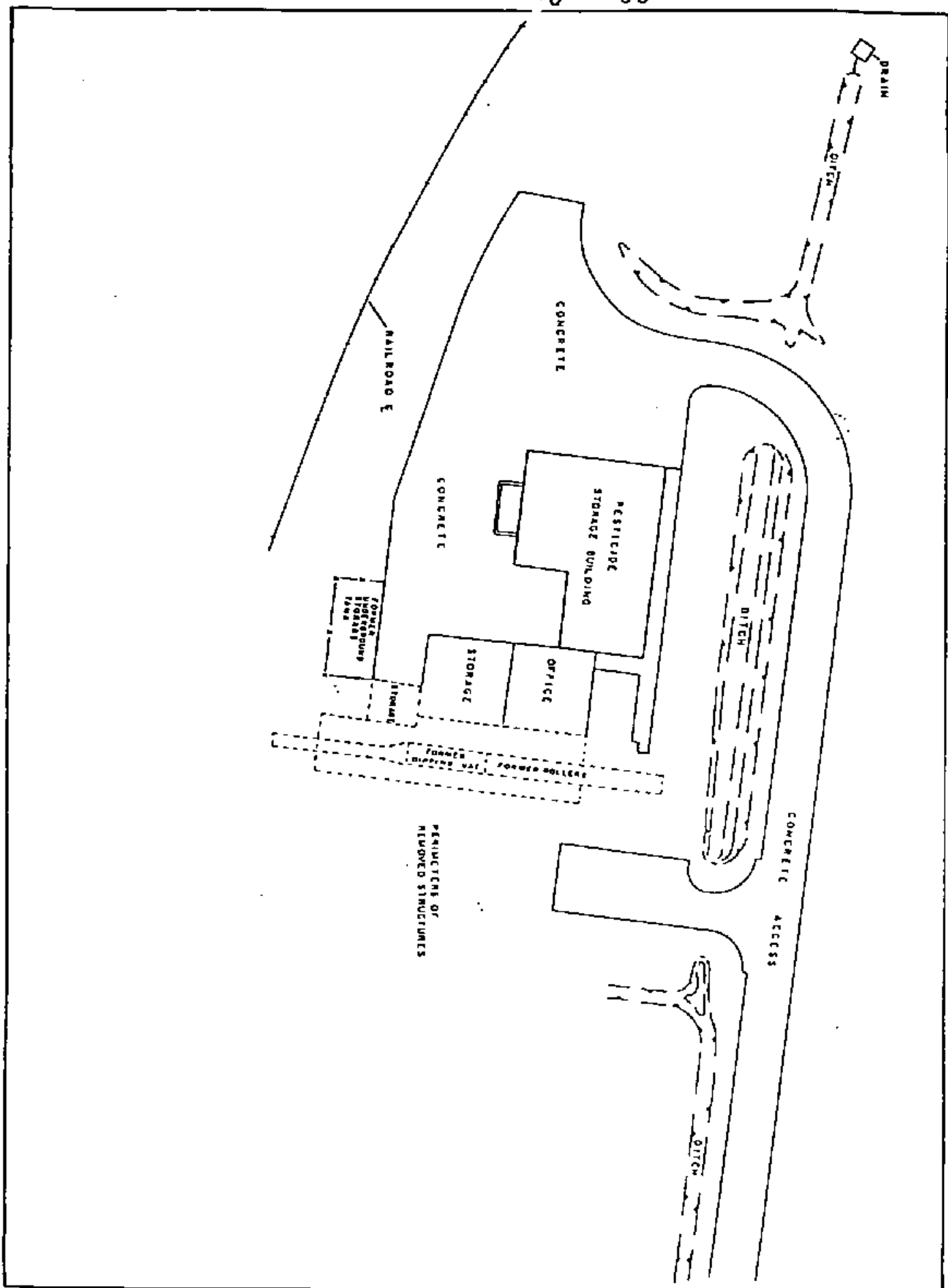
8.4 ON SITE TREATMENT

Current research is examining approaches for on site treatment of large volumes of low level dioxin contaminated soils. Photo-oxidation by ultraviolet radiation is an approach which offers promise. No commercial application is known by these authors.

9.0 DESCRIPTION OF CURRENT SITE

At project completion, OHM's work area inside Building 873, Bay 5203, was free of damaged drums, containers, and spilled products. However, accumulation of damaged containers from on-going depot operations was a persistent problem. Shelving organized by OHM personnel around the periphery of the handling area in a manner to aid segregation of incompatible materials remained as originally laid out. The gravel storage area east of the building also was devoid of staged drums and containers. OHM used a backhoe to back-drag and dress-up the area before final departure.

Figure 16 presents a birds-eye view of the former Building 737 and the immediate environs upon project completion. Figure 17 details gravelling, backdragging, and backfilling performed shortly thereafter by OHM to dress-up and "seal" the area. In conclusion, Figure 18 illustrates a complete view of all gravelling in the vicinity of Building 737 noting the extensive gravelling performed in Area 2.



Enclosure 15. New and Building - Virginia - Co. Det

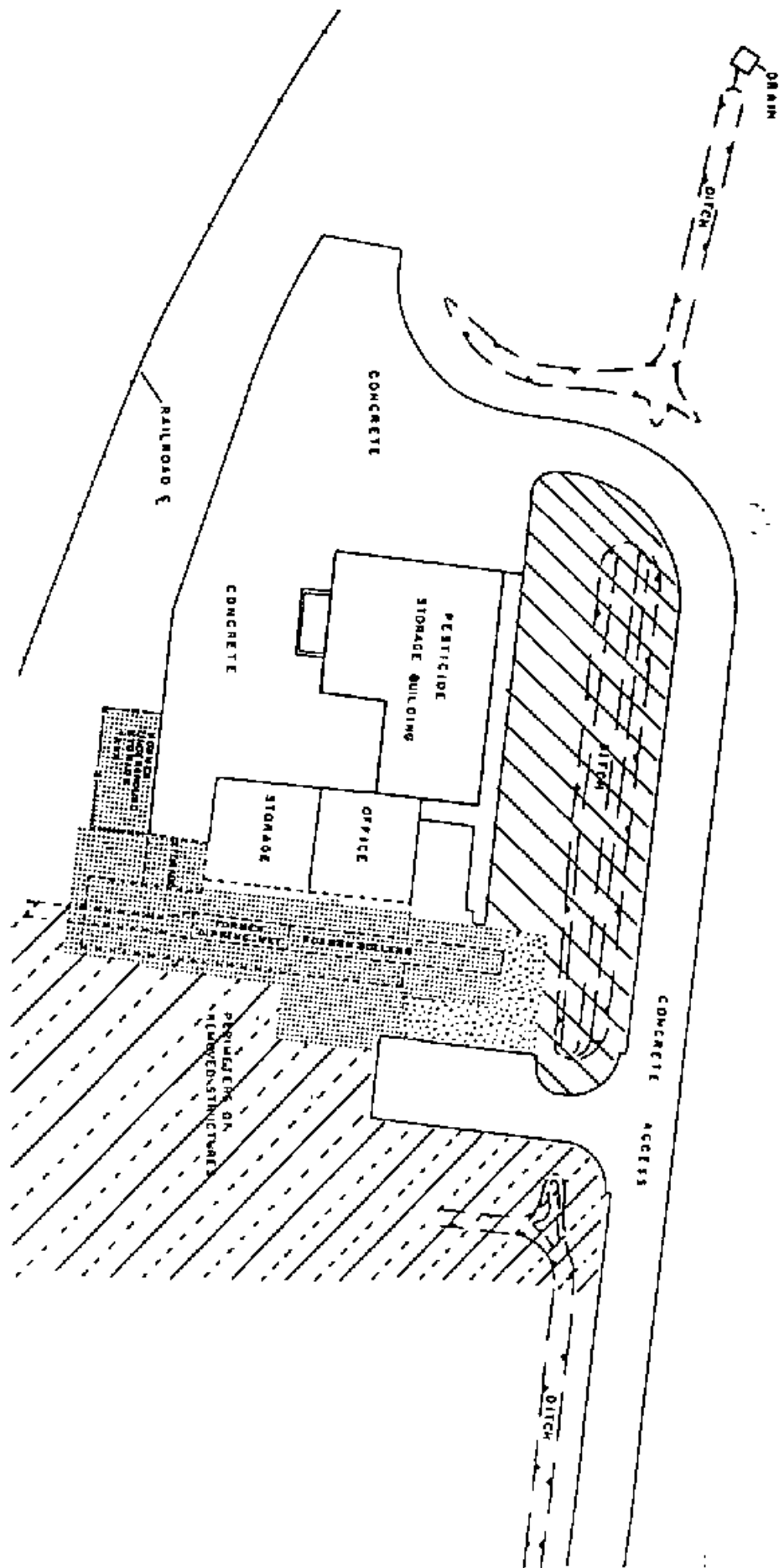
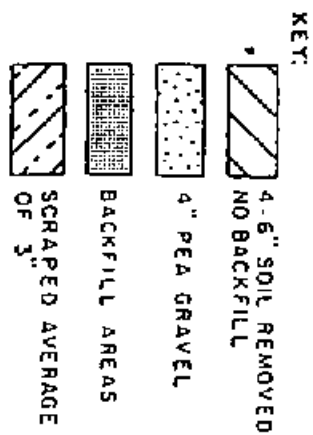


Figure 17. Closure of Building 737 Immediate Area.

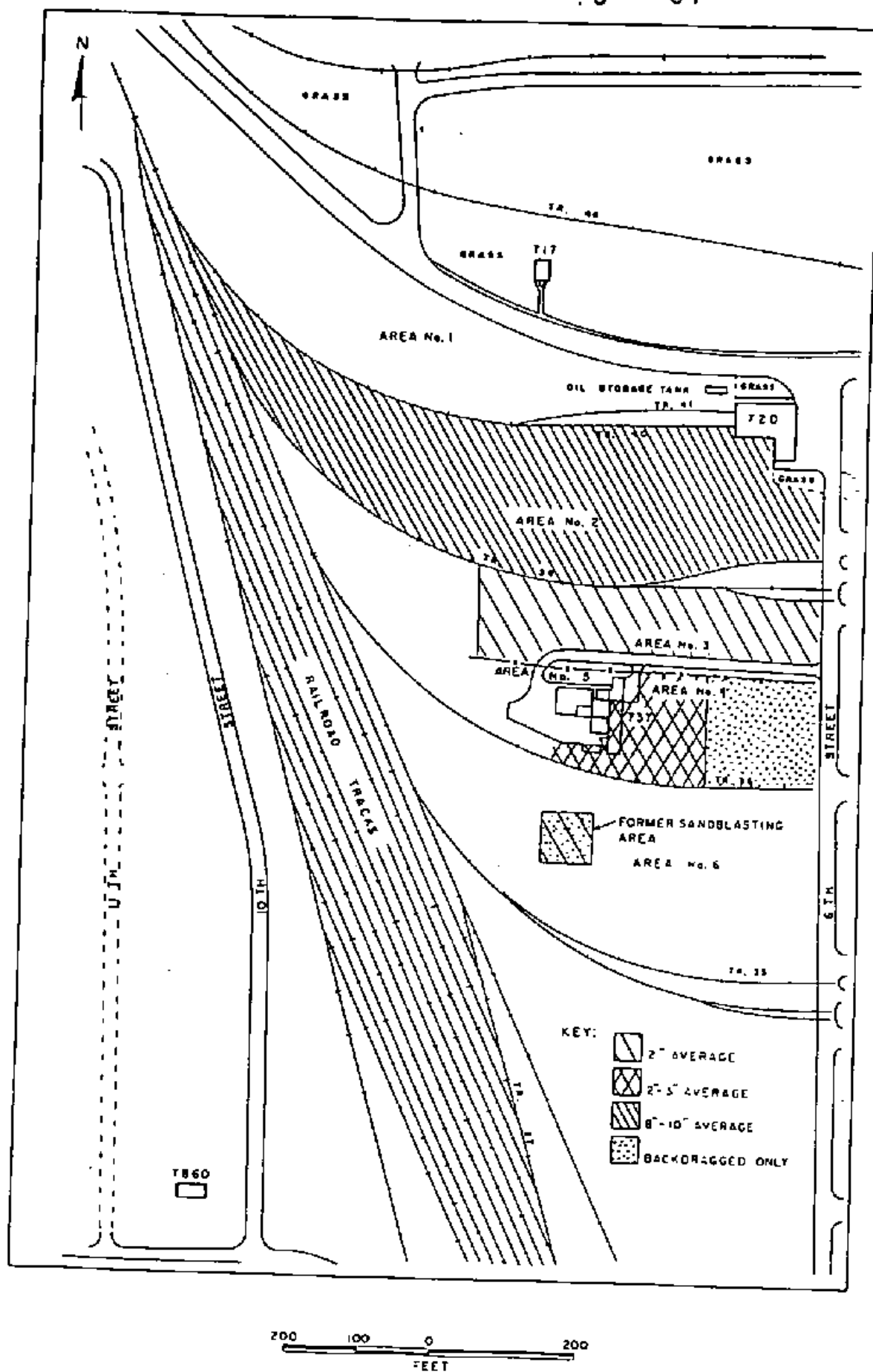


Figure 13. Final Graveling of Site-Vicinity of Building 737.

6 69

Table 1
Materials and Quantities Recouped

DESCRIPTION	QUANTITY	COST
Acetic Acid	166 1/2-gal. bt.	\$ 967.78
Acetone Liquid	280 55-gal. drums	30,906.40
Additive (toluene, Isopropanol)	2 55-gal. drums	62.80
Antifreeze	18 5-gal. drums	315.54
Antifreeze	4 55-gal. drums	640.12
Bleach	4 15-gal. drums	69.56
Cleaning Compound (Fuel Oil and Cresylic Acid)	17 5-gal. cans	514.76
Cleaning Compound (Methylene Chloride & Cresylic Acid)	16 5-gal. cans	439.68
Cleaning Compound (Methylene Chloride & Cresylic Acid)	46 55-gal. drums	11,587.36
Cleaning Compound (Petroleum Distillates)	2 5-gal. cans	-----
Cleaning Compound (Petroleum Distillates)	2 55-gal. cans	260.88
Cleaning Compound (Petroleum Solvent)	1 5-gal. can	26.94
Cleaning Compound (Phosphoric Acid, Ethylene Glycol)	1 55-gal. drum	1,026.50
Cleaning Solvent (Aromatic Solvents)	1 5-gal. can	14.84
Cleaning Solvent (Naptha, MEK, Isopropanol)	91 55-gal. drums	14,708.33
Cleaning (Stoddard) Solvent	1 55-gal. drum	108.60
Corrosion Preventative (NOS)	1 5-gal. can	28.94
Corrosion Remover (Sodium Hydroxide)	1 5-gal. can	319.60
Corrosive (Potassium Hydroxide)	1 55-gal. drum	243.71
Corrosive (Tricresyl Phosphate)	1 5-gal. can	129.11
Creosote	72 5-gal. cans	1,322.64
De-Icing Fluid (Ethylene Glycol)	3 5-gal. cans	66.96
Denatured Alcohol	1 5-gal. can	17.23
Dichloromethane	24 5-gal. cans	483.12

6 70

<u>DESCRIPTION</u>	<u>QUANTITY</u>	<u>COST</u>
Disinfectant (Gen. Purpose)	3,641 1-gal. cans	\$26,105.97
Dry Cleaning (Stoddard) Solvent	1 5-gal. can	11.86
Fog Oil	1 5-gal. can	25.71
Fog Oil	1 55-gal. drum	107.98
Grease, Aircraft	1 5-gal. can	45.86
Grease, Automotive	7 5-gal. cans	145.67
Heat Trans Fluid	7 1-gal. cans	1,060.43
Herbicide (Round-Up)	1 5-gal. can	402.54
Hydraulic Fluid (Petroleum Base)	6 5-gal. cans	166.72
Hydraulic Fluid (Petroleum Base)	1 10-gal. can	54.50
Hydrochloric Acid	360 1 pint bottles	-----
Hydrofluoric Acid	1,097 1-gal. cont.	18,067.59
Indicating Fluid, Instrumental	31 1-gal. cans	856.22
Inhibitor (Surfactant, Inorganic Salts)	1 15-gal. can	207.37
Insecticide (Malethion)	1 5-gal. can	65.21
Isopropyl Alcohol	11 5-gal. cans	170.08
Isopropyl Alcohol	2 55-gal. drums	276.84
Insulating Oil, Electric	1 5-gal. can	14.27
Lube Oil, Aircraft	3 55-gal. drums	1,494.60
Lube Oil, Engine	649 quarts	590.59
Lube Oil, Engine	1 5-gal. can	15.94
Lube Oil, Engine	3 55-gal. drums	453.45
Lube Oil (Gear)	2 55-gal. drums	187.24
Lube, Petroleum Base	1 5-gal. can	13.85
Lube Oil, Petroleum Base	1 55-gal. drums	146.38
Lubrication, Cable Pulling	1 5-gal. can	20.50
Lubrication Oil (General)	1 55-gal. can	179.74

<u>DESCRIPTION</u>	<u>QUANTITY</u>	<u>COST</u>
Methanol	3 5-gal. cans	\$ 30.51
Methyl Ethyl Ketone	195 5-gal. cans	3,079.05
Methyl Ethyl Ketone	415 55-gal. cans	66,591.56
Methyl Isobutyl Ketone	2 5-gal. cans	50.08
Mineral Spirits	2 5-gal. drums	80.32
Oil, Lubricating, Engine	1 5-gal. can	17.51
Oil, Petroleum Base	68 5-gal. cans	946.20
Petroleum Ether	500 5-gal. cans	14,105.64
Remover Compound (Orthodichloro- benzene & Cresylic Acid)	1 55-gal. drum	315.50
Silicone	12 5-gal. cans	702.36
Solvent (Freon 113)	1 55-gal. drum	499.09
Solvent (Petroleum Distillate)	2 5-gal. cans	21.18
Sulfuric Acid	6 5-gal. cans	46.68
Sulfuric Acid	20 15-gal. cans	459.88
Sulfuric Acid	8 55-gal. drums	36.56
Supertropical Bleach	20 55-gal. drums	-----
Thinner (MEK, N-Butyl Alcohol, Isobutyl Alcohol)	1 5-gal. can	15.00
Toluene	86 5-gal. cans	1,029.42
Trichloroethylene	8 5-gal. cans	229.20
Trichloroethylene	3 55-gal. drums	691.53
Xylene	17 5-gal. cans	<u>214.20</u>
	TOTAL VALUE Greater Than	\$205,000.00

TABLE 2
RESULTS OF PCB ANALYSES
FROM RECOUPMENT AREA

SAMPLE NO.	GRID LOCATION See Figure 2	DEPTH	PCB 1016	PCB 1221	PCB 1232	PCB 1242	PCB 1248	PCB 1254	PCB 1260
45	A-1	0-4"	ND	ND	ND	ND	ND	ND	ND
46	A-2	"	ND	ND	ND	ND	ND	ND	ND
47	A-3	"	ND	ND	ND	ND	ND	ND	ND
48	A-4, B-4	"	ND	ND	ND	ND	ND	ND	ND
49	B-1	"	ND	ND	ND	ND	ND	ND	ND
50	B-2	"	ND	ND	ND	ND	ND	ND	ND
51	B-3	"	ND	ND	ND	ND	ND	ND	ND
52	C-1	"	ND	ND	ND	ND	ND	ND	ND
53	C-2	"	ND	ND	ND	ND	ND	ND	ND
54	C-3	"	ND	ND	ND	ND	ND	ND	ND
55	C-4, D-4	"	ND	ND	ND	ND	ND	ND	ND
56	D-1	"	ND	ND	ND	ND	ND	ND	ND
57	D-2	"	ND	ND	ND	ND	ND	ND	ND
58	D-3	"	ND	ND	ND	ND	ND	ND	ND
59	E-1	"	ND	ND	ND	ND	ND	ND	ND
60	E-2	"	ND	ND	ND	ND	ND	ND	ND

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TABLE 3

EP TOXICITY METALS SAMPLE
RESULTS FROM RECOUPMENT AREA

(in mg/l)

(For Grid Location, See Figure 2)

SAMPLE NO.	GRID LOCATION	DEPTH	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
45	A-1	0-4"	ND	ND	ND	ND	ND	ND	ND	ND
46	A-2	"	ND	ND	ND	ND	ND	ND	ND	ND
47	A-3	"	ND	ND	ND	ND	ND	ND	ND	ND
48	A-4, B-4	"	ND	ND	ND	ND	ND	ND	ND	ND
49	B-1	"	ND	ND	ND	ND	ND	ND	ND	ND
50	B-2	"	ND	ND	ND	ND	ND	ND	ND	ND
51	B-3	"	ND	ND	ND	ND	ND	ND	ND	ND
52	C-1	"	ND	ND	ND	ND	ND	ND	ND	ND
53	C-2	"	ND	ND	ND	ND	ND	ND	ND	ND
54	C-3	"	ND	ND	ND	ND	ND	ND	ND	ND
55	C-4, D-4	"	ND	ND	ND	ND	ND	ND	ND	ND
56	D-1	"	ND	ND	ND	ND	ND	ND	ND	ND
57	D-2	"	ND	ND	ND	ND	ND	ND	ND	ND
58	D-3	"	ND	ND	ND	ND	ND	ND	ND	ND
59	E-1	"	ND	ND	ND	0.1	1.6	ND	ND	ND
60	E-2	"	0.008	ND	ND	ND	ND	ND	ND	ND

TABLE 4

RESULTS OF PESTICIDE ANALYSES FROM RECOUPMENT AREA

SAMPLE NO.	GRID LOCATION	DEPTH	(in ug/kg) (For Grid Location, See Figure 2)					CHLORDANE
			ALDRIN	ALPHA-BHC	BETA-BHC	GAMMA-BHC	DELTA-BHC	
45	A-1	0-4"	ND	ND	ND	ND	ND	ND
46	A-2	"	ND	ND	ND	ND	ND	ND
47	A-3	"	9.0	ND	ND	ND	ND	ND
48	A-4, B-4	"	ND	ND	ND	ND	ND	ND
49	B-1	"	ND	ND	ND	ND	ND	ND
50	B-2	"	ND	ND	ND	ND	ND	ND
51	B-3	"	ND	ND	ND	ND	ND	ND
52	C-1	"	5.2	ND	ND	ND	ND	ND
53	C-2	"	ND	ND	ND	ND	ND	ND
54	C-3	"	37	ND	ND	ND	ND	ND
55	C-4, D-4	"	37	ND	ND	ND	ND	ND
56	D-1	"	54	ND	ND	ND	ND	ND
57	D-2	"	21	ND	ND	ND	ND	ND
58	D-3	"	ND	ND	ND	ND	ND	ND
59	E-1	"	6.3	ND	ND	ND	ND	ND
60	E-2	"	15	ND	ND	ND	ND	ND
138	C-2	8"	ND	ND	ND	ND	ND	ND

TABLE 4, CONT'D

(in ug/kg)

(For Grid Location, See Figure 2)

SAMPLE NO.	GRID LOCATION	DEPTH	ALDRIN	ALPHA-BHC	BETA-BHC	GAMMA-BHC	DELTA-BHC	CHLORDANE
139	C-2	5'	ND	ND	ND	ND	ND	ND
140	E-1	5'	ND	ND	ND	ND	ND	ND
141	D-3	8"	ND	ND	ND	ND	ND	ND
142	F-1	4"	ND	ND	ND	ND	ND	ND
143	F-2	4"	ND	ND	ND	ND	110	ND
144	F-3	4"	ND	ND	ND	ND	ND	ND
145	F-4	4"	ND	9.5	ND	ND	5.4	ND
156	A-2	8"	ND	ND	ND	ND	ND	ND
147	B-4	8"	ND	ND	ND	ND	ND	ND

TABLE 4, CONT'D

SAMPLE GRID		(in ug/kg)							
NO.	LOCATION	DEPTH	P,P'-DDD	P,P'-DDE	P,P'-DDT	DIELDRIN	ENDOSULFAN I	ENDOSULFAN II	
45	A-1	0-4"	12	5.8	54	ND	ND	ND	
46	A-2	"	ND	5.3	42	ND	ND	ND	
47	A-3	"	21	28	38	ND	ND	ND	
48	A-4, B-4	"	20	5.3	71	ND	7.7	ND	
49	B-1	"	22	9.8	69	ND	11	ND	
50	B-2	"	21	18	1200	ND	ND	ND	
51	B-3	"	14	20	160	ND	ND	ND	
52	C-1	"	29	14	180	ND	22	ND	
53	C-2	"	270	47	1000	5.9	12	ND	
54	C-3	"	19	56	240	ND	ND	ND	
55	C-4, D-4	"	140	220	1100	ND	110	ND	
56	D-1	"	23	30	430	ND	350	ND	
57	D-2	"	450	170	750	ND	120	ND	
58	D-3	"	26	44	160	ND	ND	ND	
59	E-1	"	55	400	910	ND	11	ND	
60	E-2	"	160	180	780	ND	160	ND	
138	C-2	8"	ND	ND	11	ND	ND	ND	

TABLE 4, CONT'D

(ug/kg)

(For Grid Location, See Figure 2)

SAMPLE NO.	GRID LOCATION	DEPTH	ENDOSULFAN SULFATE	ENDRIN	ENDRIN ALDEHYDE	HEPTACHLOR	HEPTACHLOR EPOXIDE	TOXAPHENE
60	E-2	0-4"	ND	ND	ND	ND	13	ND
138	C-2	8"	ND	ND	ND	ND	ND	ND
139	C-2	5'	ND	ND	ND	ND	ND	ND
140	E-1	5'	ND	ND	ND	ND	ND	ND
141	D-3	8"	ND	ND	ND	ND	ND	ND
142	F-1	4"	ND	ND	ND	ND	ND	ND
143	F-2	4"	30	ND	ND	14	ND	ND
144	F-3	4"	ND	ND	ND	ND	ND	ND
145	F-4	4"	40	ND	ND	ND	31	ND
146	A-2	8"	ND	ND	ND	ND	ND	ND
147	B-4	8"	ND	ND	ND	ND	ND	ND

TABLE 5
TRANSFORMER STORAGE AREA AND SANDBLAST SAND RESULTS

Sample			
No.	Location	Description	Results
1	Property Disposal Area	Transformer Oil	240 ppm PCB as Aroclor 1260
2	Property Disposal Area	Water, taken from drum in vicinity	0.0068ppm PCB as Aroclor 1260
3	Property Disposal Area	Water, as above	0.0033ppm PCB as Aroclor 1260
4	Property Disposal Area	Transformer Oil	910ppm PCB as Aroclor 1260
5	Property Disposal Area	Soil, taken near drums, transformers	5.1 ppm PCB as Aroclor 1260
6	Grassy area on facility grounds	Field Blank	<0.5 ppm PCB as Aroclor 1260
61	Facility Sand-blasting Area	Sandblasting Sand	Nondetect- able for As, Ba, Cd, Cr, Pb, Hg, Se, Ag

TABLE 6
MISCELLANEOUS SAMPLE RESULTS
BUILDING 737 OPERATIONS
(in ug/kg except as indicated)

SAMPLE NO.	DESCRIPTION	¹ DIOXINS					² FURANS				
		TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
7	Oil from PCP Vat	<2.5	<11.0	624.0	58,400	128,000	<2.0	<3.0	3,800	91,600	116,000
113	Sludge from PCP Vat	>10.0	10.0	>10.0	>280	0.1%	>10	16.0	>10.0	2,000	.1%
162	Composite of Sandblasting sand from Bldg. & Vat	<0.07	<0.2	<0.3	13	34	<0.1	<0.2	<0.2	12	15
166	Water Sample from Carbon Filter (in ng/l)	<1.0	<1.0	<2.0	<3.0	<6.0	<1.0	<1.0	<2.0	<3.0	<6.0

¹TCDD=tetrachlorodibenzo-p-dioxin
PCDD=pentachlorodibenzo-p-dioxin
HxCDD=hexachlorodibenzo-p-dioxin
HpCDD=heptachlorodibenzo-p-dioxin
OCDD=octachlorodibenzo-p-dioxin

²TCDF= tetrachlorodibenzofuran
PCDF=pentachlorodibenzofuran
HxCDF=hexachlorodibenzofuran
HpCDF=heptachlorodibenzofuran
OCDF=octachlorodibenzofuran

TABLE 7
SOIL SAMPLE RESULTS IN VICINITY OF BUILDING 737
(in ug/kg)

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
62	40 Ft. E. of PCP Bldg, Composite	0.3									
63	Field blank, N. of Bldg 529, discrete	<0.05									
64	Drainage Ditch N. End of Process Line, Area 4	<0.05									
66	End of Process Line in Front of Pest Shop, Area 5	0.85									
68	Far North Area From PCP Bldg., Composite, Area 1	<0.05									
69	Next Area to the South, Composite, Area 2	5.6									
70	Next Area to the South, Composite, Area 3	<0.05									
71	Area Adjacent and South of PCP Bldg, Composite, Area 6	<0.05									
72	Outfall Between Gate #9 and Perry Road, sediment	<0.05									
114	Area #1, 0-4", North of PCP Bldg.	0.1	<0.1	10.0	230.0	1600	0.3	<0.1	9.2	190.0	230.0

93

63

80

TABLE 7, CONT'D

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HPCDF	OCDF
115	Area #2, 0-4"	0.1	0.4	5.4	59.0	54	<0.05	<0.1	11.0	47.0	21.0
116	Area #3, "	0.1	<0.1	2.4	38.0	100	<0.05	<0.1	8.4	67.0	20.0
117	Area #4, "	0.3	1.6	7.5	82.0	190	<0.05	<0.1	20.0	70.0	30.0
118	Area #5, "	0.5	2.2	3.5	91.0	720	<0.05	<0.1	23.0	120.0	120.0
119	Area #6, "	<0.05	<0.1	1.6	15.0	35	<0.05	<0.1	1.8	7.3	3.3
120	Area #1, 4-8"	<0.05	<0.1	3.7	63.0	330	<0.05	<0.1	5.7	50.0	48.0
121	Area #2, "	<0.05	<0.1	1.6	22.0	110	<0.05	<0.1	1.4	16.0	14.0
122	Area #3, "	<0.05	<0.1	<0.2	6.1	21	<0.05	<0.2	<0.2	4.9	4.9
123	Area #4, "	0.1	<0.1	3.1	46.0	180	0.2	<0.1	6.7	37.0	31.0
124	Area #5, "	<0.05	<0.1	0.6	8.9	53	<0.05	<0.1	1.1	7.4	9.1
125	Area #6, "	<0.05	<0.1	<0.2	49.0	270	<0.05	<0.1	<0.2	36.0	34.0
247	Composite of Field, South of PCP Bldg., Storage Tank Decon Area	0.05	2.2	17.0	230.0	1200	0.8	9.9	53.0	110.0	180.0
											81

TABLE 8

SAMPLING RESULTS WITHIN BUILDING 737
(in ug/kg; wipe results in total ng)

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HxCDD	OCDD	TCDF	PCDF	HxCDF	HxCDF	OCDF
65	Soil along Process Line, Composite	5.3									
103	Field Blank (Wipe)	<0.05	<0.1	<0.2	3.9	17	<0.05	<0.1	<0.2	<0.4	11
104	Sheet Metal, Wipe, 2 S.E. of Bldg, 100cm ²	<0.05	<0.1	<0.2	<0.4	25	<0.05	<0.1	<0.2	<0.4	25
105	Sheet Metal, Wipe, 2 N.E. of Bldg, 100cm ²	<0.05	<0.1	<0.2	<0.4	25	<0.05	<0.1	<0.2	<0.4	14
106	Cinder Block Wall, Chips, 4"x4"	11	38	12	0.6	0.9	31	48	24	<0.4	<0.5
107	Outside Concrete Pad, end of rollers, 3"x3"	0.6	4.3	63	>2200	>4300	<0.1	3.5	28	340	310
108	Middle Wood Beam, Chips, 4"x4"	<0.05	<0.1	<0.2	31	130	<0.05	<0.1	<0.2	9.6	14
109	Metal Beam, middle section, Wipe, 100cm ²	<0.05	<0.1	<0.2	3.1	13	<0.05	<0.1	<0.2	<0.4	5
110	Wood Beam by Vat, Wood Chips, 4"x4"	0.4	3.7	91	>3300	>7600	1.0	6.8	63	>2200	>1400
111	Concrete Floor next to Vat, Chips, 3"x3"	2.3	16	280	>9800	>8700	7.9	19	390	>7500	>3100
172	1 ft. below PCP Vat, Soil, South End, Discrete	0.2	3.9	14	420	1100	<0.01	2.1	68	1100	750
173	2 ft. below PCP Vat, Soil, South End, Discrete	1.4	2.7	11	170	140	2.7	1.4	19	140	110

TABLE 9

SAMPLE RESULTS OF BORINGS - BUILDING 737

(ug/kg)

See Figure 5 for Grid

SAMPLE NO.	HOLE	DEPTH (ft)	GRID LOCATION	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HPCDF	OCDF
190	#1	10	G-44	0.4	0.7	0.9	3.9	12	0.3	0.1	1.0	2.4	7.5
192	#2	10	D-44	0.1	0.2	<0.5	<0.5	6.3	0.1	0.2	<0.5	<0.5	<1.0
194	#3	5	E-40	0.1	3.4	26	670	1600	0.2	3.1	100	1300	1000
195	#3	10	E-40	<0.1	<0.1	1.3	14	22	<0.1	<0.1	3.5	26	17
198	#4	5	H-45	<0.1	<0.1	0.9	13	32	<0.1	<0.1	2.6	20	18
199	#5	5	F-46	<0.1	<0.1	<0.5	6.9	17	<0.1	0.1	1.3	9.2	8.5
201	#6	10	H-32	<0.1	<0.1	<0.5	<0.5	1.7	<0.1	<0.1	<0.5	0.8	<1.0
202	#6	12	H-32	0.07	<0.1	<0.5	1.3	5.0	<0.1	<0.1	<0.5	0.7	<1.0
203	#7	12	K-32	<0.1	<0.1	<0.5	1.3	10	<0.1	<0.1	<0.5	0.7	1.0
205	#6	5	H-32	0.2	<0.1	<0.5	1.8	10	<0.1	<0.1	<0.5	2.0	2.6
206	#8	5	N-32	0.1	0.2	<0.5	<0.5	12	0.1	0.2	<0.5	0.5	2.9
208	#9	10	H-38	<0.1	<0.1	<0.5	<0.5	4.8	<0.1	<0.1	<0.5	<0.5	1.4
210	#10	10	L-38	0.2	1.8	75	2100	4600	<0.1	4.0	320	2800	2300
211	#10	12	L-38	<0.1	<0.1	<0.5	<0.5	1.6	<0.1	<0.1	<0.5	<0.5	<1.0
212	#11	10	O-38	<0.1	<0.1	<0.5	<0.5	1.0	<0.1	<0.1	<0.5	<0.5	<1.0
214	#12	5	R-38	<0.1	0.1	<0.5	3.5	9.1	<0.1	0.1	<0.5	2.0	3.4
215	#13	15	H-26	<0.1	<0.1	<0.5	2.5	4.2	<0.1	<0.1	<0.5	2.5	13
216	#13	17	H-26	<0.1	<0.1	<0.5	<0.5	2.7	<0.1	<0.1	<0.5	<0.5	<1.0

TABLE 9, CONT'D

SAMPLE NO.	HOLE	DEPTH (ft)	GRID LOCATION	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HCDF	OCDF
217	#14	15	K-26	<0.1	0.1	7.2	110	160	<0.1	0.7	38	210	98
218	#14	17	K-26	<0.1	0.1	4.9	150	510	0.1	0.2	25	250	290
219	#15	15	N-26	<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
220	#16	5	P-26	<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
221	#17	10	L-41	<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
222	#17	13	L-41	<0.1	<0.1	<0.5	<0.5	1.8	<0.1	<0.1	<0.5	<0.5	<1.0
223	#18	10	P-41	<0.1	<0.1	<0.5	<0.5	2.1	<0.1	<0.1	<0.5	<0.5	<1.0
224	#19	5	R-41	<0.1	<0.1	<0.5	1.5	5.0	<0.1	<0.1	<0.5	2.6	2.4
225	#20	5	L-44	<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
226	#21	5	P-44	<0.1	<0.1	<0.5	2.7	6.4	<0.1	<0.1	<0.5	4.0	3.0
227	#22	5	H-23	<0.1	<0.1	<0.5	23	73	<0.1	<0.1	3.7	48	46
228	#23	20	K-23	<0.1	0.2	7.5	180	380	<0.1	0.9	35	280	300
229	#24	20	H-19	<0.1	0.1	<0.5	1.7	6.3	<0.1	0.1	<0.5	1.9	3.3
230	#25	20	K-19	0.4	0.7	24	270	260	0.6	3.1	59	260	260
231	#26	15	N-19	<0.1	<0.1	<0.5	2.4	6.6	<0.1	0.1	<0.5	3.4	4.1
232	#27	5	P-19	<0.1	0.1	<0.5	1.0	2.0	<0.1	0.1	<0.2	1.2	1.3
233	#28	15	Far Left, Fig. 5	<0.1	<0.1	<0.5	0.8	1.9	<0.1	<0.1	<0.2	0.5	1.5

TABLE 9, CONT'D

SAMPLE NO.	HOLE	DEPTH (ft)	GRID LOCATION		TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
234	#29	5	G-14		<0.1	<0.1	<0.5	0.5	2.9	<0.1	<0.1	<0.5	<0.5	1.1
235	#30	20	K-17		<0.1	<0.1	1.1	46	250	<0.1	<0.1	7.2	100	130
236	#31	17	K-11		<0.1	<0.1	<0.5	0.9	5.2	<0.1	<0.1	<0.5	0.7	1.9
237	#32	13	K-6		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
238	#33	10	H-1		0.4	<0.1	<0.5	<0.5	3.0	<0.1	<0.1	<0.5	<0.5	<1.0
239	#34	10	H-11		<0.1	<0.1	<0.5	1.1	3.5	<0.1	<0.1	<0.5	1.3	1.7
240	#34	13	H-11		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
241	#35	5	G-6		<0.1	<0.1	2.2	33	91	0.1	0.5	9.8	53	41
242	#36	4	K-4		<0.1	<0.1	<0.5	<1.0	<0.1	<0.1	<0.1	<0.5	<0.5	<1.0
243	#37	5	L-5		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	0.2	<0.5	<0.5	<1.0
244	#38	5	O-10		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
245	#39	27	K-18		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
246	#40	29	J-27		<0.1	<0.1	<0.5	<0.5	<1.0	<0.1	<0.1	<0.5	<0.5	<1.0
248	#41	5	J-44		<0.1	<0.1	<0.5	3.2	8.0	<0.1	<0.1	<0.5	1.9	1.1
249	#42	5	N-45		<0.1	<0.1	4.7	84	250	<0.1	1.0	21	140	110
250	#43	5	P-31		<0.1	<0.1	<0.5	7.5	25	<0.1	<0.1	1.9	13	10
251	#44	10	M-12		<0.1	<0.1	<0.5	<0.5	1.9	<0.1	<0.1	<0.5	<0.5	<1.0
252	#44	14	M-12		<0.1	<0.1	<0.5	<0.5	2.7	<0.1	<0.1	<0.5	<0.5	<1.0

TABLE 10

SAMPLE RESULTS FROM AREA OF STORAGE TANK
 *Soil of piles returned as backfill

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
136	West wall, surface composite	<0.05	<0.1	0.2	2.5	14	<0.05	<0.1	<0.2	3.6	6.3
137	East wall, 2 ft. below pipe, discrete					11	<0.05	<0.1	<0.2	<1.0	3.8
149*	Soil composite, NW pile of dirt	0.6	<0.1	1.8	10	40	0.1	1.9	13	15	32
150*	Soil composite, west end of tank	0.6	0.1	1.5	5.5	20	0.2	1.1	7.8	6.0	13
151	Soil composite, east end of tank	0.6	1.9	22	440	>2000	2.9	14.8	110	810	>700
153	Soil above concrete pad supporting chocks, middle to west, composite	<0.8	<0.5	1.4	28	110	0.3	0.7	5.0	41	36
155	Concrete slab, chips, storage tank excavation	<0.1	<0.1	<0.5	<0.5	8.1	<0.1	<0.1	<0.5	<0.5	3.2
160	Soil above concrete pad supporting chocks, middle to east	<0.2	0.2	3.8	47	150	0.6	3.0	9.6	55	48
163	SE corner of storage tank hole, composite after pad removal	<0.1	<0.1	<0.5	<0.5	3.8	<0.1	<0.1	<0.5	<0.5	<1.0
164	NE corner of storage tank hole, composite, after pad removal	<0.5	0.8	1.7	120	820	0.3	0.8	21	460	640

TABLE 10, CONT'D

*Soil of piles returned as backfill

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
73*	Soil from pit south of storage tank, composite	<0.05									
74*	Soil, top two feet of pit, composite	<0.05									
112	Soil, west end of tank, composite	<0.05	0.9	30	>3400	>7700	<0.05	2.1	220	>6200	>5100
126	One foot from surface, east wall, composite	0.4	<0.1	2.0	76	240	0.7	<0.1	13	220	120
127	North wall, 5 feet deep, composite	1.1	<0.1	<0.1	4.8	10.0	3.0	<0.1	1.1	10	6
128	Bottom of hole, after tank removal, composite	<0.05	0.2	2.7	62	150	0.2	0.5	15	150	77
129	Scale from outside of tank, composite	<0.1	<0.1	.02	66	310	<0.1	<0.1	13	120	80
133	South wall surface, composite	<0.06	<0.1	<0.2	1.8	9.2	<0.05	<0.1	<0.2	1.3	2.2
134	North wall, surface, composite	<0.05	<0.1	<0.2	<0.4	8.8	<0.05	<0.1	<0.2	<0.4	25
135	East wall, 1 ft. below pipe, discrete sample	0.09	0.3	4.0	25	120	<0.05	<0.1	6.7	53	64

TABLE 10, CONT'D

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
165	Composite of base of storage tank, underneath concrete pad	<0.1	<0.1	<0.9	34	120	<0.1	<0.1	9.0	110	110
174	NE corner of storage tank hole, underneath pad	<0.1	<0.1	<0.5	4.2	18	<0.1	<0.1	0.7	8.1	6.5
175	Bottom composite of storage tank hole	4.4	1.0	1.3	23	72	55	1.0	1.3	29	34
253	Storage tank hole, NE corner	<0.1	<0.1	3.8	110	400	<0.1	1.8	18	180	200
254	Storage tank hole, bottom, after rain	0.5	0.9	11	130	250	1.4	8.4	68	300	150
255	Storage tank hole, Midpoint west, under concrete pad	0.4	0.6	8.4	200	550	0.8	2.9	66	580	500

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TABLE 11

SAMPLE RESULTS DURING CLEAN UP PROCESS
(in ug/kg; results of wipe samples in total ng recovered)

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
130	Wipe Sample from PCP Vat, 100 cm ²	<0.05	<0.1	<0.2	0.5	2.8	<0.05	<0.1	<0.2	0.4	1.3
148	Wipe, Ceiling above PCP Vat, 100cm ²	<0.3	<0.1	<0.3	<0.3	3.1	<0.1	<0.4	<0.3	<0.3	1.7
152	Wipe of Rollers, 200 cm ²	<0.3	<0.7	<1.4	2.8	2.1	0.3	0.7	1.0	2.4	8.0
168	Wipe, Concrete, End of Process Line, 1/2 Power Hydroblast, 200 cm ²	1.1	1.7	3.6	6.2	360	0.7	1.7	3.0	5.5	17
169	Wipe, Concrete, inside Bldg., 1/2 Power Hydroblast, 200 cm ²	0.4	0.7	1.4	2.4	69	0.3	0.7	1.2	2.1	2.1
170	Wipe, Metal Catch Pan, Hydroblast, 200 cm ²	0.8	1.2	2.6	4.4	93	0.5	1.2	2.1	4.0	31
171	Wipe, inside Storage Tank, 100 cm ² (Sandblast only)	1.0	1.7	2.2	140	270	1.3	1.8	2.3	56	30
176	Wipe, Section of Tank Sandblasted & Hydroblasted, 100 cm ²	0.1	0.2	<0.5	5.8	11	0.1	0.2	<0.5	5.2	4.1
177	Concrete Floor, West of Vat, Hydroblast, Chips	1.4	10	1.7	810	980	2.8	14	84	310	87

TABLE 11, CONT'D

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HPCDF	OCDF
178	Concrete, Vat Foundation West Wall, South End, Hydro-blasted, Chips	0.2	1.1	6.7	97	190	0.3	1.1	20	110	44
179	Concrete, Vat Foundation, West Wall North End, Hydro-blasted, Chips	<0.1	0.2	500	440	900	<0.1	0.9	20	150	72
180	Concrete, Floor of PCP Bldg., Chips	23	84	500	>2900	>3200	62	220	450	1100	290
181	Wood Chips, support beams of PCP Bldg.	0.7	1.1	7.1	49	600	1.4	7.2	9.8	31	17
182	Wipe, Metal Cage, 100 cm ² , Hydroblasted	<0.1	<0.1	0.9	8.2	18	<0.1	0.6	1.3	3.7	2.4
183	Wipe, Sheet Metal Sliding, 100 cm ²	<0.1	<0.1	<0.5	1.4	3.0	<0.1	0.3	<0.5	0.5	<1.0
184	Wipe, Field Blank	<0.1	<0.1	<0.5	0.8	1.9	<0.1	<0.5	<0.5	<0.5	<1.0
185	Wood from Sandblasting Building	<0.01	<0.01	<0.05	1.0	2.5	<0.01	0.3	<0.05	<0.05	<1.0
186	Vat Exterior, Wipe, 200 cm ²	0.2	0.2	<0.5	6.7	19	0.2	0.3	<0.5	0.7	3.2
187	Tank Exterior, Wipe, 200 cm ²	<0.1	0.1	<0.5	2.5	7.7	<0.1	0.5	<0.5	<0.5	4.0

TABLE 11, CONT'D

SAMPLE NO.	DESCRIPTION	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF
188	Vat Interior, Wipe, 200 cm ²	0.1	0.2	<0.5	8.2	33	0.1	0.2	<0.5	1.7	6.0
189	Wood from Ceiling and Top of PCP Building, Chips	<0.1	<0.1	1.8	17	83	<0.1	0.5	0.8	11	9.5

TABLE 12

SAMPLE RESULTS OF SOILS STORED ON SITE (ppb)

SAMPLE MATRIX CONTAINER		SAMPLE											
NO.	NO.	TYPE	TCDD	PCDD	HxCDD	HpCDD	OCDD	TCDF	PCDF	HxCDF	HpCDF	OCDF	
256	SOIL	11	COMPOSITE	5.3	7.6	9.4	140	1400	3.0	35.0	120	410	520
257	"	12	"	9.5	8.7	0.6	120	2500	0.2	0.4	47	680	2500
258	"	13	"	<0.1	1.0	7.3	100	380	0.7	2.3	28	180	180
259	"	14	"	3.0	4.2	17.0	150	500	5.6	8.1	64	230	200
260	"	16	"	1.4	1.1	12.0	340	2800	3.2	4.5	57	980	2500
261	"	18	"	1.5	0.6	8.2	54	120	2.1	5.2	28	92	59
262	"	19	"	1.4	6.3	22.0	380	1000	2.9	5.9	130	910	880
263	"	20	"	0.8	1.7	5.9	44	130	2.3	4.3	18	44	39
264	"	21	"	3.4	2.6	3.5	51	3300	1.0	8.1	22	300	3000
265	"	22	"	0.6	1.9	5.6	51	180	1.0	1.4	23	83	72
266	"	23	"	3.5	11.0	29.0	620	3800	3.1	13.0	130	1500	3600
267	"	24	"	0.1	6.5	62.0	1500	6700	0.1	2.1	200	2000	1400
268	"	25	"	0.1	19.0	21.0	140	660	49.0	0.2	66	180	210
274	"	26	"	1.1	12.0	29.0	470	2800	2.4	12.0	140	900	1900
275	"	27	"	2.4	10.0	23.0	280	1600	2.7	11.0	110	590	980
276	"	28	"	2.4	11.0	21.0	150	500	1.9	12.0	100	330	290
277	"	29	"	2.6	6.2	12.0	170	930	2.1	6.6	54	320	560
278	"	30	"	0.2	4.6	11.0	480	NR-2	2.5	1.8	91	2100	NR-2

TABLE 12, CONT'D

SAMPLE NO.	MATRIX	CONTAINER NO.	SAMPLE TYPE	TCDD	PCDD	HxCDD	HPCDD	OCDD	TCDF	PCDF	HxCDF	HPCDF	OCDF
279	SOIL	31	COMPOSITE	2.5	8.1	26.0	410	1700	6.4	11.0	110	820	1100
280	"	32	"	0.8	5.9	30.0	910	5900	<0.1	12.0	240	2500	5000
281	"	33	"	1.9	2.6	2.0	15	33	13.0	2.6	12	17	12
282	"	34	"	0.8	<0.1	<0.5	4.0	9.7	3.5	0.4	1.6	3.5	2.0
283	"	35	"	1.4	10.0	26.0	250	1300	1.3	13.0	130	710	1000
284	"	36	"	1.5	3.1	6.6	39	220	14.0	5.8	20	43	29
285	"	37	"	1.3	5.8	16.0	170	530	1.8	6.0	74	410	380
286	"	38	" NR-1		1.7	39.0	330	1500	5.0	4.7	75	350	440
287	"	39	"	1.8	26.0	18.0	210	630	3.7	7.8	60	290	370

NR-1 not reported due to interferences

NR-2 not reported, value est. > 5ppm

= 5

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12345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989910010110210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913

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Environmental Protection Agency

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 261, 264, 265, 270, and 275

[SWN-FRL 2701-3]

Hazardous Waste Management System; Dioxin-Containing Wastes

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is today amending the regulations for hazardous waste management under the Resource Conservation and Recovery Act (RCRA), by listing as hazardous wastes certain wastes containing particular chlorinated dioxins, -dibenzofurans, and -phenols, and by specifying management standards for these wastes. These wastes are being listed as acute hazardous wastes. Because of this action, we are removing several commercial chemical products from the list of hazardous wastes contained in 40 CFR 261.33, since these listings are duplicative. For the same reason, EPA is revoking the regulation concerning the disposal of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)-contaminated wastes under the Toxic Substances Control Act (TSCA) when the regulation under RCRA becomes effective. The effect of this rule will be to subject these dioxin-containing wastes to the hazardous waste regulations issued under RCRA.

DATES: *Effective date:* The RCRA hazardous waste regulation becomes effective on July 15, 1985 while the TSCA rule concerning the disposal of TCDD-contaminated wastes is revoked on July 15, 1985.

Compliance dates: All persons (including those who have previously notified the Agency under Section 3010 of RCRA) who generate, transport, treat, store, or dispose of the wastes listed today are required to notify EPA or a State authorized by EPA to operate the hazardous waste program of their activities under Section 3010 no later than April 15, 1985. Notification instructions are set forth in 45 FR 12746 (February 26, 1980).¹

¹ Under the Solid Waste Disposal Amendments of 1980 (Pub. L. 96-432 (October 21, 1980)), EPA was given the option of waiving the notification requirement under Section 3010 of RCRA, following revision of the Section 3010 regulations, at the discretion of the Administrator. In this instance, we believe that all persons handling or managing these wastes need to notify the Agency because of the extreme toxicity of these wastes. Therefore, all persons, including those individuals who have previously notified EPA that they generate or

All existing hazardous waste management facilities (as defined in 40 CFR 270.2) which treat, store, or dispose of wastes listed in these regulations and which qualify to manage these wastes under interim status under Section 3005(a) of RCRA must file with EPA or a State authorized by EPA to operate the hazardous waste program a notification by April 15, 1985 and a Part A permit application by July 15, 1985. Facilities which have already qualified for interim status will not be allowed to manage the wastes listed in these regulations after July 15, 1985 unless: (1) The regulation allows them to handle such wastes under interim status, (2) they file a notification with EPA or an authorized State by April 15, 1985 and (3) they submit an amended Part A permit application with EPA or an authorized State by July 15, 1985 (see 40 CFR 270.10(g)).

ADDRESSES: Public Docket: The public docket for 40 CFR Parts 261, 264, 265, and 270 is located in Room S-212A, U.S. Environmental Protection Agency, 401 M Street SW., Washington, D.C. 20460, and is available for viewing from 9:00 a.m. to 4:00 p.m., Monday through Friday, excluding holidays.

The public docket for 40 CFR Part 275 is located in Room E-107 at the same address, and is available for viewing during the same hours.

FOR FURTHER INFORMATION CONTACT: RCRA Hotline, toll-free at (800) 424-6346 or (202) 382-3000. For technical information contact: Dr. Judith S. Bellin, Office of Solid Waste (WH-562B), Environmental Protection Agency, 401 M Street SW., Washington, D.C. 20460, (202) 382-4787.

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I. Background

On April 4, 1983, EPA proposed to amend the regulations for hazardous waste management under RCRA by listing as acute hazardous wastes certain wastes containing particular chlorinated dioxins, dibenzofurans, and phenols, and by specifying certain management standards for these wastes (see 48 FR 14514-14529). Some of these materials already are hazardous wastes under 40 CFR 261.33(f), a provision which lists discarded commercial grade, technical grade, off-specification products, and discarded formulations when the toxicant is present as the sole active ingredient. Since we proposed to list these wastes as acute hazardous wastes, we also proposed to delete several commercial chemical products (i.e., EPA Hazardous Waste Nos. U212, U230, U231, U232, U233, and U242) from the list of hazardous wastes contained in 40 CFR 261.33(f) in order to avoid listing the same waste under two different (and inconsistent) provisions. Finally, EPA proposed to revoke its regulation concerning the disposal of 2,3,7,8-TCDD contaminated wastes under TSCA when the RCRA regulation becomes effective.

EPA requested comments on all aspects of the proposed regulation. The agency has evaluated these comments and has accordingly modified the regulations as well as the supporting documentation. This notice finalizes the regulation proposed on April 4, 1983, and outlines EPA's response to many of the comments received on that proposal. (The Agency's response to the other comments are set forth in the revised Background Document for this listing.) The Agency also notes that the proposed regulation was validated by Congress in the Hazardous and Solid Waste Amendments of 1984 (HSWA). In particular, the bill requires EPA to finalize the "dioxin-containing hazardous waste numbered FO21, FO21, FO22, and FO23 (as referred to in the proposed rule published by the Administrator in the Federal Register on April 4, 1983)" within six months of the bill's enactment (Section 222(a)). In

¹ The RCRA definition of acute hazardous waste is set forth at 40 CFR 261.11(c)(2). Under that definition, a material is not necessarily "acutely toxic" in the way that term is used by toxicologists. Rather, the term is intended by EPA to identify wastes that are so hazardous that they may, either through acute or chronic exposure "cause, or significantly contribute to an increase in serious irreversible, or incapacitating reversible illness" regardless of how they are managed. Wastes with particularly low LD₅₀ or LC₅₀ measures, or wastes containing substantial concentrations of potent carcinogens, are the most likely candidates for listing as acute hazardous wastes (see 45 FR 33106-33107, May 19, 1980).

addition, Section 201(e) of the law requires EPA to consider prohibiting the land disposal of the proposed listings. (The prohibition on land disposal is rebuttable under certain circumstances.)

II. Summary of the Regulation

This regulation designates as RCRA acute hazardous wastes process wastes from the manufacturing use of tetra-, penta-, or hexachlorobenzenes under alkaline conditions; wastes from the production and manufacturing use of tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivatives; and discarded unused formulations containing tri-, tetra-, and pentachlorophenols or formulations containing compounds derived from these chlorophenols. Also listed are wastes that are generated in the course of a manufacturing process performed on equipment previously used for such operations, except where the equipment was used only for the manufacture or formulation of pentachlorophenol (PCP) or its derivatives. The wastes covered by this rule include reactor residues, still bottoms, brines, spent filter aids, spent carbon from product purification, and sludges from wastewater treatment, but do not include untreated wastewater or spent carbon from hydrogen chloride purification.

As a consequence, these wastes will all be subject to the 1 kg per month small quantity generator exclusion limit. See 40 CFR 261.5(e) and 261.30(d). Residues in containers that contain these listed wastes are also regulated under subtitle C of RCRA, unless the container has been triple-rinsed using a solvent capable of removing the waste, or the container has been otherwise cleaned by a method that has been shown to achieve equivalent removal. See § 261.7(b)(3).² In addition, soils

² The following acronyms and definitions are used in this document (and to the Background Document for this regulation):

PCDDs = all isomers of all chlorinated dibenzo-p-dioxins.

PCDFs = all isomers of all chlorinated dibenzofurans.

CDDs and CDFs = all isomers of the tetra-, penta-, and hexachloro-dibenzo-p-dioxins and -dibenzofurans, respectively.

TCDDs and TCDFs = all isomers of the tetrachlorodibenzo-p-dioxins and -dibenzofurans, respectively.

TCDD and TCDF = the respective 2,3,7,8-isomers.

The prefixes O, Tr, T, Pe, and Hx denote the di-, tri-, tetra-, penta-, and hexachlorodioxins and -dibenzofurans congeners, respectively.

³ The proposed regulation specified these derivatives as the chlorophenoxy acids, esters, and aryl ether salts, but omitted reference to other derivatives and other (e.g., alkaline) salts. This inadvertent omission is rectified in the final regulation.

⁴ If the container is cleaned, the container would be considered empty and no longer subject to

contaminated with these wastes are also regulated since soils contaminated by hazardous wastes spills are defined as being in the RCRA system.

These wastes also will be subject to special standards when land disposed, incinerated, or stored. Since these wastes will now be subject to regulation under RCRA, we are also revoking the TSCA dioxin rule.

III. Wastes Subject to This Regulation

EPA proposed to list as acute hazardous wastes process wastes from the manufacture of tetra-, penta-, or hexachlorobenzenes under alkaline conditions; wastes from the production and manufacturing use of tri-, tetra-, or pentachlorophenols and their chlorophenoxy derivatives; and discarded unused formulations containing tri-, tetra-, and pentachlorophenols or formulations containing compounds derived from these chlorophenols. We also proposed to list wastes resulting from the production of materials on equipment previously used for such operations. This section of the preamble discusses the comments received on the listing of these wastes as acute hazardous wastes, as well as our response.

A. Wastes Containing Tetra- and Pentachloro-dibenzo-p-dioxins and -dibenzofurans

In listing these wastes as acute hazardous wastes, EPA relied principally upon the presence, in significant concentrations, of CDDs and CDFs in the wastes, and to a lesser extent on the presence of certain chlorophenols and chlorobenzenes. The CDDs and CDFs are, for certain animal species, the most potent man-made toxicants known. These wastes also have been associated with some of the most serious hazardous waste damage incidents known, including those at Love Canal (NY), and at Times Beach (MO).

The levels of TCDD in these wastes are of concern in terms of the potential for serious harm to human health if they are released to water or air, either in soluble form or adsorbed to soil, particulates. Based on its carcinogenic potential, the Water Quality Criterion for 2,3,7,8-TCDD is 10⁻⁶-10⁻⁷ ppb (U.S. EPA, 1978b). This value is a very small fraction (about 10⁻¹³) of the concentration of TCDDs in the listed wastes.

regulation. However, the residue that is generated would be an acute hazardous waste, and thus subject to regulation. See 43 FR at 75123 (November 25, 1980).

Commenters did not seriously challenge that production wastes containing TCDDs and TCDFs were properly listed. We therefore are adopting these listings as final today. Challenges to EPA's decision to list wastes generated on equipment previously used to produce wastes containing TCDDs and TCDFs are discussed in Section C. of this section of the preamble.

Several respondents, however, did comment on EPA's use of structure/activity relationships in its decision to list all CDDs and CDFs as toxicants of concern, stating that it is not scientifically valid to consider all the CDDs and CDFs as having the same toxicologic properties, and that there are species-specific exceptions to the correlations cited between biochemical endpoints and toxicity. Several commenters also suggested that EPA's reliance on the case of *EDF v. EPA* (568 F.2d 62 (D.C. Cir. 1978)), cited in partial support for EPA's determination, is incorrect. The commenters stated that the court's determination in the case of *EDF v. EPA* (which involved polychlorinated biphenyls) [PCBs] allowed EPA to infer toxicity based on structure-activity relationships because the congeneric composition of the PCB mixture was not known, and because the toxic characteristic of all the congeners was not known.

EPA agrees with the commenters that there is considerable variation in the acute and chronic toxicity, as well as in the biochemical activity of the various CDD and CDF congeners and isomers. We alluded to these differences in the preamble to the proposal. See 48 FR 14515, April 4, 1983. In addition, these differences were noted both in the background document and in the health and environmental effects profiles. However, we continue to judge that, because most of the isomers of the listed CDDs and CDFs are very toxic, albeit to different degrees, and because the Agency believes that most of these wastes contain a certain percentage of the most toxic (TCDD) component, it is appropriate and permissible to rely, in part, on the known structure/activity relationships to establish the potential toxicity of these wastes.⁴

It should also be noted that the Agency is not evaluating the toxicity of the HxCDD and HxCDF congeners—the chlorinated dioxins and -dibenzofurans

most prevalent in wastes from PCP production and manufacturing use—solely by reference to structural similarity with TCDD and TCDF. Rather, we have made an independent assessment of the toxicity of the HxCDDs, and believe that they are also very potent carcinogens, albeit less potent than TCDD. We are, however, relying on structure/activity relationships in stating that all forms of HxCDDs and HxCDFs are constituents of concern.

B. Pentachlorophenol (PCP) Manufacturing Wastes

1. Standards for Determining if Wastes Are Acute Hazardous Wastes

Before challenging the Agency's substantive determinations, some commenters argued that EPA does not have the authority to regulate the designated wastes as acute hazardous wastes under 40 CFR 261.31. In particular, these commenters argue that the criteria cited in the regulation for listing acute hazardous waste (see 40 CFR 261.11(a)(2)) allows EPA to classify as acute hazardous wastes only those wastes which meet all of the criteria set forth, and that the criterion that such a waste be "capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible illness" is impermissibly vague.

We believe that the commenters have misinterpreted the cited regulation. The regulation (40 CFR 261.11(a)(2)) clearly states that a waste is considered to be an acute hazardous waste if its acute toxicity meets the criteria for acute lethality as defined in 40 CFR 261.11(a)(2), or if it can cause or contribute to serious irreversible illness. The regulations do not state that an acute hazardous waste must meet all of the listed criteria; the conjunction "or" is employed. As to the lack of definitiveness of the qualitative criterion, the regulation quotes the statutory standard verbatim. No one has challenged the statutory provision (Section 1004(5)(A)) as impermissibly vague, nor did we receive any comments on this criteria during the comment period following the promulgation of § 261.11(a)(2) on May 19, 1980.

Furthermore, in the preamble to that regulation, EPA stated its intent to apply this standard to wastes "containing substantial concentrations of potent carcinogens . . ." (See 48 FR 33107). TCDD and several HxCDDs are among the most potent carcinogens tested in rodents, and are present in these wastes in substantial concentrations. We therefore believe that neither the statute

nor the regulations are impermissibly vague, and that we have fully articulated the reasons for our conclusion that these wastes meet the criterion for listing as acute hazardous wastes.

2. Whether Wastes From the Production and Manufacturing Use of Pentachlorophenol (PCP) Should Be Classified as Acute Hazardous Wastes

EPA proposed to list wastes from the production and manufacturing use of PCP, discarded unused formulations containing PCP, and wastes from equipment previously used for the production or manufacturing use of PCP as acute hazardous waste. Generators of these wastes questioned whether the wastes should be classified as acute hazardous wastes. They argued that these wastes do not contain the most toxic dioxin or dibenzofuran congener (2,3,7,8-TCDD or TCDF), and went on to argue that the dioxin congeners they do contain—HxCDDs—are not carcinogenic or otherwise toxic enough to justify the acute hazardous waste classification. They also maintained that there are no other reasons to justify listing these wastes as acute hazardous wastes.

As already explained, wastes are listed as acute hazardous waste under the criteria for listing contained in 40 CFR § 261.11(a)(2). The principal basis for listing the PCP wastes as acute hazardous wastes is the presence of substantial concentrations of HxCDDs and HxCDFs, and of PCP, which has potential chronic systemic effects.⁵ While TCDDs are very rarely found in PCP or in wastes resulting from the production or manufacturing use of PCP (Buser and Bosshardt (1978) reported 0.50–0.25 ppm of an unidentified "TCDD" isomer), HxCDD concentrations range from 1–39 ppm (USEPA, 1981a; Miles et al., 1984). In addition, an isomer-specific analysis determined that the carcinogenic 1,2,3,6,7,8-HxCDD constitutes about 20–60% of the HxCDDs present (USEPA, 1978; Miles et al., 1984). Moreover, PCP contains about 0.12 ppm each of TCDFs and PeCDFs, and from 9–69 ppm of

⁴ Furanic and dioxin-like effects (statistically significant effects and not those associated with growth retardation, and improved embryonic development) have been reported in rats exposed to commercial and purified PCP (USEPA, 1982a).

⁵ These wastes also contain hexachlorobenzene (HCB), a compound identified by the Agency's Carcinogen Assessment Group as a potential human carcinogen. Because the Agency has no data on the concentrations of HCB in these manufacturing wastes, HCB is not at this time listed as a constituent of concern (Appendix VII comment). If data warrant, these listings may accordingly be amended.

⁴ We also believe that the identification of individual isomers in the waste (i.e., analyze the waste for the specific dioxin and dibenzofuran isomers) would be quite costly and unnecessary because of the toxic nature of the dioxin and dibenzofuran congeners.

HxCDFs (USEPA, 1978). As discussed below (Section III. B. 3.), these levels are of regulatory concern.

Several commenters disputed EPA's determination that the two HxCDDs are carcinogenic. They submitted an expert's review of the bioassay conducted by the National Cancer Institute (NCI) of a mixture of two HxCDDs (Squire, 1983).⁹ The expert reviewer reported a lower incidence of neoplastic nodules in female rats than that reported by NCI (and originally accepted by EPA). He evaluated several of the lesions diagnosed as tumors by NCI as non-neoplastic regenerative nodules, but concluded that there is "equivocal" evidence that these HxCDDs are potential human carcinogens.

As a result of these comments, scientists from EPA's Carcinogen Assessment Group (CAG) and the National Toxicology Program (NTP) have reviewed both the reviewing expert's comments and the underlying data (histology slides) gathered in the original NCI study. Their re-evaluation confirms the original conclusion that there is sufficient evidence that the mixture of HxCDDs studied by NCI is carcinogenic as indicated by a statistically significant increased incidence of liver tumors in female rats and in mice of both sexes (Haberman and Bayard, 1984; Hildebrandt, 1983; McGaughey, 1984). This review led EPA to estimate that the carcinogenic potency of the two HxCDD isomers ranged from 0.59 (male rat) to 11 (male mouse) per $\mu\text{g}/\text{kg}/\text{day}$. The CAG recommended that 6.2 per $\mu\text{g}/\text{kg}/\text{day}$, derived from hepatocellular carcinoma and adenoma data in the male mice and female rats (the test systems in which the response was most strongly evident) be used as the best estimate of the upper limit potency estimate for HxCDD (McGaughey, 1984).

Even the lowest of these estimates, however, makes HxCDD one of the most potent carcinogens identified by the Agency. For example, this mixture of HxCDDs, although about $1/4$ as potent as TCDD, is as potent a carcinogen as Aflatoxin B₁ (a well recognized potent carcinogen), and is about a thousand times more potent than ethylene dibromide (EDB).

Commenters also submitted an epidemiologic study of the effects of several chemical preservatives, including PCP, on the health of woodworkers, as evidence that no deleterious health effects can be

ascribed to these chemicals (AWPI, 1983).¹⁰ EPA reviewed this study, and notes that it has severe limitations (Erdreich, 1983; Ris, 1983). First, a cross-sectional study design is not a suitable method for detecting a cancer effect because in such a study persons with cancer who are currently employed are not likely to be identified as having the disease. In addition, other deficiencies were pointed out, viz., small sample size; insufficient follow-up period following the onset of exposure; and lack of exposure definition. EPA, therefore, concludes that the submitted epidemiological study is not adequate for assessing the presence or absence of a cancer risk or other health effects in wood treaters exposed to PCP (Erdreich, 1983; Ris, 1983). In addition, reports have been accumulating in the open literature which indicate that workers in occupations associated with PCP exposure are at increased risk of nasal and nasopharyngeal cancer, stomach cancer, and non-Hodgkins lymphoma (Griffman et al., 1978; Bishop and Jones, 1981; Hardell et al., 1982; Gallagher and Threlfall, 1984). Since these are reports of studies of occupational exposure, it is of course unclear whether the etiologic agent is PCP or its associated CDD or CDF impurities. However, these reports reinforce EPA's decision regarding the capability of these wastes to cause or contribute to serious irreversible, or incapacitating reversible, illness.

Several commenters also suggested that the toxicity of HxCDDs at the levels found in PCP are not of regulatory concern. The commenters argue that, because the amount of HxCDDs which they estimate, is contained in the median rat lethal dose of PCP is less than the teratogenic lowest observed effect level (LOEL) noted for HxCDDs, EPA should be more concerned with the acute toxicity of PCP than with the chronic toxic effects of its HxCDD contaminants. They further state that no increased risk of oncogenicity will result from HxCDD exposure resulting from exposure to PCP at its NOEL for reproductive effects.

EPA disagrees with these statements. When we consider cancer, daily exposure even at one hundredth of the LD₅₀ of PCP containing 15 ppm of HxCDDs would result in exposure to 10 ng HxCDD/kg/day.¹¹ Lifetime exposure

at this level could entail a potential excess cancer risk as high as one in a hundred. With respect to reproductive toxicity, the Allowable Daily Intake (ADI) is estimated as one hundredth (NAS, 1977) of the reproductive NOEL or 1 ng HxCDD/kg/day. Someone exposed to a dose approaching the median LD₅₀ established in the rat (120 mg PCP/kg/day) therefore would receive a dose 1800¹² times larger than the ADI anticipated for the reproductive effects of HxCDD. Therefore, the reproductive effects of HxCDD potentially occur at doses three orders of magnitude lower than those at which the lethal effects of PCP are expected.

Additionally, the levels of HxCDDs in PCP wastes are of concern in terms of the potential for serious harm if they are released to water or air, either in soluble form, or absorbed to soil particulates. Based on its carcinogenic potential, the Water Quality Criterion for 2,3,7,8-TCDD has been set as 10^{-5} - 10^{-7} $\mu\text{g}/\text{l}$ (USEPA, 1984b). Since a mixture of two HxCDDs is about 4% as potent a carcinogen as TCDD (McGaughey, 1984), and because the water solubility, soil sorption characteristics, and bioaccumulation potential of HxCDDs and TCDD are very similar (see Background Document for this listing), an appropriate estimate for a similar criterion for HxCDDs is about 25 times as large as that for TCDD, viz., 10^{-2} - 10^{-4} $\mu\text{g}/\text{l}$. This value is a minuscule fraction (10^{-9}) of the concentration of HxCDDs in the PCP wastes.

We therefore conclude that the potential toxicity of HxCDDs at the levels found in PCP are of regulatory concern and that these wastes contain significant concentrations of potent carcinogens. These wastes therefore meet the criteria of 40 CFR 261.11(a)(2), justifying the listing of these wastes as acute hazardous wastes.

3. Toxicity of PCP as a Measure of the Wastes' Toxicity

One commenter noted that PCP, which is contaminated with carcinogenic HxCDDs, was not carcinogenic in several bioassays, and therefore questioned the Agency's conclusion that the two HxCDDs are potential human carcinogens.

We do not believe that the PCP bioassays are adequate to support a conclusion concerning the potential carcinogenicity of PCP and HxCDD-containing wastes. The carcinogenic risk

⁹This review was submitted well after the close of the comment period, but the Agency chose to consider it as part of the rulemaking record.

¹⁰This review also was submitted well after the close of the public comment period, but the Agency again chose to consider it as part of the rulemaking record.

¹¹ $10^{-5} \times \text{LD}_{50} \times 15 \text{ ppm of HxCDD/PCP} \times 1/\text{body weight} = 10^{-5} \times 120 \text{ mg PCP/kg/day} \times (15 \times 10^{-4} \text{ mg HxCDD/mg PCP}) \times 10^6 \text{ ng/mg} = 18 \text{ ng HxCDD/kg/d} = 0.018 \text{ ng HxCDD/kg/day}$.

¹² $\text{Exposure/ADI} = (15 \times 10^{-4} \text{ mg HxCDD/mg PCP} \times 120 \text{ mg PCP/kg/d} \times 100 \text{ ng/mg}) / 1 \text{ ng HxCDD/kg/day} = 1800$.

of PCP containing ppm concentrations of HxCDD is not expected to give positive results at the dosages used in these bioassays. At the lowest dose used in the HxCDD oral bioassay (1.25 ug HxCDD/kg/day), tumor rates of 0 and 20% were noted in groups of 50 female and male Osborne Mendel rats (USDHHS, 1980). For a dose of 0.3 ug HxCDD/kg/day (the amount of HxCDD contained in the highest PCP dose used in the PCP study) a 0-5% response rate would be expected in the same rat strain. This rate is far too low for reliable detection. Moreover, the two best PCP bioassays (USDHHS, 1980 and Schwetz, 1978) were conducted in rats of different strains, that may differ in response. A review of these and other PCP bioassays also noted procedural deficiencies, such as an inadequate observation period, the use of only one animal species per test, and inadequate numbers of animals (Williams, 1982). Therefore, we believe that these studies do not permit a conclusion as to the potential carcinogenicity of PCP. In addition, as outlined above, there are several reports showing increased cancer risk (of unknown etiology) in occupations associated with PCP exposure. Moreover, the fact that HxCDDs are potential human carcinogens of very high potency renders them of great regulatory concern.

We therefore conclude that, because these wastes contain the potent carcinogen HxCDD at levels of regulatory concern, they meet the criteria of 40 CFR 261.11(a)(2), and are properly listed as acute hazardous wastes.

4. Changing the Regulatory Status of Discarded PCP Formulations

Several respondents commented that EPA does not have the authority to regulate tri- and pentachlorophenol containing wastes as acute hazardous wastes. These persons called attention to prior RCRA rulemaking involving these compounds.

More specifically, in the hazardous waste regulations published on May 18, 1980, PCP was listed as an acute hazardous waste (§ 261.33(e)) because the Agency was under the mistaken impression that its oral LD50 in the rat was less than 50 mg/kg. When this error was pointed out, the Agency's determination was rectified, and PCP was listed as a hazardous waste under § 261.33(f) (see 45 FR 78533, November 23, 1980). However, EPA's evaluation considered only the acute oral toxicity of PCP, and did not consider its known contamination with CDDs and CDFs. It would not be in the best interests of the

public if EPA allowed a previous determination to go unaltered when additional data show that prior rulemaking was in error. Thus, the regulatory classification of PCP was initially rectified when data seemed to warrant it. In the current regulation, that status is once more changed, because reconsideration of additional data warrant such action.

5. Alternative Basis for Establishing a 1 kg per Month Small Quantity Generator (SQG) Exclusion Limit

In response to the arguments that these wastes are not acute hazardous wastes, we note that we also have an alternative (and independent) justification for a small quantity generator limitation of 1 kg per month for these (PCP) wastes. Under § 261.11(c) of these regulations, EPA may consider the criteria for listing contained in § 261.11(a)(2) and (a)(3) of the regulations to establish small quantity generator limitations for particular wastes that are lower than 1000 kg per month. EPA will do this where "the general exclusion limits of 1000 kg per month is insufficient to protect human health or the environment." (See Background Document to Section 261.11, May 19, 1980, at p. 60.) That situation is the case for these wastes. As explained in the preamble and the Background Document for the proposed rule, and restated here, these wastes contain significant concentrations of potent carcinogens, and high concentrations of other compounds (HxCDFs and PCP) that are also very toxic. These contaminants have proven to be mobile and persistent in the environment. There also have been many damage incidents involving PCP formulation wastes (see Background Document for this listing). For all these reasons, we believe that these wastes could (and have) caused substantial harm to human health and the environment when managed at unregulated facilities, and that a 1000 kg per month SQG limit is inappropriate for these wastes. In order to ensure that these wastes will be managed at Subtitle C facilities, the appropriate exclusion limit established in the 40 CFR Part 261 regulations is 1 kg per month. This same reasoning applies, with equal force, to the other wastes covered by this listing. The legislative history of the newly enacted HSWA also states unequivocally that these wastes (i.e., all of the wastes covered by the April 4 proposal) are not to be excluded from regulation by virtue of the small quantity generator exemption. See S. Rep. No. 98-204, 98th Cong. 2nd Sess. at 34.

We are making a conforming change to § 261.30(d) of the regulations to indicate that these wastes are subject to the 1 kg. per month small quantity generator limitation. (It should be noted, however, that we read § 261.30(d) as a provision for designating toxic as well as acute hazardous wastes as subject to the lower small quantity generator limits).

6. Regulation of Wastes from Equipment Previously Used in the Production or Manufacturing Use of PCP

Based on the arguments presented above, the commenters also believe that wastes from equipment previously used in the production or manufacture use of PCP should not be regulated as acute hazardous waste. Although we generally disagreed with the specific points of toxicology made by the commenters, we nevertheless have decided not to finalize this provision at this time. In reviewing our data base, we determined that, unlike wastes that are generated on equipment previously used in the production or manufacture use of tri- and tetrachlorophenols or their derivatives, we have insufficient information on the concentration of HxCDDs and HxCDFs in wastes generated on equipment previously used in the production or manufacture use of PCP to determine whether these wastes contain HxCDDs and HxCDFs in sufficient concentrations to be regulated generically as acute hazardous or hazardous waste. As a result, EPA expects to further investigate the wastes that are generated on previously contaminated equipment based on these findings. We will take appropriate regulatory action. In the meantime, these wastes may still be hazardous waste if they either exhibit one or more of the characteristics of hazardous waste, or if the waste is already listed (or contains a waste listed) in Subpart D of Part 261.

C. Wastes Generated on Equipment Previously Used in the Production and Manufacturing Use of Tri- and Tetrachlorophenols

Several respondents commented on EPA's proposal to regulate, as acute hazardous wastes, wastes resulting from manufacturing processes conducted on equipment previously used to produce tri- and tetrachlorophenols (proposed EPA Hazardous Waste No. F022). These wastes were listed based on sampling and analysis data which show that wastes generated on equipment previously used in the production and manufacturing use of tri- and tetrachlorophenols are contaminated with CDDs even after production shifts

to other products. In many cases, these toxicants have been found to remain in the wastes years after production shifted. In addition, there is a history of environmental contamination resulting from these contaminated equipment wastes at such places as Verona, Missouri, to justify these regulations. Furthermore, there is precedent for listing these wastes in that some of them are currently regulated under 40 CFR Part 775, a regulation issued under Section 6 of the Toxic Substances Control Act (TSCA), based on a finding that unregulated disposal presents an unreasonable risk of injury to health or the environment.

Nevertheless, a number of commenters questioned the scope and practicality of the regulations and suggested several changes.

1. Scope of the Listing

(a) Several commenters felt that the proposed definition of EPA Hazardous Waste No. FO22 was broader than intended by EPA. In particular, they indicated that EPA Hazardous Waste No. FO21 refers only to the *manufacturing* use of certain chlorobenzenes under alkaline conditions, but does not cover the actual production of the compounds themselves. These commenters argue that the proposed listing of FO22 refers to wastes from the production of materials on equipment previously used for the production or manufacturing use of materials listed under FO20 and FO21. Thus, the commenters believe that there is an unintended inconsistency in the rules as proposed.

In reviewing these comments, we agree that the proposal erroneously read to include wastes generated on equipment once used to produce chlorobenzenes. Therefore, we have modified the listing to make it clear that the listing only applies to wastes from equipment used previously in the *manufacturing* use of designated chlorobenzenes (under alkaline conditions) (See new hazardous waste listing FO23.)

(b) One commenter argued that the effect of the contaminated equipment listing is extremely broad, and indicates that, while it is not explicitly stated, storage, treatment, and disposal facilities that have ever managed these chlorophenols and chlorobenzenes will be deemed to be part of the "equipment" used to manufacture these products, and thus, be covered under this listing. Consequently, they argue that all waste management facilities in this category would be shut down until full permit status is achieved.

We disagree with the point made by the commenter. As currently drafted, and as discussed in the supporting documentation, this listing applies and is only meant to apply to equipment used in the *actual* production or manufacturing use of the appropriate products (i.e., reactor vessels, distillation columns, filtration equipment, etc.), and does not apply to equipment used by waste management facilities (i.e., treatment, storage, and disposal facilities). The existing TSCA rule (40 CFR 775.183(g)) is likewise so limited. The commenter raises a valid point, however, that needs to be investigated to determine whether the listing should be expanded. EPA will, therefore, investigate the extent of dioxin contamination in wastes (e.g., incineration residues) generated from waste management facilities that previously managed these dioxin wastes. However, until these investigations are completed and a decision is made, this listing will only apply to wastes generated on equipment used as part of the actual production process.

It has also been argued that like the wastes that are generated from manufacturing operations—namely, the production and manufacturing use of tri- and tetrachlorophenols—that have become contaminated from past production or use, the equipment on which these wastes were generated (i.e., reactor vessels, product storage tanks, etc.) when they are taken from service and scrapped (rather than cleaned) should likewise be regulated under RCRA. In fact, extensive TCDD contamination at a scrap metal salvage facility in Newark (NJ) has been traced to the presence of scrapped reaction vessels which, it is thought, were once used for the production of 2,4,5-T. Scrap metal wipe samples, taken many years after the equipment has been scrapped, showed extensive contamination: 250 ng TCDD/m² at the surface of a large reaction vessel in the center of a waste pile. Soil adjacent to cut tanks contained about 3 ppm of TCDD, and low ppb concentrations were detected in surrounding properties (USEPA, 1984). Although situations such as these are of great concern to the Agency, we have decided not to list this equipment, even if discarded, as hazardous (or acute hazardous) waste at this time. EPA has very limited information to define, on a generic basis, all equipment which at one time was used to produce tri- or tetrachlorophenols as hazardous (or acute hazardous) waste under RCRA. However, as is the case for residues which are generated from waste

management facilities, EPA plans to study the extent of environmental contamination from this equipment if it were discarded prior to decontamination. Once these investigations are completed, we will take the appropriate regulatory action.

(c) One commenter argued that the regulation regarding contaminated equipment waste should be limited to equipment used during the actual synthetic process, and the subsequent purification procedures, since these wastes would tend to have the highest concentrations of CDDs and CDFs. The commenter also suggested that EPA should specifically exclude equipment used for subsequent handling of products in ways which are not expected to generate additional CDDs or CDFs.

We cannot agree that the listing should be limited in this way. While it is true that wastes generated on equipment used in synthesis or purification are expected to contain CDDs and CDFs in concentrations several orders of magnitude higher than in waste generated on equipment used only for formulation (i.e., several hundred ppm vs. several ppm), the latter levels are still of regulatory concern. Accordingly, EPA has decided that all wastes that are generated on equipment which has become contaminated from previous manufacturing operations must be managed as acute hazardous wastes, unless a delisting petition establishes that a particular waste is not of regulatory concern or should not be considered an acute hazardous waste.

2. Practicality of the Listing

Several commenters questioned the reasonableness of listing as hazardous wastes that are generated on equipment that may, at any time in the past, have been used in processes generating CDDs or CDFs. They argued that such a listing is not necessary since current cleaning practices (i.e., triple rinsing or other equivalent cleaning methods) will ensure that any wastes generated from such equipment will not be contaminated. They, therefore, suggest that a person be allowed to make such a demonstration. They believe that such a showing could be accomplished by demonstrating that the equipment has been adequately cleaned (e.g., by vapor phase degreasing, solvent washing, etc.), or by testing the waste to determine if it contains significant concentrations of CDDs/CDFs. (The commenters, however, did not indicate how such a demonstration of adequate cleaning would be made, short of testing the waste.) One commenter felt, in any

event, that after some time period during which the equipment has been in another use, the equipment should automatically be considered to no longer be contaminated with CDDs/CDFs. In particular, they suggested a reasonable time period would be three years, as it is common for industry to retain records for this time period.

EPA agrees that persons should be allowed to demonstrate that their waste is no longer contaminated with CDDs/CDFs. However, we believe the only way to make this showing is by testing the waste and submitting an exclusion petition (commonly referred to as "delisting") under 40 CFR 260.21 and 260.22. These procedures have been in use for several years, and we see no reason to set up a special set of procedures. There is no difference between a petition making such a demonstration for these wastes, and petitions to exclude any other waste from the hazardous waste regulations, or petitions to change the regulatory status of a waste from acute hazardous to hazardous.

We do not believe, however, that a showing of equipment cleanliness could easily be made by evaluating the concentration of CDDs and CDFs in equipment rinseate. Such a showing would be very difficult, if not impossible, to make without knowing a great deal of detail for each equipment train, such as its size and complexity, and the amount of rinseate that was used. Even knowing this information, however, may not suffice, because of the many factors that need to be considered to set a standard for CDD/CDF "cleanliness". For example, large equipment trains are difficult to rinse, and the concentration of CDDs and CDFs in the rinseate would depend in part on the amount of solvent used; compliance would therefore be difficult to determine.

In an effort to get additional information on this option, however, we requested the commenter (and several other industrial entities) to provide the Agency with data showing in what manner, and to what extent adequate decontamination of manufacturing equipment might be achieved and demonstrated. We did not obtain a response. Additionally, experience indicates that decontamination is, in fact, very difficult, even if strenuous attempts are made (see, for instance, Blitberg, 1964; Goldmann, 1973; Dalderup, 1978; Flabbein, 1982; Sambeth, 1983).

We likewise do not believe that enough information is available to set a time period after which wastes that are generated on previously contaminated

equipment should be deemed non-contaminated. Quite the opposite: recent sampling and analysis at a facility which used 2,4,5-TCP almost eight years ago showed ppb concentrations of TCDD in still bottoms from 2,4-DCP manufacture (where the presence of 2,3,7,8-TCDD in such concentrations is not expected, absent contamination from an outside source). We also requested further information from those commenters who made this last point (i.e., set a time period after which the waste is no longer considered to be contaminated with CDDs/CDFs); however, no response was returned, indicating a lack of information to justify setting any time period at this time.

3. Economic Burden

Several commenters argued that this listing will result in economic hardship by requiring premature discarding of "contaminated" equipment, especially to those who prudently cleaned and are reusing the equipment. They believe that such a requirement bears no relationship to whether or not any contaminants may be present and would preclude the use of some very sophisticated and expensive equipment to establish the absence of hazards in wastes that they claim would present no risk.

We disagree with these comments. As discussed above, generators who have cleaned their equipment can show by analysis of their wastes, and a delisting petition, that their wastes do not contain the toxicants of concern at levels that are of regulatory concern. Generators also can dispose of the wastes generated on this equipment as acute hazardous wastes, rather than discarding the equipment (i.e., nowhere in this regulation does the Agency require (or even suggest) that existing production equipment must be scrapped and discarded). In any case, a regulatory impact analysis conducted for this regulation (see Section IX, A. below) has convinced us that its economic burden will be modest. The details of this analysis are discussed in Section IX, of this preamble.

4. Historical Documentation

As part of the proposal, the Agency also solicited comments on the appropriate recordkeeping time periods and types of historical records that should be considered adequate for a showing that equipment was not used for processes generating CDDs/CDFs. Several commenters suggested that three to four years should be set as the typical document retention period. Otherwise, they argue, the approach will

not have much utility, since most corporations will not have the records necessary to make the requisite showing. Regarding the types of records that should be considered adequate, they suggest that production process and product records would supply the necessary information.

In requesting comments in this area, EPA was concerned as to how a generator could legitimately know whether the equipment in question was previously used in these processes. If records are kept for only three to four years, as claimed by the commenters, a generator could question how this regulation could be enforced, i.e., will every generator be required to test their waste to determine whether it is contaminated with CDDs/CDFs if records are not available?

Upon re-evaluation of this point, we now believe this to be much less of a problem than originally thought. More specifically, as part of its preliminary investigations conducted as part of the dioxin strategy, EPA has identified most, if not all, of the manufacturers and formulators of tri- and tetrachlorophenols and their derivatives from the list of registrants who have notified the Agency, under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In addition, the Agency, through its Regional Offices, has contacted many of these companies to verify the Agency's information.

Therefore, we believe that those companies who once made these products, and who still use the equipment, will most likely know that this regulation applies to them. The same is true for those who bought equipment from companies that produced or formulated tri- or tetrachlorophenols (or their derivatives), and who knew what type of equipment they bought (i.e., these buyers know that this equipment is contaminated with CDDs and CDFs, and that the resultant wastes are regulated under RCRA). Therefore, the only group of persons who may not know that the wastes they are generating are regulated under these dioxin rules are those who unknowingly bought equipment used to produce or formulate tri- or tetrachlorophenols or their derivatives. This group of individuals may have difficulty in knowing that they are subject to the regulations. However, as indicated above, the Agency has been able to identify most, if not all, companies that produce or formulate these products.

Therefore, any person who suspects that he may have equipment that is contaminated with CDDs or CDFs should contact EPA for further

information. In any event, this list will be useful for any person wishing verification that they are generating dioxin-contaminated wastes. It should also be noted that some of these persons should already be aware of this contamination, since they have been subject to the TSCA rule since May 1980.

D. Hexachlorophene Manufacturing Wastes

One commenter believes that EPA had approximately excluded wastes from the production on Hexachlorophene (HCP) synthesized from highly purified 2,4,5-TCP from the proposed FO20 listing,¹³ but added that, because CDDs and CDFs are not generated in that process, HCP production and formulation wastes should similarly be exempted from the proposed FO22 and FO23 hazardous waste listings.

EPA agrees with the commenter that a similar exception is warranted in cases where such HCP is the only ingredient in the discarded formulation. The regulatory language has been changed to reflect this point. It should also be noted, however, that HCP is itself toxic. Therefore, we anticipate listing HCP manufacturing wastes and discarded formulations which contain HCP as hazardous wastes at some future date.

IV. Management Alternatives and Requirements

A. Land Disposal and Storage of These Wastes

The Agency proposed a degree of hazard approach for these wastes. In light of their inherent danger and previous poor management history, EPA proposed that these wastes be prohibited from being managed at most types of interim status facilities, and that land disposal be conducted pursuant to additional special standards implemented during the course of the permit proceeding. We also requested comment as to whether incinerators, and tank and container storage facilities should be subject to additional management standards when they manage these wastes. This section of

the preamble describes the comments to these proposals, and the Agency's response and changes in approach made in response to comments.

We also note that all of these wastes are specifically identified as candidates for being banned from land disposal in two years under the HSWA (See RCRA amended Section 3004(e)). Thus, the following discussion describes an interim regulatory regime, insofar as it pertains to land disposal of these wastes.

1. Management of the Dioxin Wastes at Interim Status Facilities

a. Prohibitions on Management

Several comments related to EPA's decision prohibiting the management of CDD- and CDF-containing wastes at land disposal, incinerator, and open pile storage interim status facilities. Several commenters suggested that interim status facilities that are properly equipped and managed (i.e., that meet the Part 264 standards) should be allowed to manage these wastes. Other commenters suggested that the proposed rules should be changed to allow the incineration of dioxin wastes in interim status incinerators that have approval under TSCA to burn PCBs. This suggestion was put forth since the process of gaining fully permitted status under RCRA would take some time. The commenters, therefore, fear that the requirement in the proposed rule would lead to a shortage of available management capacity.

The Agency continues to believe that, for these wastes, management in fully permitted facilities is preferable due to the extreme toxicity of these wastes, the persistence of the toxicants of concern, and the wastes' mismanagement history.¹⁴ At the same time, the Agency is concerned about possible shortages in short-term management capacity for these wastes. We thus reject the suggestion that these wastes should be prohibited from all interim status facilities. We believe that certain types of interim status storage facilities can provide adequate management in the short term. Other interim status facilities, we think, can be evaluated for compliance with the Part 264 standards without undue administrative complication, and so also should not be prohibited from managing these wastes.

We do not believe, however, that interim status land disposal facilities should be allowed to manage these wastes. (There is one exception, for

interim status impoundments in which these wastes are generated.) Not only are the interim status standards insufficient to prevent an unreasonable risk (see 45 FR 32682), but it is very difficult to evaluate these facilities for compliance with the Part 264 standards in the absence of a permit proceeding, because, under today's rule, land disposal facilities must seek approval of a waste management plan.

The only interim status facilities that may accept these wastes are: (a) impoundments holding wastewater treatment sludges that are created in those impoundments as part of the plant's wastewater treatment system, (b) waste piles that meet the requirements of § 264.250(c) (referred to in this preamble as "enclosed waste piles"), (c) tanks, (d) containers, (e) incinerators if certified, and (f) thermal treatment units subject to regulation under Subpart P of Part 265, if certified. (See next Section for more detailed discussion.) However, we believe it appropriate to discuss here the management of sludges in impoundments in which the waste was created.

For surface impoundments, the Agency has determined that this is a situation when a distinction between new and existing facilities may permissibly be drawn. (See RCRA Section 3004 and 49 FR 16319). If the Agency were to ban all interim status impoundments from managing these wastes, facilities generating wastewater treatment sludges in impoundments would have to build and receive a permit for new capacity before they could legally manage these wastes. As a practical matter, this would require halting the manufacturing process for some undetermined period of time. The short-term management of these sludges in interim status impoundments could be protective, since the CDDs and CDFs will adsorb to the sludges, and other mobilizing organics will be present in these wastes at low concentrations due to dilution and biological treatment (USEPA, 1982).¹⁵ It should also be noted that these facilities also must obtain a Part 264 permit (which includes compliance with the waste management plan), so that management at these impoundments will be upgraded as part of the permitting process. This could

¹³ EPA has re-examined its decision not to list these wastes as acute hazardous wastes, and has developed an engineering analysis for this process. (The document (which contains Confidential Business Information) is available in the docket for this rule making.) Based on this analysis, the Agency believes that wastes from the production of HCP synthesized from highly purified 2,4,5-TCP prepared by the usual route could contain TCDDs. However, since there are no present producers of HCP using this route, the wastes from HCP production are not listed. The Agency is aware of a new route of synthesis for 2,4,5-TCP during which no CDDs or CDFs are formed (CBI information).

¹⁴ We are, however, allowing the residue resulting from the incineration or thermal treatment of dioxin-contaminated soil to go to interim status facilities. See Section VI.C. for discussion.

¹⁵ One facility, that used to produce PCP, estimated that process wastewater could contain various chlorophenols at <100 to >1000 ppb. However, these data are estimates submitted to the Agency, and were not verified by sampling and analysis. Because they differ greatly from sampling data at other facilities, they are judged to be too unreliable for use in the present context.

result, for example, in a requirement that the impoundment not be allowed to receive the wastes unless it is lined. If the permit writer concludes that there is potential for leaching from the impoundment. (See text at FN 26 below.) Thus, interim status impoundments in which these wastes are generated might not be able to continue receiving these wastes indefinitely. In addition, under the new legislation, within four years these impoundments must be upgraded to meet the technical permitting standards for new surface impoundments (subject to certain enumerated exceptions). See RCRA amended Section 3005(f). (These impoundments, however, will not be immediately prohibited from receiving these wastes as a result of this rule.) In light of all of these circumstances, we have decided to allow surface impoundments in which wastewater treatment sludges are generated to continue to manage these sludges.

The suggestion that land disposal facilities which meet the requirements for fully permitted facilities be allowed to handle these wastes is reasonable only in theory. The evaluation process presently needed to ascertain whether a facility meets the requirements of Part 264 would need to be thorough, and EPA judged that, in terms of necessary documentation and public participation, the process of ensuring this fact would be equivalent (or virtually equivalent) to the evaluation needed for issuing a Part 264 permit. This is particularly true for preparing and evaluating the waste management plan. This plan must be discussed with the permit writer; there is no way a facility can be evaluated in advance to determine if they meet this standard. EPA thus believes that there is no reason for either applicants or EPA to go through the permitting process twice.

We generally agree that allowing these wastes to be disposed of only at fully permitted facilities (except as discussed below) will, in the short term, lead to a shortage of facilities able to handle these wastes. This problem will be alleviated, as is the case at present, by the possibility of storage in tanks, containers, or enclosed waste piles at interim status facilities. Such storage will not in the short term be harmful to human health or the environment, and will reduce the pressure to permit a facility to handle these wastes immediately without a full evaluation of the facility's performance. Interim status incinerators will also be allowed to burn these wastes if they can demonstrate compliance with the performance standards for fully permitted incinerators (including destruction and

removal of principal organic hazardous constituents in the waste). Likewise, interim status thermal treatment units can also be approved to handle these wastes.¹⁴ The Agency also may issue emergency permits (see 40 CFR 270.61) to facilities to store these wastes in situations where there is no other realistically available management capacity. For example, if no management capacity is available following a dioxin waste clean up, an emergency permit could be issued to a facility if the alternative is to leave the wastes in place in an unsecured setting.

B. Interim Status Facilities Allowed To Manage These Wastes

Two persons commented on EPA's proposal to allow interim status facilities to handle these wastes. One of them stated that the Agency should, at a minimum, require submission of a Part B application: a demonstration, with respect to surface impoundments, that the wastes will not migrate; and notification to the Regional Administrator on the part of interim status facilities handling such wastes.¹⁵ The commenter further stated that management in unlined impoundments should not be allowed. In view of the fact that we will require a waste management plan for fully permitted land disposal facilities, one commenter also questioned how EPA can allow interim status land disposal facilities to handle these wastes.

As discussed above, EPA agrees that for these wastes, management at fully permitted facilities is preferable. However, as outlined above, pragmatic as well as environmental considerations motivate the Agency to allow interim status facilities to manage some of these wastes for an interim period under some conditions.

In the case of surface impoundments in which the wastewater treatment sludges are generated, we have determined that the manufacturing facilities now generating the listed wastewater treatment sludges would probably have to close down until they

can obtain permits for their impoundments or build alternative treatment facilities. (See 48 FR at 14519.) In addition, and as described above, allowing these interim status surface impoundments to store or treat these wastewater treatment sludges should present a limited risk in the short-term due to the reduced potential of the CDDs and CDFs to migrate into the environment. These impoundments, however, must obtain a Part 264 permit which will include whatever requirements are imposed by the waste management plan.

EPA also judges that interim status tank and container storage facilities provide adequate short term management of these wastes. Although not providing maximum protection, they do provide control of these wastes to prevent them from posing a substantial environmental hazard or an unreasonable risk in the interim: tanks or containers at interim status facilities that will accept these wastes must meet most of the requirements required for fully permitted tank and container facilities. See, e.g., §§ 263.171, 265.171, and 265.174 (containment, management, and inspection of containers) and §§ 265.192 and 265.194 (containment and inspection of tanks).

In addition, the Agency judged that storage in interim status enclosed waste piles also represents a minimal, and acceptable risk. By "enclosed waste pile" we mean a pile that meets the requirements of § 264.250(c)—namely, that the pile is inside a structure that provides protection from run-on, precipitation, and wind dispersal, does not generate leachate, and does not contain free liquids. This regulation allows enclosed waste piles to accept these wastes without first obtaining a permit, because enclosure of this type will guard in the short-term against the exposure pathways of concern (run-off, wind dispersal, and leaching). Allowing this type of interim status facility to accept these wastes should help provide necessary management capacity until disposal facilities receive permits to manage these wastes.

The Agency also believes that interim status incinerators that are evaluated by EPA to determine whether they can meet the performance standards for these wastes contained in § 264.243 will provide adequate protection to human health and the environment (see Section IV, B. 2. for detailed discussion on the use of interim status incinerators to burn these dioxin wastes). Similar considerations justify allowing interim status thermal treatment units subject to regulation under Subpart P of Part 265 to

¹⁴ The Agency must provide some legal means of handling these materials while disposal capacity is made available through the permitting program.

¹⁵ As already indicated, all persons who generate, transport, treat, store, or dispose of these CDD/CDF-contaminated wastes are required to notify EPA of their activities under Section 3010 of RCRA. It should be noted that the newly enacted HSWA creates strict new deadlines for submission of Part B applications by facilities having existing permits. See newly amended Section 3005(a). Under the statute, land disposal facilities must submit applications by November 8, 1985. Incinerators must submit applications by November 8, 1986, and all other facilities must submit applications by November 8, 1988. A facility which fails to meet these deadlines will, under the statute, lose interim status.

receive these wastes. (Examples are pyrolysis units not designed as incinerators.) These units will be evaluated the same way as interim status incinerators, and, thus, must be certified as meeting the applicable performance standards in § 264.343 (including the 99.9999% DRE for POHCs in the waste). Procedures for obtaining certification likewise will be the same as for interim status incinerators. Another reason for allowing these interim status thermal treatment facilities to receive these wastes is that there are presently no Part 264 permit standards for these facilities. A prohibition on interim status facilities consequently, would prohibit these facilities from receiving these wastes at all. This result is unwarranted since a means exists to evaluate their compliance with the most important environmental standard, and these facilities may prove to be one of the optimal means of managing these wastes. Managing these wastes at these types of interim status facilities is therefore judged to present minimal risks until final permits are issued.

Several commenters stated that interim status facilities should be allowed to handle wastes containing PCP, since these wastes do not contain TCDD, other CDDs do not pose substantial risks of chronic or acute toxicity, and there is no history of mismanagement of these wastes.

We generally agree that wastes derived from the production or manufacturing use of PCP are unlikely to contain 2,3,7,8-TCDD or other TCDDs or TCDFs at levels of concern. These wastes, however, are likely to contain high concentrations of HxCDDs and HxCDFs—the PCP in these wastes is contaminated with these potent carcinogens. While we agree that these congeners are less toxic than 2,3,7,8-TCDD, we believe them to be sufficiently toxic to warrant the designation of wastes containing these substances as acute hazardous wastes. (The reasons for this determination were outlined earlier in this preamble.)

In addition, there is a substantial history of mismanagement of wastes (including spilled or abandoned formulations) resulting from the use of PCP in wood treatment processes. These wastes, or very similar wastes, have been mismanaged repeatedly, causing very serious damage incidents. There have been many actions under RCRA and CERCLA involving wood treatment facilities using PCP solutions and wood preservation wastes; in addition, there are 22 damage incidents involving these chemicals at sites on the National

Priorities List for Actions under CERCLA. These mismanagement incidents (outlined in the revised Background Document for this listing) include discharge of process wastes into off-site drainage ditches, storage (in most cases for many years) of such wastes in impoundments which were improperly sited, improper storage of treatment solutions in leaky tanks and containers, etc. These mismanagement incidents resulted in PCP contamination of soil, surface water, and ground water. In several instances, this contamination was at very high levels. In one instance, the soil of a residential area surrounding a wood treating facility that mismanaged these wastes was analyzed for HxCDDs and HxCDFs. In four samples, HxCDDs ranged from 1.5 to 12 (average, 4) ppb, while HxCDFs were present at 1.7 to 21 (average 9.5) ppb. The clean up of these contaminated sites can be quite costly.

Because these wastes are very toxic, because the toxic components of the waste are mobile, persistent and (particularly the HxCDDs and HxCDFs) will bioaccumulate, and because of their history of mismanagement, EPA judges that they must be managed at fully permitted facilities when land disposed, incinerated (except as already discussed), or stored in open piles.

2. Requirement of a Waste Management Plan

Several respondents commented on EPA's proposal to require a waste management plan to specify additional requirements for land disposal facilities intending to manage these wastes. Most agreed that such a requirement is desirable. (In fact, one commenter stated that a waste management plan should be required for all management options for these wastes.) However, several respondents stated that a waste management plan would not be adequate to ensure proper handling of these wastes. Still others stated that interim status facilities which meet the Part 264 requirements should be allowed to submit such a plan (and thus be able to handle these wastes) before receiving a final permit.

After reviewing these comments, the Agency still believes that a waste management plan will help provide assurance, as far as is practically possible, that these wastes are properly managed in a land disposal situation. The waste management plan will be the interim vehicle for assuring individualized consideration that the wastes will be managed safely. The plan must be submitted by the owner or operator of the facility as part of the

permit application.¹² Therefore, it will be considered in the normal course of the permitting process, so that no special EPA review procedures are required.

The waste management plan should address the factors mentioned at proposal (see 48 FR at 14520) including waste volume, concentrations of CDDs and CDFs in the waste, aerosol/particulate dispersion, volatilization of the toxicants of concern, soil attenuation properties, waste leaching potential, and anticipated solvent co-disposal. To assist the owner or operator in preparing this document, EPA will provide detailed guidance for the presentation of a waste management plan. This document will discuss the physicochemical properties of the waste constituents, and the specific factors to be addressed for disposal of these wastes at each type of land disposal facility (i.e., land treatment units, surface impoundments, open waste piles, and landfills). The document will explain (1) how the existing Part 264 standards should and can be implemented for these wastes where specific guidance is appropriate (i.e., wind dispersal, liner compatibility) and (2) what new requirements should be imposed for such wastes (e.g., soil types, co-disposal, etc.).

More specifically, this guidance document will address a number of areas where existing regulations already provide adequate control. However, due to the extreme toxicity of the toxicants in these wastes, further guidance is provided to the permit writer and the owner or operator of the land disposal facility on how the existing regulations can be applied to these wastes. For example, the existing management standards under Part 264 are adequate to prevent the dispersion of the CDDs and CDFs by wind dispersal. See §§ 264.221, 264.250, 264.273, and 264.301. However, because of the toxicity of the CDDs and CDFs, the waste management guidance document will provide specific management techniques for controlling this exposure pathway (i.e., immediate cover of wastes when placed in landfills and open waste piles, air monitoring to ensure compliance with this provision, etc.). In addition, the existing regulations already address liner compatibility. See §§ 264.221, 264.251, 264.301, and 264.302. However, the waste management guidance document includes a

¹² Sections 270.17, 270.18, 270.23, and 270.21 of the hazardous waste regulations have also been amended to include the specific Part II information requirements concerning the waste management plan that must be included in the permit application for surface impoundments, non-enclosed waste piles, land treatment units, and landfills.

discussion of an advanced liner design system to assist the Region and the owner or operator of the land disposal facility to comply with these provisions.¹²

In addition to the existing standards, we believe that additional requirements (for which the existing rules do not address) also need to be considered in land disposing these dioxin-containing wastes. Therefore, the waste management guidance document will discuss the types, the additional factors the permit writers should consider in approving the waste management plan, in particular:

(1) *Co-disposal*—The appropriateness of disposing of the dioxin-containing wastes with other wastes that may increase the solubility of the CDDs and CDFs. In general, we believe that it is more desirable to co-dispose these wastes.

(2) *Soil Types*—The appropriateness of using various soil types at land disposal facilities. In particular, we believe these wastes should be disposed of in facilities with underlying soil of high sorptive capacity for organic chemicals (*i.e.*, high organic carbon content) and low permeability; this could be accomplished by bringing soils with high sorptive capacity and low permeability to a particular site.

(3) *In-situ Treatment*—The appropriateness of using in-situ treatment, such as mixing with carbon or other sorbents, to minimize the migration potential of the CDDs and CDFs, and the formation of free liquids.

(4) *Liners*—The appropriateness of disposing of these wastes in unlined units. In general, we believe that these CDD and CDF-containing wastes should not be stored or disposed of in unlined units.¹³ This does not mean that owners or operators of existing facilities will need to retrofit the facility to put in liners. Rather, we expect that the permit writer would preclude placing these wastes in unlined units after a specified date. Permittees wishing to continue placing wastes in the unit would have the option of lining the unit.

With respect to the other comments, we believe that it is neither necessary nor appropriate to require incinerators,

thermal treatment units, tanks, containers, or enclosed waste piles to submit a waste management plan. For incinerators, the requirement (see below) of a trial burn showing 99.9999% (six 9s) destruction and removal efficiency (DRE) is adequate protection for proper incineration of these wastes. The same is also true for thermal treatment facilities. The regulatory requirements for tank, container, and enclosed waste pile storage facilities likewise provide the Agency with sufficient information to evaluate the storage facility's ability to contain these wastes, and the additional requirement for secondary containment for such facilities (see Section IV, A.4. below) provides further protection.

We also do not agree with the suggestion that interim status facilities be allowed to submit a waste management plan and manage these wastes. (See, also, Section IV, A. 1. above rejecting the suggestion that interim status facilities meeting the requirements of fully-permitted facilities be allowed to accept these wastes.) We have determined that interim status facilities, in general, should not be allowed to manage these wastes. In fact, where management at interim status facilities is allowed, EPA expects to issue permits quickly, in order to limit the interim status period. Therefore, the Agency will not allow interim status facilities that have submitted a waste management plan to manage these wastes.

2. Prohibiting Land Disposal of These Wastes

Several commenters suggested that land disposal of these wastes should be prohibited except "in exceptional circumstances." One person, however, felt that a better approach would be to develop a "level of concern" (LOC) above which all dioxin-containing wastes should be prohibited from land disposal; however, the commenter did not specify what such a level should be.

The recently enacted legislation gives the Agency two years to determine whether these wastes should be banned from some or all types of land disposal, except for underground injection in which the Agency has 45 months to make such a decision, and the circumstances under which they should be banned. The Agency has recently initiated a program to explore whether certain hazardous wastes should be restricted from some or all types of land disposal, what the nature of the restrictions should be, and what treatment and recycling alternatives exist for such wastes. CDD/CDF-containing wastes are currently being

examined under this program for possible restriction. For more details on this program, see the Advance Notice of Proposed Rulemaking published on February 15, 1984, at 49 FR 5854. In addition, as discussed in the April 4 proposal for this regulation (48 FR 14321), EPA is considering developing special management standards for CDD/CDF-contaminated wastes in addition to the special standards required by today's rule. It is possible that our investigations may enable us to define concentration limits within which land disposal should be prohibited. However, until these studies are completed, we believe it is inappropriate to make any decision with respect to prohibiting these wastes from land disposal.

4. Secondary Containment at Permitted Tank and Container Storage Facilities

EPA solicited comments as to whether secondary containment for tanks that store or treat CDD- and CDF-contaminated wastes should be required as part of their permit. (Interim status facilities would not be subject to this requirement.) As justification, we cited the wastes' toxicity as well as long storage periods, and described mismanagement incidents involving both containers and in-ground and above-ground tanks. Some commenters disagreed with such a requirement and argued categorically that secondary containment requirements at such facilities are not warranted. However, many other commenters argued just as strongly that secondary containment requirements are needed, and urged their adoption.

We have decided that secondary containment should be required as a permit requirement for all tanks that treat or store these wastes presently subject to the existing tank design and operating standards in 40 CFR Part 264, Subpart J, namely above-ground and in-ground tanks, and all underground tanks that can be entered for inspection. It is the Agency's intent to guard against the risks posed by storing or treating these wastes in all types of tanks, including covered underground tanks that cannot be entered for inspection. However, this latter type of tank is not presently subject to the Part 264 Subpart J requirements (see § 264.190(b)) and, as such, cannot receive a permit to treat or store these wastes. In addition, the use of secondary containment at such facilities was not explicitly discussed in the April 4, 1983 proposal. Therefore, we believe we must first solicit public comment on our intent to require secondary containment at covered

¹²It should be noted that this guidance document may also be appropriate for other hazardous wastes that contain similar hazardous components (*i.e.*, chlorinated).

¹³As already discussed, we will allow storage that are constructed to interim status surface impoundments (even if unlined) as part of the plant's wastewater treatment system to manage these wastes. These impoundments are subject to all Part 264 standards, however. Thus, the permit writer will address whether it is appropriate for unlined impoundments to continue to receive these wastes.

underground tanks that cannot be entered for inspection that handle CDD- and CDF-contaminated wastes. We intend to address this issue in forthcoming regulations dealing comprehensively with management standards for tanks.

We believe that the secondary containment requirement for the storage or treatment of these wastes in tanks is justified based on the following three considerations: (1) When released into the environment, it is well-documented that these extremely toxic wastes present a substantial hazard to human health or the environment; (2) these wastes may be stored for a long time before a disposal or incineration facility is found that is willing or able to accept them (for example, the same wastes at the Vertac facility have now been stored on-site for nearly ten years); and (3) EPA's experience indicates that these wastes are particularly difficult and expensive to cleanup when spilled, and therefore warrant the additional protection afforded by secondary containment.

For the same reasons cited above, we believe that secondary containment should be part of the permit requirements for all facilities that store CDD- and CDF-containing wastes that are not free liquids in containers. (EPA specifically solicited comments on this approach in the proposal, but commenters did not reach a consensus on this issue. Some commenters supported it while others opposed this aspect of the proposal.) Accordingly, all the present requirements for secondary containment will apply to container storage facilities, except for the waiver provision in § 264.175(c). This waiver allows an exemption from the secondary containment requirements for non-liquid wastes, an exception which we believe should not apply to container facilities storing CDD/CDF-contaminated wastes. Rather, we have concluded that all possible releases of these wastes to air, ground water, and surface water from such facilities must be prevented. Therefore, a waiver of secondary containment requirements for containers will not be allowed. A container storage area must have a base which is sufficiently impervious and continuous to prevent spills or leaks of these non-liquid wastes into the environment.

With respect to tanks, we have chosen to implement the secondary containment requirement through a general performance standard. Therefore, the rule does not specify the types of designs for the containment system, but rather requires the owner or operator to choose a design and propose

it in the RCRA permit application for EPA review. Under new § 264.200(a), facilities seeking permits for tanks that store or treat these wastes must have a system designed and operated to detect and adequately contain spills or leaks from the tanks. The design of acceptable containment and detection systems can vary considerably according to the type of tank and other factors, as discussed below.

An example of a containment system that might be acceptable for a tank situated above-ground is one with an impervious base (such as concrete, or a synthetic liner) underlying the tank, and walls or dikes around the tanks that provide containment for at least 100% of the design capacity of the largest tank in the containment area. This is to prevent release of CDD- and CDF-contaminated wastes into the environment from the tank in the event of a complete (worstcase) tank failure. The Agency does not believe that the regulations need protect against the extremely remote possibility of simultaneous multiple tank failures in one containment area. Each containment system must also have a method of mechanical or visual detection that will identify leaks of CDD- and CDF-contaminated wastes from the bottom of the tank.

An example of a containment system that might be acceptable for an underground tank is one with a synthetic-type liner underlying the tank, or a liner placed inside the tank so that the tank itself provides the secondary containment. In either configuration, the containment system must be compatible with the wastes being stored, and must be installed and have sufficient strength and thickness so as to prevent failure due to abrasion, pressure gradients, or climatic conditions. A method to detect any leaks between the primary and secondary containment system must also be provided.

An example of a containment system that might be acceptable for underground tanks that can be entered for inspection is a vault structure constructed of material impervious to the wastes being stored in the tank or simply compatible with the wastes and lined or coated with an impervious material. This type of containment system must also have a method to detect any leaks from the tank.

As a general alternative to these examples of containment systems, double walled tanks equipped with an interstitial zone monitoring device to detect leaks that enter the space between the walls would also be

considered acceptable for meeting the new standard prescribed in § 264.200(a).

Today's rule requires tank facilities storing or treating CDD- and CDF-containing wastes to provide EPA with information in its permit application specifying: The precise design of the secondary containment system and its accompanying leak detection method; the choice of construction material and specifications; and whether additional run-on or precipitation controls are needed to preserve the system's integrity. These new technical information requirements are specified in new § 270.16(g) and must be addressed by each individual facility in its RCRA permit application. This information will be evaluated by EPA before a permit is issued.

With the addition of today's secondary containment requirements, we have also decided it is necessary to require tank facilities storing CDD/CDF-containing wastes to address in the facility contingency plan the steps to be taken should a leak be detected. When a leak is detected, the owner or operator must act promptly to prevent release of the hazardous waste into the environment, and wastes must be removed from the secondary containment system as soon as possible. The plan also needs to specify how the tank will be removed from service and repaired, if there is a leak and containment is breached. These new steps are provided in revised § 264.194(c) and build upon the procedures that already must be specified in the contingency plan under existing § 264.194(c).

It should be noted that today's action should not be viewed as a determination by EPA that secondary containment requirements are only appropriate for tanks that store or treat CDD- and CDF-containing wastes. EPA is presently considering whether to require secondary containment for hazardous waste storage and treatment tanks, including tanks that have not yet been permitted and that are presently covered under the existing Part 265 interim status standards. In addition, we are also considering whether to propose several more requirements that we believe are needed to more adequately control the risks posed by all hazardous waste storage and treatment tanks, including those that store or treat CDD- and CDF-containing wastes. For example, EPA is presently evaluating the need for a secondary containment system at all hazardous waste tanks that would provide containment of more than just leaks in the tank's shell. Possible hazardous waste discharges to

the environment that EPA believes may also warrant secondary containment include leaks from nearby tank ancillary equipment (e.g., valves, pumps, and flanges in close proximity to the tank) and spills of hazardous waste in the area immediately surrounding the tank from overflows of the top of the tank or from tank in-filling practices (both caused by equipment failure or operator error). An example of another requirement presently being considered by the Agency is secondary containment for all generators storing or treating hazardous waste in tanks or containers for less than 90 days without a RCRA permit under § 262.34. The Agency believes that leaks and spills at such facilities are no less prevalent than at other RCRA tank facilities and therefore may warrant similar secondary containment requirements.

B. Incineration of Dioxin-Contaminated Wastes

1. Burning at Interim Status Incinerators

As discussed in the April 4, 1983 proposed rule, EPA does not believe that current regulatory controls on interim status incinerators are sufficient to limit the risks associated with dioxins. Interim status incinerators are not required to meet the performance standards for destruction and removal efficiency, HCl removal, and particulate emissions that are necessary to prevent an unacceptable level of risk from burning these wastes. In addition, they are not subject to the rigorous scrutiny of operating and management procedures that result from the RCRA permit review process. Thus, the final regulations prohibit combustion of these wastes in incinerators that have only interim status.

We have decided, however, to allow interim status incinerators to burn these wastes without first obtaining a RCRA permit if they are certified by the Assistant Administrator for Solid Waste and Emergency Response as satisfying the performance standards in Subpart O of Part 264 for RCRA incinerators burning these wastes.¹² In addition, there must be an opportunity for public comment on EPA's determination before the determination becomes final.

We are allowing this exception because we think incinerators meeting these conditions are virtually as protective as those receiving Part 264

permits,¹³ and to provide additional incineration capacity for these wastes until there are more fully-permitted RCRA incinerators. Interim status incinerators that have been approved under the Toxic Substances Control Act (TSCA) to burn polychlorinated biphenyls (PCBs) are a type of incinerator that may wish to apply for certification. As pointed out by commenters, PCB incinerators are a logical choice to burn these wastes without first receiving a RCRA permit because they are required to meet the same performance standard (99.999% destruction and removal efficiency) that we are requiring for the dioxin and dibenzo-furan-containing wastes, and PCB's, in some cases, are more difficult to incinerate than the dioxins and dibenzofurans. (See Section IV, E. 2. b. below.)

We accordingly are promulgating a new § 265.352(a) stating that RCRA interim status incinerators may burn these wastes if they meet the conditions outlined above. Procedures for applying and obtaining a certification are found in § 265.352(b). Applicants should submit information to the Assistant Administrator for Solid Waste and Emergency Response demonstrating that they can meet the performance standards in Part 264. The most pertinent data is that required by § 270.19(b) and (c), and, if a trial burn is necessary, § 270.62. The Assistant Administrator for Solid Waste and Emergency Response will make a tentative finding whether the applicant can meet the Part 264 performance standards. These tentative findings will be submitted for public comment, and persons in the vicinity will be notified by newspaper announcement and radio broadcast (this last requirement is consistent with the § 124.10(c)(2)(ii) notice procedures for RCRA permits). The comment period will remain open for 60 days. At the end of that time, the Assistant Administrator for Solid Waste and Emergency Response will issue a decision whether or not to certify the incinerator. This decision is final Agency action. Any facility receiving a certification, however, must still obtain a Part 264 incineration permit.

A number of commenters stated that the complexity in complying with the standards in Subpart O and the time required to obtain a full RCRA permit would, in the short term, limit the

locations where these wastes could be incinerated, creating a capacity short fall. We believe that the potential problem should not become severe. First, the wastes to which this restriction applies are generated in relatively small quantities. Secondly, as discussed above, we are allowing interim status incinerators that have been certified by the Assistant Administrator for Solid Waste and Emergency Response to burn these dioxin wastes. Finally, an owner or operator of an interim status incinerator who wishes to incinerate these wastes can speed up the permit process by voluntarily submitting the Part B of their permit application instead of waiting until the permitting official requests that it be submitted. This should reduce the time lag and give more incinerators the capability of burning these wastes.

2. Burning at Fully-Permitted Incinerators

The proposed rule also discussed the management of these wastes at fully permitted incinerators. It was EPA's initial view that burning these wastes in an incinerator which has a proven capability to assure 99.99% destruction and removal efficiency (DRE) for the principal organic hazardous constituents (POHCs) which are as difficult or more difficult to incinerate than the CDDs or CDFs, was sufficiently rigorous to ensure the proper management of these wastes. However, we specifically requested comments concerning the possibility of requiring a DRE greater than 99.99% when these wastes are incinerated. The Agency also discussed the possibility of requiring special notification to the Regional Administrator when a facility burns these wastes.

a. Alternative DRE for Dioxin-Contaminated Wastes. While some commenters were opposed to changing the present DRE requirement, most of the comments focused on more stringent standards, i.e., 99.999% (six 9s) DRE. The commenters pointed out that six 9s DRE is required of incinerators burning polychlorinated biphenyls (PCBs) (40 CFR 781.20) compounds that are less toxic than the CDDs and CDFs. They argue that, since CDDs and CDFs are among the most toxic compounds known, nothing less than the best achievable performance should be required. In addition, they argued that six 9s DRE will result in the lowest achievable emission rate. Furthermore, one commenter submitted risk modelling data indicating that a large incinerator burning wastes containing 20 parts per million of TCDD with a 99.99% (four 9s)

¹² It should be noted that some type of test burn data will be required which demonstrates that the incinerator achieves 99.999% destruction and removal efficiency (DRE) before the incinerator would be certified. See Section IV.E.2.b. below.

¹³ The only significant difference is that these incinerators would not yet be evaluated to determine if they meet the facility standards in Subpart A through H of Part 264. Most of these standards, however, are required by the Part 263 interim status standards.)

DRE could result in ambient air concentrations which could present a public health hazard for residents living in the facility's immediate vicinity.

In evaluating these comments, the Agency conducted its own risk assessment in order to determine the potential risks from burning these wastes at different levels of performance in certain hypothetical situations. As part of this analysis, EPA evaluated the potential risks presented by the TCDD content of the wastes, and by the content of total CDDs and CDFs. The latter analysis assumed that the CDDs and CDFs *in toto* have thirty times the carcinogenic potency of TCDD. (This may not be a very conservative assumption, since, for the soot generated in the Binghamton, NY PCB transformer fire, it was estimated that the CDDs and CDFs present had 58 times the carcinogenic potency of TCDD [Eaton, 1982].) If only the HxCDD components are considered, the potential carcinogenic risks are about one twenty-fifth of those calculated for the TCDD component, since that is the ratio of their carcinogenic potencies. The risk to the maximum exposed individual²² and the average exposed individual was then estimated. The variables examined were the concentration of the dioxins in the feed, the size of the incinerator, and the DRE (which ranged from 99.00% to 99.9999%).

The conclusions reached from this effort indicated that wastes containing ppm concentrations of TCDDs, HxCDDs or CDDs/CDFs, burned in large incinerators achieving four 9s DRE could result in ambient concentrations that present a lifetime excess cancer risk level of 10^{-4} . With small incinerators, lower feed rates, lower (ppb) dioxin concentrations, or better meteorological conditions, the modelling showed that four 9s DRE provided levels of risk lower than 10^{-4} .

Based on these results, the Agency considered three options. The first was to establish "acceptable" levels of risk and to use risk modelling on a case-by-

case basis to set limits on the waste concentration or feed rate for each incinerator; the second option was to leave the standard at 99.99% DRE; the third option was to establish a performance standard of six 9s DRE, the current standard for PCB wastes.

The first option is now effectively precluded by statute. See RCRA amended Section 3004(o)(1)(B) stating that facilities receiving permits after enactment of the Hazardous and Solid Waste Amendments of 1984 must at a minimum meet the 99.99% DRE standard. The Agency also rejected the first option because, while it is theoretically more precise from a conceptual standpoint, and allows for tailoring of the regulation to specific circumstances, it is extremely resource intensive for the government, the regulated community, and the interested public. It also requires agreement on the models, assumptions, and acceptable risk levels. Since such modelling is inherently subject to debate, EPA questions its practicality for case-by-case applications in this context.

As described above, a four 9s DRE could result in risk levels for certain situations that are in a range that is of questionable acceptability. Partly because of this, we have decided to impose a more stringent performance requirement of six 9s DRE for CDD/CDF wastes. In addition, this level of destruction and removal is technically feasible. Incinerators burning PCBs are required to operate under conditions that result in six 9s destruction. Consistent destruction to six 9s have been measured at a number of incinerators (e.g., those of SCA, Inc. in Chicago, IL; Rollins Environmental Services, in Deer Park, TX; the facilities operated by Energy Systems Company in El Dorado, AR; and by the General Electric Corporation in Waterford, NY (MRL 1983; USEPA, 1981c and 1981d)). Similar DREs are expected to be achievable for CDDs and CDFs, since PCBs, and CDDs, and CDFs have a similar degree of incinerability. (See Table I below.) The second factor is one of general environmental policy. If one is to incinerate waste containing one of the most toxic substances known, one should use the best incinerators operating at their peak capability. (See, for instance, 46 FR at 7698, January 21, 1981.) Several commenters made this point, including a commenter for a facility that incinerates hazardous waste commercially. In addition, the decision is reinforced by our estimate that, in certain situations, the other principal technological option (four 9s DRE) might

not be sufficiently protective of human health.

b. Requirements for Conducting a Trial Burn for These Wastes. One commenter argued that incinerators burning these wastes should be required to demonstrate compliance with the incinerator performance standard for organics by conducting trial burns for dioxins, rather than by using a surrogate Principal Organic Hazardous Constituent (POHC) that is more difficult to incinerate. The commenter also argued that trial burns should be conducted on waste matrices physically similar to those that would be burned.

Although the commenter's point is desirable in theory, determining compliance with a six 9s DRE (or even a four 9s DRE) standard for these wastes would be very difficult, if not impossible, without a system for surrogate POHCs as established in § 284.342. The concentrations of the CDDs/CDFs in these wastes are too low to find measurable amounts in the stack gas (at six 9s DRE) at present limits of detection, and public health considerations preclude, in most cases, "spiking" the waste with higher concentrations of CDDs or CDFs. Therefore, it is not possible to measure and calculate a six 9s DRE using CDDs/CDFs as the principal organic hazardous constituents (POHCs) with the needed accuracy. However, by selecting a POHC in the waste mixture or by spiking the waste with a compound that is more difficult to incinerate than the CDDs and CDFs, and that is present in sufficient concentrations to determine a six 9s DRE, it is possible to use a trial burn to predict compliance with a six 9s DRE for the CDDs and CDFs.

We also agree with the commenter that the waste mixture used for the trial burn should, as nearly as possible, be in the same physical matrix as the wastes to be routinely burned (see § 204.345(b) indicating that incinerator permits will allow variations in the waste feed physical properties so long as the variations will not affect compliance with the incinerator performance standards), and the waste should be fed into the incinerator at the same rate. For example, if the CDD/CDF wastes that are to be incinerated are contained in a sludge, the trial burn should be conducted on a similar sludge containing the POHC selected to prove compliance. Additional information concerning POHC selection and physical state is contained in the "Guidance Manual for Hazardous Waste Incineration Permits", SW-666 (July 1983).

²² A person who spends 24 hours a day, 365 days a year for 70 years at the site of maximum ground level concentration. This person weighs 70 kg, breathes 20 m³ of air per day, and retains 50% of all contaminants inhaled. It was also assumed that the incinerator burns the waste consistently for the 70-year exposure period, and that "worst case" meteorological conditions would prevail. Obviously, these are conservative assumptions. However, this analysis does not consider other sources of exposure, the possible synergistic effects of concurrent exposures to other carcinogens, or the fact that some of the POHCs, such as chlorobenzene and chlorophenol, can, in the course of incineration, give rise to CDDs and CDFs. Thus, like all risk assessments, this analysis represents a rough balance of factors relevant to potential impacts.

EPA uses heat of combustion as its incinerability hierarchy. Table 1 lists the heats of combustion of the CDD and CDF homologues, as well as of PCB homologues and a few compounds commonly selected as POHCs. The lower its heat of combustion, the more difficult a compound is to incinerate.

c. Special Notification to the Regional Administrator. In the proposal, EPA considered requiring owners or operators of incineration facilities burning these wastes to notify the Regional Administrator of that fact. Such notification was considered because it was felt that Regional authorities might wish to determine compliance monitoring priorities for facilities incinerating these wastes. Although a few commenters did not believe that a notification requirement is necessary, most of the commenters felt that such a requirement is important and should be required. The requirement of a six 9s DRE standard for these wastes will, in most instances, require a trial burn and full permit issuance procedures. Thus, the Regional Administrator will, in most instances, be aware that a facility may burn these wastes. However, this is not true in all cases. If an incineration facility has a permit based on trial burn data showing six 9s DRE capability for a substance more difficult to decompose than the CDDs or CDFs (e.g., trial burn data showing six 9s DRE for certain PCBs) there would be no need to inform the Regional Administrator that the facility plans to burn CDD/CDF wastes. EPA will, therefore, require owners or operators of incinerators managing these wastes to notify the Regional Administrator of that fact.

d. Periodic Compliance Tests. A few commenters suggested or implied that incinerators burning CDD/CDF wastes should undergo periodic performance verification. Repeating the trial burn on some periodic schedule might be reasonable in cases where strict operating parameters are not established. For example, under the Clean Air Act, a stack could not emit more than some amount of pollutant per given time. No specific operating parameters are established by the regulators, and, instead, periodic compliance checks are conducted.

TABLE 1

Compound	Heat of combustion (kcal/gm)
Chlorinated Dibenzodioxins	
Tetra	2.08

TABLE 1—Continued

Compound	Heat of combustion (kcal/gm)
PCBs	2.10
Hexa	2.01
Chlorinated Dibenzofurans	
Tetra	3.06
Penta	2.40
Hexa	2.07
Chlorinated Biphenyls	
Mono	1.79
Di	2.30
Tri	2.10
Tetra	4.23
Penta	2.88
Hexa	2.28
Hepta	2.08
Octa	2.73
Typical POHCs	
Tetrachloroethane	0.94
Trichloroethane	1.20
Hexachlorocyclopentadiene	1.70
1,1,1-Trichloroethane	1.90
Perfluorooctane	2.08

In contrast, during the RCRA permit process, very carefully chosen operating conditions are established in the permit. These conditions, measured during the trial burn, establish the range of operating conditions of the incinerator, within which it has been determined to meet the performance standards of Subpart O. Should it operate outside this range, it would not be in compliance with the standards and would have to stop incinerating the waste. In addition, if the owner or operator wishes to change any of the critical operating parameters, they would have to request a permit modification, and have to conduct another trial burn to prove compliance with the standards under different operating conditions. Therefore, we do not believe it necessary to require periodic testing.

3. Amendments to Parts 264 and 265

Today's notice amends § 264.343 to require that incinerators burning the listed CDD/CDF-containing wastes must achieve a DRE of 99.9999% in addition to the other standards contained in Subpart O. The amendments specify that six 9s DRE will be measured on a POHC that is more difficult to incinerate than the particular CDDs or CDFs. For example, using the heat of combustion hierarchy, and burning wastes containing, for example, HxCDD, a POHC would be selected with a heat of combustion less than 2.81 kcal/gm—perhaps 1,1,1-trichloroethane. The permit application procedures in Part 270 and permit issuance procedures in Part 124 are not changed by today's amendment. For a new incinerator (or an interim status incinerator seeking certification), the trial burn plan would show how the unit will be operated so as to comply with the standards in

Subpart O including the requirement for six 9s DRE. EPA expects that the permit for a new incinerator would not allow any of the listed CDD/CDF-containing wastes to be burned until the trial burn is complete and final operating conditions are established. In addition, none of the listed CDD/CDF-containing wastes should be burned during the pre-trial burn and post-trial burn periods described in §§ 264.344 and 270.62 which provide that the Regional Administrator place limits on the feed to the incinerator until assurance is provided that the unit can meet the standards.

If an incinerator already has a RCRA permit, it may burn CDD/CDF wastes (provided the owner or operator has notified the Agency of this fact) if its previous trial burn, or data in lieu of a trial burn, demonstrates a six 9s DRE on a POHC or compound more difficult to incinerate than the CDDs or CDFs in the waste. This may be the case for incinerators that have TSCA permits for PCB destruction. During the trial burn for PCBs, the unit would have had to ascertain six 9s DRE on a specific chlorinated biphenyl, or a compound that is more difficult to incinerate than the chlorinated biphenyl in the waste. If this chlorinated biphenyl or the surrogate is more difficult to incinerate than the CDDs or CDFs in the waste feed, and if it was in the same physical state, another trial burn may not be required. For example, if an incinerator proved six 9s DRE on PCP, which has a heat of combustion of 2.09 kcal/gm, it could incinerate all the CDDs and CDFs, since the CDD/CDF compound most difficult to decompose is HxCDD with a heat of combustion of 2.81 kcal/gm. However, if the incinerator has not demonstrated six 9s DRE, or it had shown six 9s DRE on a POHC less difficult to burn than the CDDs or CDFs (e.g., tetrachlorobiphenyl (4.23 kcal/gm)), another trial burn would be necessary, and the permit would need to be modified. For additional information see the "Guidance Manual for Hazardous Waste Incineration Permits" (op. cit.).

Today's notice also amends § 265.340 to exclude burning of CDD/CDF wastes in incinerators with interim status, except as previously discussed. An interim status incinerator may not burn these wastes until a permit is issued or the incinerator is certified to burn these wastes.

C. Burning at Other Interim Status Treatment Facilities

The Agency also believes that interim status thermal treatment units subject to

regulation under Subpart P of Part 265 are insufficient to limit the risks associated with dioxins, just as they are insufficient to limit risks associated with interim status incinerators (i.e., most of the requirements address administrative rather than technical controls). However, the Agency also believes that means exist to determine their environmental performance. Therefore, we will allow interim status thermal treatment units to be certified if they can demonstrate that they can properly treat these wastes.

Under the existing regulations, these units cannot be permitted since there are no existing RCRA permitting standards. However, such treatment units may provide a very promising way of treating these wastes. In particular, a number of emerging thermal treatment technologies may be used to treat CDD/CDF-containing wastes in order to render them non-hazardous (or at least, less hazardous). Some of these technologies are thought now to be practical, while others are in the pilot stage, and pilot scale field experiments need to be performed. In the absence of RCRA permit standards, such pilot scale research activities would not be allowed. This would stifle and discourage the development of new alternatives and the development of innovative technology for treatment of these very toxic wastes. We believe such an outcome is undesirable.

As a result, we have decided to promulgate a new § 265.363 stating that interim status thermal treatment units may burn these wastes if they are certified by the Assistant Administrator for Solid Waste and Emergency Response that they can properly treat these wastes. These units will be evaluated the same way as interim status incinerators, and thus must be certified as meeting the applicable performance standards in § 264.343 (including six 9s DRE for POHCs in the waste). In addition, the procedures for obtaining certification will be the same as for interim status incinerators (see Section IV, B. 1. above). In particular, the applicant must submit an application to the Assistant Administrator for Solid Waste and Emergency Response which demonstrates that they meet the applicable performance standards in Subpart O of Part 264. The most pertinent data to be submitted is the same as for interim status incinerators, that is the information cited in § 270.19 (b) and (c) and, if a trial burn is necessary, § 270.62. However, since these units are somewhat different than incinerators, additional data and information may be required. See

§ 270.19 (c)(7). Because the type of additional information that may be required will vary with the type of thermal treatment unit, we suggest that the owner or operator of the thermal treatment unit contact the Agency before submitting their application to determine whether any additional information will be required, and if so, what type of data will be needed. This information will then be evaluated for compliance with the appropriate performance standards. The Assistant Administrator's tentative decision will then be published (after public notification) for a 60 day comment period; at the end of that time, the Assistant Administrator for Solid Waste and Emergency Response will issue a final decision whether or not to certify the thermal treatment unit. As with interim status incinerators, this decision is final Agency action.

V. Relation of This Rule to Regulation of TCDD-Contaminated Wastes Under the Toxic Substances Control Act

Many wastes containing TCDD are presently regulated under 40 CFR Part 775, a regulation issued under Section 6 of the Toxic Substances Control Act (TSCA).⁴ The relationship between that regulation and the rule being promulgated today under RCRA, was discussed at proposal (see 48 FR at 14518). At that time, we stated that the regulation of the treatment and disposal of hazardous wastes properly belongs under RCRA, and that the Agency should avoid overlapping and potentially contradictory approaches to the same problem under different regulatory authority, e.g., TSCA and RCRA. In fact, Section 9(b) of TSCA provides that EPA must utilize its authority under the other environmental laws it administers where these laws are adequate to protect against unreasonable risk, and where there is no strong public interest in taking action under TSCA.

In the proposal, we argued that RCRA provides the appropriate long-term solution for controlling the management of TCDD-contaminated wastes. EPA promulgated the TSCA § 6(a) rule based on a determination that the unregulated disposal of TCDD-contaminated wastes presents an unreasonable risk of injury to health or the environment, and determined that removal for disposal of certain TCDD wastes at Vertac's Jacksonville, Arkansas site would

present an unreasonable risk (see 45 FR 32680, May 19, 1980). We also determined that disposal of TCDD wastes by other persons without prior notification to EPA would present an unreasonable risk. These determinations were reached, in part, because the then existing RCRA regulations for the treatment and disposal of hazardous waste were not appropriate for TCDD-contaminated waste, since EPA had not yet developed final permit standards for the land disposal or incineration of hazardous wastes.

As explained at proposal (see 48 FR at 14518), the general RCRA regulations are now effective, and provide a means for properly evaluating the land disposal and treatment (i.e., incineration) of TCDD-contaminated wastes, thus ensuring that these wastes are managed in a manner that does not present an unreasonable risk. (This also is true of those interim status incinerators and interim status thermal treatment units that are certified to burn these wastes, since these units must be able to meet the same performance standards as fully-permitted incinerators, and must notify and be evaluated by the Agency before they begin burning.) Therefore, when the RCRA dioxin waste rules are effective and the TCDD-contaminated wastes are controlled under RCRA, their disposal will no longer pose an unreasonable risk finding under TSCA. Consequently, we proposed to revoke the TSCA rule when the rule, under RCRA, becomes effective. No one disagreed with this provision of the proposal; in fact, several commenters explicitly agreed that EPA should revoke the TSCA rule. Today's action, therefore, revokes the TSCA Section 6(a) regulation that applies to the Vertac Chemical Corporation, and those that require a sixty-day notification to EPA on the part of persons wishing to dispose of TCDD-contaminated wastes.

VI. Comments on Other Issues

A. Development of a Toxicity Characteristic for Defining Dioxin-Contaminated Wastes as Hazardous

Several respondents commented on EPA's question regarding the advisability, practicality, and desirability of developing a "characteristic" definition of hazardousness under 40 CFR Part 261 for CDD/CDF-containing wastes. Several commenters agreed with EPA that this might not be a suitable regulatory alternative, adding that to set a lower limit of concern might encourage dilution as a means of circumventing regulation. Several others, however,

⁴TCDD wastes are defined as those resulting from the production of 2,4,5-TCP or its pesticide derivatives, or substances produced on equipment that was previously used for the production of 2,4,5-TCP or its pesticide derivatives.

stated that a clear indication of a lower level of concern would be a desirable regulatory goal; one commenter suggested what such a lower limit might be, stating that a 1 ppb level in soil might be a suitable level. One other commenter also suggested that a level of concern should be set as a regulatory threshold, but not as a basis for listing.

On reconsideration of the advantages and disadvantages of setting a lower level of concern (LOC) for the toxicants in these wastes, and of the data needed to perform the needed risk assessments, we have concluded that, with the data presently available, it is not possible to make a determination regarding such a level. The matrix variability of these wastes, ranging from still bottoms to filter aids to contaminated soils, is very great, and their specific isomeric composition is not known. It is also very difficult to judge the bioavailability of the CDDs and CDFs in these different matrices. The development of exposure and risk assessments would therefore be extremely difficult in this case, and even more suspect than is usually the case because it would entail even more assumptions than those usually made in such a procedure. Therefore, EPA has not developed a LOC for the toxicants—in particular, the CDDs and CDFs—in these wastes. EPA, however, will continue to explore this alternative as additional information becomes available.

B. Discarded Unused Formulations

This regulation designates as RCRA hazardous wastes discarded unused formulations containing tri-, tetra-, or pentachlorophenol and their derivatives (EPA Hazardous Waste No. F027), except those discarded as household wastes. In proposing the regulation, EPA solicited comment as to how generators could identify whether these formulations are subject to this regulation.

Two respondents commented on this problem. One person stated that chemical product labels should contain recommendations for disposal; another recommended that EPA coordinate with OSHA to require that OSHA Form 20 (Material Safety Data Sheet (MSDS)) be amended to require disposal information. In particular, they indicated that Section VII of the MSDS (Spill and Leak Procedures) provides space for the manufacturer's recommendations for disposal of the chemical or its waste residues. They suggest that manufacturers be required to state in this space that the product, when discarded, is a hazardous waste, list the hazardous waste number, and include a

statement concerning the appropriate waste disposal method.

EPA agrees that implementation of these suggestions would go a long way toward solving the problem. If chemical products were identified on the label as an EPA hazardous waste, when discarded, there would be no need to divulge specific (and possibly proprietary) information, and users of such products would not be in doubt that the product in question, when discarded, is subject to RCRA regulation. However, EPA does not have the authority under RCRA to label products and provide disposal information. In addition, form OSHA-20 seldom accompanies a product, and therefore would not solve the problem.

However, EPA possesses authority under other statutes to deal with this problem. Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Agency, under the Label Improvement Program, has sent a notice to all registrants (Notice 87-3) indicating to them that pesticide products that are RCRA hazardous wastes, when discarded, must include a statement which indicates that the pesticide (when discarded) is a hazardous or an acute hazardous waste. This requirement becomes effective on January 1, 1985 for all pesticide products except for pesticides discarded by the household. This same label provision will be required for those pesticide products covered by today's regulation (i.e., for these pesticide products, the label will indicate that they are acute hazardous wastes (EPA Hazardous Waste No. F027) when discarded. The label will not provide specific instructions as to its disposal, but rather will refer the user or any other person who handles these specific pesticides to contact the EPA Regional Office or the State environmental office for disposal instructions. Thus, the label on all pesticidal products containing tri-, tetra-, or pentachlorophenol or their derivatives, will identify whether the formulation is hazardous, if discarded, and will provide the user with instructions on who to contact if disposal information is necessary.

C. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Clean Up Activities

Several commenters felt that the proposed rule, while beneficial and important, is predominantly slanted toward prevention of future accidental releases of CDDs and CDFs to the environment rather than cleanup of existing contaminated areas (i.e., Times Beach, MO). The commenters expressed concern that certain portions of the

proposed rules may hinder or prevent remedial action of contaminated sites. For example, incineration of soil with relatively low concentrations of TCDD could be costly to accomplish, and, since the residue of hazardous waste treatment is still a hazardous waste, there would be little incentive to incinerate contaminated soils. Also, permitting a site under RCRA could be very difficult, possibly delaying or preventing remedial action which could be conducted under CERCLA.

While we agree that the proposed rule is slanted toward prevention of future accidental releases of CDDs/CDFs to the environment, we do not agree that this rule will significantly hinder or prevent cleanup of existing contaminated sites. The major waste that is generated at these sites, as implied by the commenter, is soil contaminated with CDDs/CDFs. These soils are acute hazardous wastes, since soil contaminated with hazardous waste spills are defined as being in the RCRA system. See 48 FR 2508, January 19, 1983; see § 261.3(c)(2). Ongoing and anticipated cleanup activities have generated, and will continue to generate, large volumes of soils contaminated with CDDs/CDFs. For instance, it is conservatively estimated that about 500,000 cubic yards of CDD/CDF-contaminated soil will result from CERCLA remedial action activities in Missouri.

The Agency developed a strategy for dealing with dioxin (USEPA, 1983), which, among other things, deals with alternatives for the cleanup of contaminated sites. These alternatives include securing the soil in place, novel remediation techniques (e.g., solvent extractions), incineration, and removal of soil to a secure containment system (e.g., a concrete vault). The Agency has indicated that remediation and enforcement measures under CERCLA will be carried out as expeditiously as possible.

In addition, we are also allowing the disposal of residues resulting from the incineration or thermal treatment of dioxin-contaminated soils at interim status land disposal facilities,²⁰ and to allow treatment, storage, or disposal at facilities pursuant to the usual Part 264 standards (i.e., not meeting the special standards for other dioxin-containing wastes, such as secondary containment or a waste management plan). Although

²⁰ Although the incineration of dioxin-contaminated soils is not prohibited in any great extent, EPA plans to promote this management option for dioxin-contaminated soils, and, in fact, has allocated considerable resources to that area.

there are very few data on the characteristics of the residues resulting from soil incineration, data are available on the incineration of materials such as PCP capacitors and sewage treatment sludges. These data indicate that the residues resulting from such incineration contain PCBs at levels three to four orders of magnitude less than that contained in the original waste before incineration. Most dioxin-contaminated soils contain less than 1 ppm of TCDD. Thus, it is expected that the concentration of this isomer in the residue from the incineration of soils will be less than about 1 ppb. This concentration in soil was determined to be a reasonable level at which to consider limiting human exposure in a residential setting (USDHHS, 1984). We believe the same is true for the other chlorinated dioxin isomers of concern, as well as for the dibenzofurans.

Data on carbon regeneration show similar results. These data indicate that toxicants such as PCBs, that bind strongly to activated carbon or organic carbon can be effectively removed and destroyed from such matrices such that very low levels of the toxicants remain in the resulting residues. There is no reason to doubt that CDDs and CDFs (of similar incinerability) when bound to organic carbon in a soil matrix will behave any differently. We have therefore determined that the residues of incineration or thermal treatment of CDD/CDF contaminated soils, present much less risk than the untreated soils, and thus can be managed at interim status land disposal facilities.²⁸ We have, therefore, provided a special designation (EPA Hazardous Waste No. F028) for these wastes.

D. Other Wastes Containing CDDs and CDFs

Several respondents commented on the need to list other wastes which contain CDDs and CDFs, i.e., chlorinated benzenes and PCBs, dichlorophenol process wastes, fly ash and emission control dusts from the low-temperature combustion of

chlorophenols, and presently unlisted residues from wood preservation.

The recently enacted HSWA specifically provides additional time to the Agency for evaluating whether to list additional dioxin-containing wastes. See RCRA amended Section 3001(e). As stated in the preamble to the proposed regulation (48 FR 14523), EPA is presently conducting a study on wastes from the production of dichlorophenol. Under EPA's Industry Studies program, the Office of Solid Waste (OSW) has performed engineering analyses, and has gathered sampling and analysis data from several dichlorophenol production facilities, and from facilities that use dichlorophenol. These data are presently being evaluated. In addition, under Tier 4 of the "Dioxin Strategy" (USEPA, 1983), EPA is investigating possible combustion sources of CDDs and CDFs. These materials will be listed if evidence demonstrates that they are indeed hazardous (or acute hazardous) wastes. We also have begun investigating whether additional wastes from wood preservation processes using PCP should be listed as hazardous (or acute hazardous) wastes, and whether CDDs and CDFs should be added as constituents of concern in the wood preservation process waste already listed (EPA Hazardous Waste No. K001, Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol). After completion of those studies, we will take regulatory action, if warranted.

With respect to wastes resulting from the manufacturing use of chlorobenzenes, such processes are not expected to generate CDDs or CDFs except under alkaline conditions and elevated temperatures. We therefore judge that these processes are adequately covered by the present listings. It is possible that commercial preparations of mono- and dichlorobenzene (which are not covered by today's listing) contain homologues with higher degree of chlorination, and thus could give rise to CDDs and CDFs at levels of concern. If further investigation proves that this is the case, we will list the wastes from such processes.

With respect to PCBs, we agree that CDDs and CDFs may well occur in processes involving these materials. However, PCBs are no longer manufactured in the U.S., and their use and disposal are currently regulated under TSCA (40 CFR Part 761). The major problem at present is the generation of CDDs and CDFs resulting from transformer fires. The regulation of

the disposal of the wastes (including soot) from such fires is presently being studied under the dioxin strategy, and EPA recently proposed a regulation intended to control the potential hazards resulting from PCB transformer fires (see 49 FR 39968-39989, October 11, 1984).

E. Wastes Containing Other Halogenated Dioxins and Dibenzofurans

Two respondents commented that EPA should not limit its consideration to processes which are expected to generate tetra-, penta-, or hexachlorinated dioxins and dibenzofurans, because the brominated analogues are also of great concern in terms of their potential to harm human health, and because the congeners of higher degree of chlorination can undergo dechlorination in the environment.

We agree that the brominated analogues are a potential threat. EPA has investigated whether there are at present manufacturing processes generating these toxicants. It was determined that there are at present no U.S. manufacturers of the brominated chemicals (bromophenols, bromophenoxy derivatives, brominated biphenyls) which are expected, from knowledge of chemical reaction, to be contaminated with brominated dioxins and dibenzofurans. We are continuing to investigate, however, whether there are users (formulators) of such compounds. We are also evaluating other organobromine manufacturing processes. If warranted, we will list wastes from such manufacturing operations, and will include brominated dioxins and dibenzofurans as toxicants of concern.

With respect to the higher chlorinated dioxins, we agree that dechlorination occurs. However, it is very difficult to predict the extent of this process, and the equilibrium composition of the various isomers. Both photochemical synthesis and degradation of CDDs and CDFs can occur under ambient conditions. The photochemical formation of OCDDs from PCP has been shown to occur, both in solution, and on PCP-treated wood (Crosby et al., 1973; Crosby and Wong, 1978; Lampersky, 1980). Resistance to degradation increases with degree of chlorination (Hutzinger, 1973; Crosby, 1973; Desideri, 1979; Dobbs and Grant, 1979; Nestrick, 1980). In most situations, photodegradation by reductive photodechlorination exceeds photosynthetic processes, and reaction routes and rates are dependent on reaction conditions. Rate constants

²⁸ Other dioxin-containing wastes are expected to contain much higher concentrations of the dioxins and dibenzofurans. Therefore, we would expect the residues from the incineration of these wastes to also contain much higher concentrations of the dioxins and dibenzofurans. Consequently, we believe that all other incineration residues should be managed as acute hazardous wastes and comply with the special management standards. However, any person may petition the Administrator (under §§ 261.20 and 261.22) to exclude their waste from regulatory control (or at least argue that the waste should not be considered an acute hazardous waste) if they can demonstrate such facts in their petition.

show that this process is a relatively minor pathway for the destruction of the octa-, hepta-, and hexachlorodioxins, accounting for less than 10% of octachlorodioxin destruction (Dobbs and Grant, 1978). Unidentified compounds with gas chromatographic retention times longer than that of OCDD are also formed. While photodechlorination can occur rapidly in solution under laboratory conditions, it can be slow in soil, or on leaves (Crosby, 1977). Contradictory results have been obtained in the laboratory experiments on photodegradation in the adsorbed state (Crosby, 1977; Wang, 1978). When degradation does take place, however, the congeners produced are usually those of less toxic concern. Although displacement of chlorine atoms *ortho* to the oxygen atoms does occur (Buser, 1978; Crosby, 1977; Lamparski, 1980), most investigators have noted that the lateral halogen atoms are the most labile (Stehl, 1971; Dobbs and Grant, 1978; Nestrick, 1980). Therefore, the 2,3,7,8-substituted isomers are those most likely to degrade. Thus, the photodegradation of highly chlorinated CDDs and CDFs is not likely to generate the less chlorinated isomers of most toxic concern. We therefore conclude that, in view of present knowledge, the regulation of wastes containing tetra-, penta-, and hexachlorodioxins and -dibenzofurans adequately address our present regulatory concerns.

F. Small Quantity Generator Comments

Several respondents commented that this regulation constitutes an excessive and unwarranted regulatory burden. One commenter stated that because of the limited disposal options small quantity generators now exempt from regulation would need to apply for status as storage facilities. One person argued that EPA must show a "sound basis" for the 1 kg/month small quantity generator limitation for these wastes.

EPA does not agree with the comments stating that this regulation represents an unreasonable burden on the regulated community. The economic impact analysis performed for this regulation (see Section DC) determined that the costs incurred by this regulation are extremely modest (about eight million dollars per year, maximum).²¹ When compared with the costs of cleaning up the mismanaged wastes (more than thirty million dollars for Times Beach, MO, alone) this modest economic burden is entirely warranted. Moreover, the economic analysis did not

²¹ This study assumed that all generators would meet RCRA storage permit.

consider that many generators may already be covered by RCRA or TSCA regulation, and that the disposal of some of the listed formulations (those in which the listed chlorophenols or their derivatives are sole active ingredients) is already regulated under § 261.23 of RCRA. Additionally, because of their inherent value, we do not believe that the regulated community will usually discard substantial quantities of these formulations.

With respect to the comment that EPA must show a basis for the 1 kg/month small quantity generator limitation, this comment was previously discussed in Section III E. 5. above.

G. Comments on Reuse and Recycling Issue

Several commenters stated that the provisions in the proposed regulation which would list and regulate these wastes as hazardous wastes would prohibit their reuse and recycling. This was said to be at odds with the recycling objectives of RCRA. Two commenters suggested that EPA should allow on-site recycling and reuse of the listed wastes without regulation.

Most of the comments concern issues which are part of a different rulemaking proceeding, amending the existing definition of solid waste and establishing management standards for hazardous wastes that are recycled. See 48 FR 14422, April 4, 1983 proposing these rules. Thus, we will address those comments in finalizing that rulemaking. We note, however, that nothing in this proposal or in existing rules would prohibit recycling of these wastes. Rather, these wastes would remain subject to regulation when they are to be recycled.

H. Applicability of the Mixture Rule

One commenter questioned whether, and to what extent, surface water runoff and plant sweepings would be considered hazardous waste under the mixture rule. As stated in § 261.2(c)(2), precipitation run-off is not automatically considered a hazardous waste, but plant sweepings which contain an acute hazardous waste are residues of cleanup operations, and would be considered to be acute hazardous waste, unless put to direct use as a pesticide or incorporated back into product.

I. Comments on the Analytical Method and the Background Document

Several respondents commented on the proposed analytical method for CDDs and CDFs. In general, these persons commented on specific details of the method, such as the need for sample preservation, the size of the

specified extraction vessels, the suitability of the chromatographic substrates, the appropriateness of the calibration standard, and quality control procedures. Several comments were also received on the Background Document for this listing. These comments are responded to in detail in the Background Document for this listing. Where appropriate, the analytical method (see Appendix IX to Part 261 of this notice) and the Background Document have been modified.

VII. Relation of This Regulation to Those Promulgated Under CERCLA Section 102(b) (Reportable Quantities)

All hazardous wastes (or, in this case, acute hazardous wastes) included in today's final rule automatically become hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). (See CERCLA Section 101(14).) CERCLA requires that persons in charge of vessels or facilities from which hazardous substances have been released in quantities that are equal to or greater than the reportable quantities (RQs) immediately notify the National Response Center (NRC) or the release. (See CERCLA Section 103.) Except for those substances already on the list of CERCLA hazardous substances, which will retain the RQ already assigned, all hazardous wastes designated under RCRA will have an RQ of one pound, until adjusted by regulation under CERCLA. See Section 102.

If a waste has more than one constituent of concern, the lowest RQ assigned to any one of the constituents present in the waste represents the RQ for the waste. If a person completely analyzes the waste, however, and determines that the RQ for each of the constituents of concern are below the RQ established for each of those compounds, no notification is required. Thus, for the dioxin-containing wastes listed today, a one pound RQ shall be assigned upon promulgation of this rule, since a one pound RQ has already been specified by operation of law (CERCLA Section 102) for a number of the constituents of concern.²² Therefore, if a person were to spill one pound of any of the wastes covered by today's rule, he would need to notify the NRC of the release, unless the person determines

²² RQs have been assigned for the following constituents of concern: chlorobenzene, 2,4,5-TCF, 2,4,6-TCF, 2,3,4,6-TCF, TCDF 1 RQ and 2,3,7,8-TCDF, and its salt, oxime, and ester derivatives, and 5,6,7,8-TCDF and its salt, oxime, and ester derivatives.

that there is less than an RQ of each hazardous constituent in the waste.

The one pound RQ is currently the lowest level established for reporting releases of hazardous substances for emergency response reporting. The basis for this RQ level was established under the Clean Water Act (CWA) as the smallest quantity container generally shipped in commerce. Many substances on the CERCLA Section 101(14) hazardous substance list may be extremely toxic, or otherwise extremely hazardous, and, therefore, may need to be controlled at levels well below the RQ levels. For instance, the CDDs and CDFs deserve special note for their extreme toxicity.

The RQ triggers are intended to provide notice of releases so that an On-Scene Coordinator (OSC) pursuant to the National Contingency Plan (40 CFR 300), can assess the hazard and the actions that may be taken by the federal government. It is emphasized that the legal obligation for the responsible party to notify the NRC is independent of actions taken by an OSC. The different RQ levels do not reflect a determination that a release of a substance will be hazardous at the RQ level, or not hazardous below that level. EPA has not attempted to make such a determination because the actual hazard will vary with the unique circumstances of the release, and extensive scientific data and analysis would be necessary to estimate the precise hazard presented by each substance in a number of plausible circumstances. Instead, the RQs reflect EPA's judgment that the Federal government should be notified of releases to which a response might be necessary. The RQs, in themselves, do not represent any determination that releases of a particular size are actually harmful to public health or the environment. See 48 FR 23550, May 25, 1983.

Many other considerations besides the quantity released affect the government's decision concerning whether and how it should respond to a particular release. The location of the release, its proximity to drinking water supplies or other valuable resources, the likelihood of exposure or injury to nearby populations, and other factors must be assessed on a case-by-case basis. The reporting requirement is, however, the trigger for assessments to be made (see 48 FR 23580).

While the one pound RQ is clearly the smallest emergency response notification trigger at the present time for CERCLA and CWA releases, EPA can take response, cleanup, and other actions below RQ levels. The RQ is a level that legally requires reporting by

the responsible party. There obviously may be instances where EPA would need to know of releases well below the one pound RQ level. While EPA, in future refinements to the RQ scales, may consider lower levels, *this process is independent of today's rulemaking*. The reader is also advised that notification requirements within RCRA may require notification for releases which may be harmful, regardless of RQ determinations under CERCLA or the CWA. Specifically, the responsible party may be required to provide notice to EPA or the National Response Center under RCRA regarding spills and leaks of hazardous waste or hazardous waste constituents that may enter the environment (see 40 CFR 262.34, 262.35, 264.56, and 265.56). In addition, each person who generates, transports, treats, stores, or disposes of these wastes must notify EPA of their activities, and thus, EPA will be aware of those persons who handle these extremely hazardous wastes.

VIII. State Authority

A. Applicability of Rules in Authorized States

Under Section 3008 of RCRA, EPA may authorize qualified States to administer and enforce the RCRA program within their States. (See 40 CFR Part 271 for the standards and requirements for authorization.) Authorization, either interim or final, may be granted to State programs that regulate the identification, generation, and transportation of hazardous wastes and the operation of facilities that treat, store, or dispose of hazardous waste. Interim authorization is granted to States with programs that are "substantially equivalent" to the Federal program (Section 3008(c)). Final authorization is granted to States with programs that are equivalent to the Federal program, consistent with the Federal program and other State programs, and that provide for adequate enforcement (Section 3008(b)).

Under RCRA, prior to the Hazardous and Solid Waste Amendments of 1984, once EPA authorizes a State program, EPA suspends administration and enforcement within the State of those parts of the Federal program for which the State is authorized. In authorized States, EPA does retain enforcement authority under Sections 3008, 7003, and 3013 of RCRA, although authorized States have primary enforcement responsibility. However, under Section 3008(g) of the Hazardous and Solid Waste Amendments of 1984, any requirement pertaining to hazardous wastes promulgated pursuant to the

Amendments is effective in authorized States at the same time it is effective in other States. EPA will administer and enforce the requirements in each State until the State is authorized with respect to such requirements.

The listing and related management standards promulgated in today's rule are applicable in all States since the requirements are imposed pursuant to the Amendments. Thus EPA will implement these standards until authorized States revise their programs to adopt these rules.

B. Effect on State Authorizations

Under RCRA, authorized State programs must be revised to incorporate new requirements imposed by statute or EPA regulations. The procedures and schedule for State adoption of these requirements is described in 40 CFR 271.21. See 49 FR 21878 (May 22, 1984).

States that have final authorization must revise their programs within a year of promulgation of today's regulations if only regulatory changes are necessary. These deadlines can be extended in exceptional cases. See 40 CFR 271.21(c).

States that submit official applications for final authorization less than 12 months after promulgation of today's regulations may be approved without including standards equivalent to those promulgated. However, once authorized, a State must revise its program to include the listing and related management standards substantially equivalent or equivalent to EPA's within the time period discussed above.

Under the HSWA, states revising their programs to adopt new requirements imposed under the HSWA may do so based on state requirements that are equivalent or substantially equivalent to the HSWA requirements. See Section 3008(g)(2). Thus a state seeking authorization for today's amendments may do so based on controls that are equivalent or substantially equivalent to today's rule.

IX. Economic, Environmental, and Regulatory Impacts

A. Regulatory Impact Analysis

Under Executive Order 12291, EPA must determine whether a regulation is "major", and therefore subject to the requirement of a Regulatory Impact Analysis. These amendments, in part, replace regulations under a different statute (Section 4(d) of the Toxic Substances Control Act) and impose an additional regulatory burden on only a small number of manufacturers of chlorophenols, and their chlorophenoxy derivatives. In addition, some

manufacturers who use equipment which may be contaminated with CDDs and CDFs may also have an additional regulatory burden.

EPA has analyzed the potential economic impact of these amendments (JRB, 1984). This analysis considered various disposal scenarios; this analysis also assumed that all generators of these wastes would need a permit for their tank or container storage facility. (i.e., none of these generators would qualify for the short storage provision in 40 CFR § 262.34). Including the requirement for secondary containment. Based on this analysis, we estimate the cost of this regulation to be between six and eight million. In addition, we also carefully evaluated the impact of these rules on the costs, prices, and markets of these products (dePois, 1984). Based on this analysis, EPA has determined that major increases in consumer prices are not likely, and since these products have negligible foreign competition, the implementation of these regulations will have little or no adverse impact on the ability of U.S.-based enterprises to compete with foreign-based enterprises in either domestic or export markets.

Therefore, since EPA does not expect that the amendments promulgated here will have an annual effect on the economy of \$100 million or more, will not result in a measurable increase in costs or prices, or have an adverse impact on the ability of U.S.-based enterprises in either domestic or export markets, these amendments are not considered to constitute a major action. As such, a Regulatory Impact Analysis is not required.

This amendment was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12291. Any comments from OMB to EPA, and any EPA responses to those comments are available for public inspection in S-212 at EPA.

B. Regulatory Flexibility Act.

Pursuant to the Regulatory Flexibility Act 5 U.S.C. § 601 et seq., whenever an agency is required to publish a general notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the impact of the rule on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions). No regulatory flexibility analysis is required, however, if the head of the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.

The hazardous waste listed in § 261.31 of this final regulation are rarely generated by small entities. The overall compliance costs associated with the rule are modest. (See report entitled, "Cost Impact Analysis for the Proposed Rule Regulating Certain Waste Containing Certain Chlorinated Dioxins, -Dibenzofurans, and Phenols" for cost estimates.) The only one of these wastes that small entities would discard are the formulating wastes, and EPA does not believe that small entities will dispose of significant quantities of the commercial chemical products. Nor did commenters present any quantified information that significant amounts of these commercial products are discarded by large or small entities. In addition, many of these formulations are already listed wastes. See, e.g., Hazardous Waste No. U242. Thus, today's amendment is unlikely to have a significant economic impact on a substantial number of small entities. This regulation therefore does not require a regulatory flexibility analysis.

C. Paper Work Reduction Act

The information collection requirements contained in this rule have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 et seq., and have been assigned OMB control number 2050-0012.

X. References

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XI. List of Subjects

40 CFR Part 261

Hazardous materials. Waste treatment and disposal. Recycling.

40 CFR Part 264

Hazardous materials. Packaging and containers. Reporting and recordkeeping requirements. Security measures. Security bonds. Waste treatment and disposal.

40 CFR Part 265

Hazardous materials. Packaging and containers. Reporting and recordkeeping requirements. Security measures. Security bonds. Waste treatment and disposal. Water supply.

40 CFR Part 270

Administrative practice and procedure. Reporting and recordkeeping requirements. Hazardous materials.

Waste treatment and disposal. Water pollution control. Water supply. Confidential business information.

40 CFR Part 273

Environmental protection. Hazardous materials. Pesticides and pests. Waste treatment and disposal.

Dated: December 20, 1984.

Alvin L. Alm,
Acting Administrator.

For the reasons set out in the preamble, Title 40 of the Code of Federal Regulations is amended to read as follows:

PART 261—IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

1. The authority citation for Part 261 reads as follows:

Authority: Secs. 1008, 2002(a), 3007, and 3002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6903, 6912(a), 6921, and 6922).

2. In § 261.5, paragraphs (e)(1) and (e)(2) are revised to read as follows:

§ 261.5 Special requirements for hazardous waste generated by small quantity generators.

(e) * * *

(1) A total of one kilogram of acute hazardous wastes listed in §§ 261.31, 261.32, or 261.33(e).

(2) A total of 100 kilograms of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of any acute hazardous wastes listed in §§ 261.31, 261.32, or 261.33(e).

3. In § 261.7, the introductory text of paragraphs (b)(1) and (b)(3) are revised to read as follows:

§ 261.7 Residues of hazardous waste in empty containers.

(b)(1) A container or an inner liner removed from a container that has held any hazardous waste, except a waste that is a compressed gas or that is identified as an acute hazardous waste listed in §§ 261.31, 261.32, or 261.33(e) of this chapter is empty if:

(3) A container or an inner liner removed from a container that has held an acute hazardous waste listed in §§ 261.31, 261.32, or 261.33(e) is empty if:

4. In § 261.30, paragraph (d) is revised to read as follows:

§ 261.30 General.

(d) The following hazardous wastes listed in § 261.31 or § 261.32 are subject to the exclusion limits for acutely

hazardous wastes established in § 261.5: EPA Hazardous Wastes Nos. F020, F021, F022, F023, F026, and F027.

5. In § 261.31, add the following waste streams:

§ 261.31 Hazardous waste from nonspecific sources.

Industry	EPA Hazardous Waste No.	Hazardous waste	Exclusion code
General	F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification from the production or manufacturing use for a reactant, chemical intermediate, or component in a formulating process) of in- or nonchlorinated, or of intermediates used to produce such products derivatives. (This listing does not include wastes from the production of hexachlorocyclopentadiene from highly purified 2,4,6-trichlorophenol.)	P0
	F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification from the production or manufacturing use for a reactant, chemical intermediate, or component in a formulating process) of hexachlorocyclopentadiene, or of intermediates used to produce it derivatives.	P0
	F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification from the production or manufacturing use for a reactant, chemical intermediate, or component in a formulating process) of in- or nonchlorinated, or of intermediates used to produce it derivatives.	P0
	F023	Wastes (except wastewater and spent carbon from hydrogen chloride purification from the production or manufacturing use for a reactant, chemical intermediate, or component in a formulating process) of in- or nonchlorinated, or of intermediates used to produce it derivatives.	P0
	F026	Wastes (except wastewater and spent carbon from hydrogen chloride purification from the production or manufacturing use for a reactant, chemical intermediate, or component in a formulating process) of in- or nonchlorinated, or of intermediates used to produce it derivatives.	P0
	F027	Discarded chemical formulations containing 5%, 10%, or 20% hexachlorocyclopentadiene or discarded wastes containing hexachlorocyclopentadiene derived from these formulations. (This listing does not include formulations containing hexachlorocyclopentadiene derived from these formulations.)	P0
	F029	Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027.	(7)

6. § 261.33(f) is amended by revising the hazardous waste numbers for the following substances:

§ 261.33 Discarded commercial chemical product, off-specification species, container residues, and spill residues therefrom.

(f) . . .

Hazardous waste No.	Substance
See F027	Permethrin.
See F027	Phenol, polychlorinated.
Do	Phenol, 2,4,6-trichloro-
Do	Phenol, 2,4,6-trichloro-
Do	Phenol, 2,4,6-trichloro-
See F027	Propylene acid, 2-(2,4,6-trichlorophenyl)-
See F027	Stearic.
See F027	2,4,6-T.
See F027	2,4,6-Trichlorophenol.
See F027	2,4,6-Trichlorophenol.
Do	2,4,6-Trichlorophenol.
Do	2,4,6-Trichlorophenol.

7. Amend Table 1 in Appendix III of Part 261, by removing the entry "chlorinated dibenzodioxins", and adding the following entries in alphabetical order:

Appendix III—Chemical Analysis Test Methods

TABLE 1.—ANALYTICAL METHODS FOR ORGANIC CHEMICALS CONTAINED IN SW-846

Compound	First edition	Second edition
Chlorinated dibenzodioxins		020
Chlorinated dibenzofurans		020

8. Amend Table 3 in Appendix III of Part 261, by adding the following entry under Organic Analytical Methods—Gas Chromatographic/Mass Spectroscopy Methods (GC/MS) after the entry entitled "GC/MS Semi-Volatiles, Capillary:

TABLE 3.—SAMPLING AND ANALYSIS METHODS CONTAINED IN SW-846

Title	First edition	Second edition
Analysis of Chlorinated Dibenzodioxins and Dibenzofurans		02

9. Add the following entries in numerical order to Appendix VII of Part 261:

Appendix VII—Basis for Listing Hazardous Wastes

EPA Hazardous Waste No.	Hazardous characteristics for which listed
F020	Tetra- and pentachlorodibenzo-p-dioxins, hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F021	Perchlorinated dibenzodioxins, hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F022	Tetra-, penta-, and hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F023	Tetra-, penta-, and hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F026	Tetra-, penta-, and hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F027	Tetra-, penta-, and hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.
F029	Tetra-, penta-, and hexachlorodibenzo-p-dioxins, hexachlorodibenzofurans, and hexachlorodibenzofurans and their chlorinated derivatives such as, octa, deca, dodeca and other such.

10. Add the following constituents in alphabetical order to Appendix VIII of Part 261:

Appendix VIII—Hazardous Constituents

hexachlorodibenzo-p-dioxins
hexachlorodibenzofurans
pentachlorodibenzo-p-dioxins
pentachlorodibenzofurans

tetrachlorodibenzo-p-dioxins
tetrachlorodibenzofurans

11. Appendix X is added to Part 281 to read as follows:

Appendix X—Method of Analysis for
Chlorinated dibenzo-p-dioxins and
dibenzofurans

Method 8280

1. Scope and Application

1.1 This method measures the concentration of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans in chemical wastes including still bottoms, filter aids, sludges, spent carbon, and reactor residues, and in soils.

1.2 The sensitivity of this method is dependent upon the level of interferences.

1.3 This method is recommended for use only by analysts experienced with residue analysis and skilled in mass spectral analytical techniques.

1.4 Because of the extreme toxicity of these compounds, the analyst must take necessary precautions to prevent exposure to himself, or to others, of materials known or believed to contain CDDs or CDFs.

2. Summary of the Method

2.1 This method is an analytical extraction cleanup procedure, and capillary column gas chromatograph-low resolution mass spectrometry method, using capillary column GC/MS conditions and internal standard techniques, which allow for the measurement of PCDDs and PCDFs in the extract.

2.2 If interferences are encountered, the method provides selected general purpose cleanup procedures to aid the analyst in their elimination.

3. Interferences

3.1 Solvents, reagents, glassware, and other sample processing hardware may yield

discrete artifacts and/or elevated baseline causing misinterpretation of gas chromatograms. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

3.2 Interferences co-extracted from the samples will vary considerably from source to source, depending upon the diversity of the industry being sampled. PCDD is often associated with other interfering chlorinated compounds such as PCBs which may be at concentrations several orders of magnitude higher than that of PCDD. While general cleanup techniques are provided as part of this method, unique samples may require additional cleanup approaches to achieve the sensitivity stated in Table 1.

3.3 The other isomers of tetrachlorodibenzo-p-dioxin may interfere with the measurement of 2,3,7,8-TCDD. Capillary column gas chromatography is required to resolve those isomers that yield virtually identical mass fragmentation patterns.

4. Apparatus and Materials

4.1 Sampling equipment for discrete or composite sampling.

4.1.1 Grab sample bottle—amber glass, 1-liter or 1-quart volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences.

4.1.2 Bottle caps—threaded to screw on to the sample bottles. Caps must be lined with Teflon. Solvent washed foil used with the shiny side towards the sample, may be substituted for the Teflon if sample is not corrosive.

4.1.3 Compositing equipment—automatic or manual compositing system. No tygon or rubber tubing may be used, and the system must incorporate glass sample containers for the collection of a minimum of 250 ml. Sample containers must be kept refrigerated after sampling.

4.2 Water bath—heated, with concentric ring cover, capable of temperature control ($\pm 2^\circ\text{C}$). The bath should be used in a hood.

4.3 Gas chromatograph/mass spectrometer data system.

4.3.1 Gas chromatograph: An analytical system with a temperature-programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases.

4.3.2 Column: SP-2230 coated on a 30 m long $\times$ 0.25 mm I.D. glass column (Supelco No. 2-3714 or equivalent). Glass capillary column conditions: Helium carrier gas at 30 cm/sec linear velocity run splitless. Column temperature is 210°C .

4.3.3 Mass spectrometer: Capable of scanning from 35 to 450 amu every 1 sec or less, utilizing 70 volts (nominal) electron energy in the electron impact ionization mode and producing a mass spectrum which meets all the criteria in Table 2 when 50 ng of decachlorotriphenyl-phosphine (DCTPP) is injected through the GC inlet. The system must also be capable of selected ion monitoring (SIM) for at least 4 ions simultaneously, with a cycle time of 1 sec or

less. Minimum integration time for SIM is 100 ms. Selected ion monitoring is verified by injecting 50 ng of TCDD C^{13} to give a minimum signal to noise ratio of 5 to 1 at mass 328.

4.3.4 GC/MS interface: Any GC-to-MS interface that gives acceptable calibration points at 50 ng per injection for each compound of interest and achieves acceptable tuning performance criteria (see Sections 6.1-6.3) may be used. GC-to-MS interfaces constructed of all glass or glass-lined materials are recommended. Glass can be deactivated by silanizing with dichlorodimethylsilane. The interface must be capable of transporting at least 10 ng of the components of interest from the GC to the MS.

4.3.5 Data system: A computer system must be interfaced to the mass spectrometer. The system must allow the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that can search any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be able to integrate the abundance, in any EICP, between specified time or scan number limits.

4.4 Pipettes—Disposable, Pasteur, 150 mm long $\times$ 5 mm ID (Fisher Scientific Co., No. 13-678-8A or equivalent).

4.5 Flint glass bottle (Teflon-lined screw cap).

4.6 Reacti-vial (silanized) (Pierce Chemical Co.).

5. Reagents

5.1 Potassium hydroxide (ACS), 2% in distilled water.

5.2 Sulfuric acid (ACS), concentrated.

5.3 Methylene chloride, hexane, benzene, petroleum ether, methanol, tetradecane, pesticide quality or equivalent.

5.4 Prepare stock standard solutions of TCDD and ^{13}C -TCDD (molecular weight 328) in a glove box. The stock solutions are stored in a glovebox, and checked frequently for signs of degradation or evaporation, especially just prior to the preparation of working standards.

5.5 Alumina-basis, Woelm; 60/200 mesh. Before use activate overnight at 600°C , cool to room temperature in a desiccator.

5.6 Prepurified nitrogen gas

6. Calibration

6.1 Before using any cleanup procedure, the analyst must process a series of calibration standards through the procedure to validate elution patterns and the absence of interferences from reagents.

6.2 Prepare GC/MS calibration standards for the internal standard technique that will allow for measurement of relative response factors of at least three CDD/ ^{13}C -CDD ratios. Thus, for TCDDs, at least three TCDD/ ^{13}C -TCDD and TCDF/ ^{13}C -TCDF must be determined.^a The ^{13}C -TCDD/F concentration

^a ^{13}C -labeled 2,3,7,8-TCDD and 2,3,7,8-TCDF are available from K.L.B. Inc., and Cambridge

¹ This method is appropriate for the analysis of tetrachloro-, pentachloro-, and hexachlorodibenzo-p-dioxins and dibenzofurans.

² Analytical protocol for determination of TCDDs in phenolic chemical wastes and soil samples obtained from the proximity of chemical dumps. T.O. Tiersman and M. Taylor, Brehm Laboratory, Wright State University, Dayton, OH 45433.

³ Analytical protocol for determination of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans in river water. T.O. Tiersman and M. Taylor, Brehm Laboratory, Wright State University, Dayton, OH 45433.

⁴ In general, the techniques that should be used to handle these materials are those which are followed for radioactive or infectious laboratory materials. Assistance in evaluating laboratory practices may be obtained from industrial hygienists and persons specializing in safe laboratory practices. Typical infectious waste incinerators are probably not satisfactory devices for disposal of materials highly contaminated with CDDs or CDFs. Safety instructions are outlined in EPA Test Method 813/4.01.

See also 3) "Program for monitoring potential contamination in the laboratory following the handling and analysis of chlorinated dibenzo-p-dioxins and dibenzofurans" by F. D. Hileman et al. in Human and Environmental Risks of Chlorinated Dioxins and Related Compounds, R.E. Tschert, et al. eds., Plenum Publishing Corp., 1983. 2) Safety procedures outlined in EPA Method 813. Federal Register volume 44, No. 221, December 2, 1979.

in the standard should be fixed and selected to yield a reproducible response at the most sensitive setting of the mass spectrometer. Response factors for PCDD and HxCDD may be determined by measuring the response of the tetrachloro-labelled compounds relative to that of the unlabelled 1,2,3,4- or 2,3,7,8-TCDD, 1,2,3,4,7,8-PCDD or 1,2,3,4,7,8-HxCDD, which are commercially available.*

6.3 Assemble the necessary GC/MS apparatus and establish operating parameters equivalent to those indicated in Section 11.1 of this method. Calibrate the GC/MS system according to Eichelberger, et al. (1973) by the use of decafluorotriphenyl phosphine (DFTFP). By injecting calibration standards, establish the response factors for CDDs vs. ¹²C₁-TCDD, and for CDFs vs. ¹²C₁-TCDF. The detection limit provided in Table 1 should be verified by injecting .015 ng of ¹²C₁-TCDD which should give a minimum signal to noise ratio of 3 to 1 at mass 328.

7. Quality Control

7.1 Before processing any samples, the analyst should demonstrate through the analysis of a distilled water method blank, that all glassware and reagents are interference-free. Each time a set of samples is extracted, or there is a change in reagents, a method blank should be processed as a safeguard against laboratory contamination.

7.2 Standard quality assurance practices must be used with this method. Field replicates must be collected to measure the precision of the sampling technique. Laboratory replicates must be analyzed to establish the precision of the analysis. Fortified samples must be analyzed to establish the accuracy of the analysis.

8. Sample Collection, Preservation, and Handling

8.1 Grab and composite samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prewashed with sample before collection. Composite samples should be collected in glass containers in accordance with the requirements of the RCRA program. Sampling equipment must be free of tygon and other potential sources of contamination.

8.2 The samples must be iced or refrigerated from the time of collection until extraction. Chemical preservatives should not be used in the field unless more than 24 hours will elapse before delivery to the laboratory. If an aqueous sample is taken and the sample will not be extracted within 48 hours of collection, the sample should be adjusted to a pH range of 6.0-8.0 with sodium hydroxide or sulfuric acid.

Isotopes, Inc., Cambridge, MA. Proper standardization requires the use of a specific labelled isomer for each compound to be determined. However, the early labelled isomers readily available are ¹²C₁-2,3,7,8-TCDD and ¹²C₁-1,2,3,4-TCDF. This method therefore uses these isomers as surrogates for the CDDs and CDFs. When other labelled CDDs and CDFs are available, their use will be required.

* This procedure is adopted because standards are not available for most of the CDDs and CDFs, and assumes that all the compounds will show the same response as the unlabelled compound used as a standard. Although this assumption may not be true in all cases, the error will be small.

8.3 All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

9. Extraction and Cleanup Procedures

9.1 Use an aliquot of 1-10 g sample of the chemical waste or soil to be analyzed. Soils should be dried using a stream of prepurified nitrogen and pulverized in a ball-mill or similar device. Perform this operation in a clear area with proper hood space. Transfer the sample to a tared 125 ml flint glass bottle (Teflon-lined screw cap) and determine the weight of the sample. Add an appropriate quantity of ¹²C₁-labelled 2,3,7,8-TCDD (adjust the quantity according to the required minimum detectable concentration), which is employed as an internal standard.

9.2 Extraction

9.2.1 Extract chemical waste samples by adding 10 ml methanol, 40 ml petroleum ether, 50 ml doubly distilled water, and then shaking the mixture for 2 minutes. Tare should be completely dissolved in any of the recommended neat solvents. Activated carbon samples must be extracted with benzene using method 3540 in SW-846 (Test Methods for Evaluating Solid Waste—Physical/Chemical Methods, available from G.P.O. Stock #055-022-81001-2). Quantitatively transfer the organic extract or dissolved sample to a clean 250 ml flint glass bottle (Teflon lined screw cap), add 50 ml doubly distilled water and shake for 2 minutes. Discard the aqueous layer and proceed with Step 9.3.

9.2.2 Extract soil samples by adding 40 ml of petroleum ether to the sample, and then shaking for 20 minutes. Quantitatively transfer the organic extract to a clean 250 ml flint glass bottle (Teflon-lined screw cap), add 50 ml doubly distilled water and shake for 2 minutes. Discard the aqueous layer and proceed with Step 9.3.

9.3 Wash the organic layer with 50 ml of 20% aqueous potassium hydroxide by shaking for 10 minutes and then remove and discard the aqueous layer.

9.4 Wash the organic layer with 50 ml of doubly distilled water by shaking for 2 minutes, and discard the aqueous layer.

9.5 Cautiously add 50 ml concentrated sulfuric acid and shake for 10 minutes. Allow the mixture to stand until layers separate (approximately 10 minutes), and remove and discard the acid layer. Repeat acid washing until no color is visible in the acid layer.

9.6 Add 50 ml of doubly distilled water to the organic extract and shake for 2 minutes. Remove and discard the aqueous layer and dry the organic layer by adding 10g of anhydrous sodium sulfate.

9.7 Concentrate the extract to incipient dryness by heating in a 35° C water bath and simultaneously flowing a stream of prepurified nitrogen over the extract. Quantitatively transfer the residue to an alumina microcolumn fabricated as follows:

9.7.1 Cut off the top section of a 10 ml disposable Pyrex pipette at the 4.0 ml mark and insert a plug of silanized glass wool into the tip of the lower portion of the pipette.

9.7.2 Add 2.0g of Woelm basic alumina (previously activated at 600° C overnight and then cooled to room temperature in a desiccator) just prior to use.

9.7.3 Transfer sample extract with a small volume of methylene chloride.

9.8 Elute the microcolumn with 10 ml of 3% methylene chloride-in-hexane followed by 15 ml of 30% methylene chloride-in-hexane and discard these effluents. Elute the column with 15 ml of 50% methylene chloride-in-hexane and concentrate this effluent (35° C water bath, stream of prepurified nitrogen) to about 0.3-0.5 ml.

9.9 Quantitatively transfer the residue (using methylene chloride to rinse the container) to a silanized React-Vial (Pierce Chemical Co.). Evaporate, using a stream of prepurified nitrogen, almost to dryness, rinse the walls of the vessel with approximately 0.5 ml methylene chloride, evaporate just to dryness, and tightly cap the vial. Store the vial at 5° C until analysis, at which time the sample is reconstituted by the addition of tridecane.

9.10 Approximately 1 hour before GC-MS (HRGC-LRMS) analysis, dilute the residue in the micro-reaction vessel with an appropriate quantity of tridecane. Gently swirl the tridecane on the lower portion of the vessel to ensure dissolution of the CDDs and CDFs. Analyze a sample by GC/EC to provide insight into the complexity of the problem, and to determine the manner in which the mass spectrometer should be used. Inject an appropriate aliquot of the sample into the GC-MS instrument, using a syringe.

9.11 If, upon preliminary GC-MS analysis, the sample appears to contain interfering substances which obscure the analyses for CDDs and CDFs, high performance liquid chromatographic (HPLC) cleanup of the extract is accomplished, prior to further GC-MS analysis.

10. HPLC Cleanup Procedure¹

10.1 Place approximately 2 ml of hexane in a 50 ml flint glass sample bottle fitted with a Teflon-lined cap.

10.2 At the appropriate retention time, position sample bottle to collect the required fraction.

10.3 Add 2 ml of 5% (w/v) sodium carbonate to the sample fraction collected and shake for one minute.

10.4 Quantitatively remove the hexane layer (top layer) and transfer to a micro-reaction vessel.

10.5 Concentrate the fraction to dryness and retain for further analysis.

11. GC/MS Analysis

11.1 The following column conditions are recommended: Glass capillary column conditions: SP-2250 coated on a 30 m long x 0.25 mm I.D. glass column (Sapelo No. 2-3714, or equivalent) with helium carrier gas at 30 cm/sec linear velocity, run splitless. Column temperature is 210° C. Under these conditions the retention time for TCDDs is about 9.5 minutes. Calibrate the system daily with a minimum, three injections of standard mixtures.

11.2 Calculate response factors for standards relative to ¹²C₁-TCDD/F (see Section 12).

11.3 Analyze samples with selected ion monitoring of at least two ions from Table 1.

¹ For cleanup see also method 8430B in section SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (1982).

Proof of the presence of CDD or CDF exists if the following conditions are met:

11.2.1 The retention time of the peak in the sample must match that in the standard, within the performance specifications of the analytical system.

11.2.2 The ratio of ions must agree within 10% with that of the standard.

11.2.3 The retention time of the peak maximum for the ions of interest must exactly match that of the peak.

11.4 Quantitate the CDD and CDF peaks from the response relative to the ¹²C₁₂-TCDD/F internal standards. Recovery of the internal standard should be greater than 50 percent.

11.5 If a response is obtained for the appropriate set of ions, but is outside the expected ratio, a co-eluting impurity may be suspected. In this case, another set of ions characteristic of the CDD/CDF molecules should be analyzed. For TCDD a good choice of ions is m/e 257 and m/e 259. For TCDF a good choice of ions is m/e 241 and 243. These ions are useful in characterizing the molecular structure to TCDD or TCDF. For analysis of TCDD good analytical technique would require using all four ions, m/e 257, 320, 322, and 328, to verify detection and signal to noise ratio of 3 to 1. Suspected impurities such as ODE, DDD, or PCB residues can be confirmed by checking for their major fragments. These materials can be removed by the cleanup column. Failure to meet criteria should be explained in the report, or the sample reanalyzed.

11.6 If broad background interference restricts the sensitivity of the GC/MS analysis, the analyst should employ cleanup procedures and reanalyze by GC/MS. See section 10.6.

11.7 In those circumstances where these procedures do not yield a definitive conclusion, the use of high resolution mass spectrometry is suggested.

12. Calculations

12.1 Determine the concentration of individual compounds according to the formula:

$$\text{Concentration, } \mu\text{g/gm} = \frac{A \times A_s}{G \times A_s \times R_s}$$

where:

A = μg of internal standard added to the sample *

G = gm of sample extracted

A_s = area of characteristic ion of the compound being quantified.

A_s = area of characteristic ion of the internal standard

R_s = response factor *

*The proper amount of standard to be used is determined from the calibration curve (See Section 8.2).

*If standards for PCDDs/Fs and HxCDDs/Fs are not available, response factors for ions derived from these congeners are calculated relative to ¹²C₁₂-TCDD/F. The analyst may use response factors for 1,2,3,4- or 1,2,3,6-TCDD, 1,2,3,6,7-PeCDD, or 1,2,3,4,7,8-HxCDD for quantitation of TCDDs/Fs, PCDDs/Fs and HxCDDs/Fs, respectively. Implicit in this requirement is the assumption that the same response is obtained from PCDDs/Fs containing the same numbers of chlorine atoms.

Response factors are calculated using data obtained from the analysis of standards according to the formula:

$$R_i = \frac{A_i \times C_s}{A_s \times C_i}$$

where:

C_i = concentration of the internal standard
C_s = concentration of the standard compound

12.2 Report results in micrograms per gram without correction for recovery data. When duplicate and spiked samples are analyzed, all data obtained should be reported.

12.3 Accuracy and Precision. No data are available at this time.

TABLE 1.—GAS CHROMATOGRAPHY OF TCDD

Column	Retention time (min.)	Detection limit (pg/mg)
Class capillary	9.5	0.003

TABLE 3.—LIST OF ACCURATE MASSES MONITORED USING GC SELECTED-ION MONITORING, LOW RESOLUTION, MASS SPECTROMETRY FOR SIMULTANEOUS DETERMINATION OF TETRA-, PENTA-, AND HEXACHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURANS

Class of chlorinated dibenzo-p-dioxins or dibenzofurans	Number of accurate masses (m/z)	Monitored m/z for dibenzo-p-dioxins	Monitored m/z for dibenzofurans	Accuracy (ppm) based on relative abundance
Tetra-	4	179.007 221.004 227.005 256.023	183.002 225.003 231.004	0.74 1.00
Penta-	5	254.030 252.004 253.005	237.002 238.000	0.29 0.17
Hexa-	6	268.016 261.013	273.021 275.018	1.00 0.87

* Molecular ion peak.

* Calculated standard mass.

* Ions which can be monitored in TCDD analyses for confirmation purposes.

PART 264—STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

12. The authority citation for Part 264 reads as follows:

Authority: Secs. 1008, 2002(e), 3004, and 3005 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6905, 6912(a), 6924, and 6925).

13. In Subpart I of Part 264, the introductory text in paragraph (c) is revised and a new paragraph (d) is added to § 264.173:

§ 264.173 Containment.

(c) Storage areas that store containers holding only wastes that do not contain

free liquids need not have a containment system defined by paragraph (b) of this section, except as provided by paragraph (d) of this section or provided that:

(d) Storage areas that store containers holding the wastes listed below that do not contain free liquids must have a containment system defined by paragraph (b) of this section:

(1) FO20, FO21, FO22, FO23, FO24, and FO27.

(2) [Reserved]

14. In Subpart J of Part 264, amend § 264.194 by redesignating paragraph (c) as paragraph (c)(1), and adding a new paragraph (c)(2):

§ 264.194 Inspections.

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(2) [Reserved]

(c)(1) . . .

(2) For EPA Hazardous Wastes Nos. FO20, FO21, FO22, FO23, FO24, and FO27, the contingency plan must also include the procedures for responding to a spill or leak of these wastes from tanks into the containment system. These procedures shall include measures for immediate removal of the waste from the system and replacement or repair of the leaking tank.

15. In Subpart J of Part 264, add the following § 264.200:

§ 264.200 Special requirements for hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(a) In addition to the other requirements of Subpart J, the following requirements apply to tanks storing or treating hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(1) Tanks must have systems designed and operated to detect and adequately contain spills or leaks. The design and operation of any containment system must reflect consideration of all relevant factors, including:

- (i) Capacity of the tank;
- (ii) Volumes and characteristics of wastes stored or treated in the tank;
- (iii) Method of collection of spills or leaks;
- (iv) The design and construction materials of the tank and containment system; and
- (v) The need to prevent precipitation and run-on from entering into the system.

(2) As part of the contingency plan required by Subpart D of Part 264, the owner or operator must specify such procedures for responding to a spill or leak from the tank into the containment system as may be necessary to protect human health and the environment. These procedures shall include measures for immediate removal of the waste from the system and replacement or repair of the leaking tank.

16. In Subpart K of Part 264, add the following section § 264.231:

§ 264.231 Special requirements for hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(a) Hazardous Wastes FO20, FO21, FO22, FO23, FO24, and FO27 must not be placed in a surface impoundment unless the owner or operator operates the surface impoundment in accordance with a management plan for these wastes that is approved by the Regional Administrator pursuant to the standards set out in this paragraph, and in accord with all other applicable requirements of this Part. The factors to be considered are:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

(b) The Regional Administrator may determine that additional design, operating, and monitoring requirements are necessary for surface impoundments managing hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27 in order to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

17. In Subpart L of Part 264, add the following section § 264.259:

§ 264.259 Special requirements for hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(a) Hazardous Wastes FO20, FO21, FO22, FO23, FO24, and FO27 must not be placed in waste piles that are not enclosed (as defined in § 264.250(c)) unless the owner or operator operates the waste pile in accordance with a management plan for these wastes that is approved by the Regional Administrator pursuant to the standards set out in this paragraph, and in accord with all other applicable requirements of this Part. The factors to be considered are:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

(b) The Regional Administrator may determine that additional design, operating, and monitoring requirements are necessary for piles managing hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27 in order to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

18. In Subpart M of Part 264, add the following section § 264.283:

§ 264.283 Special requirements for hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(a) Hazardous Wastes FO20, FO21, FO22, FO23, FO24, and FO27 must not be placed in a land treatment unit unless the owner or operator operates the facility in accordance with a management plan for these wastes that is approved by the Regional Administrator pursuant to the standards set out in this paragraph, and in accord with all other applicable requirements of this Part. The factors to be considered are:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

(b) The Regional Administrator may determine that additional design, operating, and monitoring requirements are necessary for land treatment facilities managing hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27 in order to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

19. In Subpart N of Part 264, add the following section § 264.317:

§ 264.317 Special requirements for hazardous wastes FO20, FO21, FO22, FO23, FO24, and FO27.

(a) Hazardous Wastes FO20, FO21, FO22, FO23, FO24, and FO27 must not be placed in a landfill unless the owner or operator operates the landfill in accord with a management plan for these wastes that is approved by the Regional Administrator pursuant to the standards set out in this paragraph, and in accord with all other applicable requirements of this Part. The factors to be considered are:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through the soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring requirements.

(b) The Regional Administrator may determine that additional design, operating, and monitoring requirements are necessary for landfills managing hazardous wastes FO20, FO21, FO22, FO23, FO28, and FO27 in order to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

20. In Subpart O of Part 264, amend § 264.343 by revising paragraph (a) and redesignating paragraph (a) as paragraph (a)(1), and adding a new paragraph (a)(2) to read as follows:

§ 264.343 Performance standards.

(a)(1) Except as provided in paragraph (a)(2), an incinerator burning hazardous waste must achieve a destruction and removal efficiency (DRE) of 99.99% for each principal organic hazardous constituent (POHC) designated (under § 264.342) in its permit for each waste feed. DRE is determined for each POHC from the following equation:

$$DRE = \frac{(W_{in} - W_{out})}{W_{in}} \times 100\%$$

where:

W_{in} = mass feed rate of one principal organic hazardous constituent (POHC) in the waste stream feeding the incinerator

and

W_{out} = mass emission rate of the same POHC present in exhaust emissions prior to release to the atmosphere.

(2) An incinerator burning hazardous wastes FO20, FO21, FO22, FO23, FO28, or FO27 must achieve a destruction and removal efficiency (DRE) of 99.9999% for each principal organic hazardous constituent (POHC) designated (under § 264.342) in its permit. This performance must be demonstrated on POHCs that are more difficult to incinerate than tetra-, penta-, and hexachlorodibenzo-p-dioxins and dibenzofurans. DRE is determined for each POHC from the equation in § 264.343(a)(1). In addition, the owner or operator of the incinerator must notify the Regional Administrator of his intent to incinerate hazardous wastes FO20, FO21, FO22, FO23, FO28, or FO27.

PART 265—INTERIM STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

21. The authority citation for Part 265 reads as follows:

Authority: Secs. 1006, 2002(a), 3004, and 3005 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6903, 6912(a), 6921, and 6925).

22. § 265.1 is amended by adding paragraph (d).

§ 265.1 Purpose, scope, and applicability.

(d) The following hazardous wastes, subject to regulation under this Part:

(1) EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO28, or FO27 unless:

(i) The wastewater treatment sludge is generated in a surface impoundment or part of the plant's wastewater treatment system;

(ii) The waste is stored in tanks or containers;

(iii) The waste is stored or treated in waste piles that meet the requirements of § 264.250(c) as well as all other applicable requirements of Subpart I, of this Part;

(iv) The waste is burned in incinerators that are certified pursuant to the standards and procedures in § 265.352; or

(v) The waste is burned in facilities that thermally treat the waste in a device other than an incinerator and that are certified pursuant to the standards and procedures in § 265.363.

23. In Subpart O of Part 265, add the following § 265.352:

§ 265.352 Interim Status Incinerators Burning Particular Hazardous Wastes.

(a) Owners or operators of incinerators subject to this Subpart may burn EPA Hazardous Wastes FO20, FO21, FO22, FO23, FO28, or FO27 if they receive a certification from the Assistant Administrator for Solid Waste and Emergency Response that they can meet the performance standards of Subpart O of Part 264 when they burn these wastes.

(b) The following standards and procedures will be used in determining whether to certify an incinerator:

(1) The owner or operator will submit an application to the Assistant Administrator for Solid Waste and Emergency Response containing applicable information in §§ 270.19 and 270.62 demonstrating that the incinerator can meet the performance

standards in Subpart O of Part 264 when they burn these wastes.

(2) The Assistant Administrator for Solid Waste and Emergency Response will issue a tentative decision as to whether the incinerator can meet the performance standards in Subpart O of Part 264. Notification of this tentative decision will be provided by newspaper advertisement and radio broadcast in the jurisdiction where the incinerator is located. The Assistant Administrator for Solid Waste and Emergency Response will accept comment on the tentative decision for 60 days. The Assistant Administrator for Solid Waste and Emergency Response also may hold a public hearing upon request or at his discretion.

(3) After the close of the public comment period, the Assistant Administrator for Solid Waste and Emergency Response will issue a decision whether or not to certify the incinerator.

24. In Subpart P of Part 265, add the following § 265.363:

§ 265.363 Interim Status Thermal Treatment Devices Burning Particular Hazardous Wastes.

(a) Owners or operators of thermal treatment devices subject to this Subpart may burn EPA Hazardous Wastes FO20, FO21, FO22, FO23, FO28, or FO27 if they receive a certification from the Assistant Administrator for Solid Waste and Emergency Response that they can meet the performance standards of Subpart O of Part 264 when they burn these wastes.

(b) The following standards and procedures will be used in determining whether to certify a thermal treatment unit:

(1) The owner or operator will submit an application to the Assistant Administrator for Solid Waste and Emergency Response containing the applicable information in §§ 270.19 and 270.62 demonstrating that the thermal treatment unit can meet the performance standard in Subpart O of Part 264 when they burn these wastes.

(2) The Assistant Administrator for Solid Waste and Emergency Response will issue a tentative decision as to whether the thermal treatment unit can meet the performance standards in Subpart O of Part 264. Notification of this tentative decision will be provided by newspaper advertisement and radio broadcast in the jurisdiction where the thermal treatment device is located. The Assistant Administrator for Solid Waste and Emergency Response will accept comment on the tentative decision for 60 days. The Assistant Administrator for

Solid Waste and Emergency Response also may hold a public hearing upon request or at his discretion.

(3) After the close of the public comment period, the Assistant Administrator for Solid Waste and Emergency Response will issue a decision whether or not to certify the thermal treatment unit.

PART 270—EPA ADMINISTERED PERMIT PROGRAMS: THE HAZARDOUS WASTE PERMIT PROGRAM

23. The authority citation for Part 270 reads as follows:

Authority: Secs. 1008, 2002(a), 3005, 3007, and 7004 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6905, 6912(a), 6923, 6927, and 6974).

26. In Subpart B of Part 270, paragraph (b)(7) of § 270.14 is revised to read as follows:

§ 270.14 Contents of Part B: General requirements.

(b) * * *

(7) A copy of the contingency plan required by Part 264, Subpart D. Note: Include, where applicable, as part of the contingency plan, specific requirements in §§ 264.227, 264.255, and 264.200.

27. In Subpart B of Part 270, § 270.18 is amended by adding paragraph (g):

§ 270.18 Specific Part B information requirements for tanks.

(g) Where applicable, a description of the containment and detection systems to demonstrate compliance with § 264.200(a) must include at least the following:

(1) Drawings and a description of the basic design parameters, dimensions, and materials of construction of the containment system.

(2) Capacity of the containment system relative to the design capacity of the tank(s) within the system.

(3) Description of the system to detect leaks and spills, and how precipitation and run-on will be prevented from entering into the detection system.

28. In Subpart B of Part 270, § 270.17 is amended by adding paragraph (j):

§ 270.17 Specific Part B information requirements for surface impoundments.

(j) A waste management plan for EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO26, and FO27 describing how the surface impoundment is or will be designed, constructed, operated, and maintained to meet the requirements of § 264.231. This submission must address the following items as specified in § 264.231:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

29. In Subpart B of Part 270, § 270.18 is amended by adding paragraph (j):

§ 270.18 Specific Part B information requirements for waste piles.

(j) A waste management plan for EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO26, and FO27 describing how a waste pile that is not enclosed (as defined in § 264.250(c)) is or will be designed, constructed, operated, and maintained to meet the requirements of § 264.259. This submission must address the following items as specified in § 264.259:

(1) The volume, physical, and chemical characteristics of the wastes to be disposed in the waste pile, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

30. In Subpart B of Part 270, § 270.20 is amended by adding paragraph (i):

§ 270.20 Specific Part B information requirements for land treatment facilities.

(i) A waste management plan for EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO26, and FO27 describing

how a land treatment facility is or will be designed, constructed, operated, and maintained to meet the requirement § 264.283. This submission must address the following items as specified in § 264.283:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

31. In Subpart B of Part 270, § 270.21 is amended by adding paragraph (j):

§ 270.21 Specific Part B information requirements for landfills.

(j) A waste management plan for EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO26, and FO27 describing how a landfill is or will be designed, constructed, operated, and maintained to meet the requirements of § 264.317. This submission must address the following items as specified in § 264.317:

(1) The volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) The attenuative properties of underlying and surrounding soils or other materials;

(3) The mobilizing properties of other materials co-disposed with these wastes; and

(4) The effectiveness of additional treatment, design, or monitoring techniques.

PART 775—STORAGE AND DISPOSAL OF WASTE MATERIAL [REMOVED]

32. The authority citation for Part 775 reads as follows:

Authority: Sec. 6 of the Toxic Substances Control Act (TSCA) Pub. L. 94-469, 90 Stat. 2020 (15 U.S.C. 2605).

33. Part 775 is removed.

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CHLORINATED DIOXINS WORKGROUP POSITION DOCUMENT
April, 1985

INTERIM RISK ASSESSMENT PROCEDURES FOR MIXTURES OF CHLORINATED DIOXINS
AND -DIBENZOFURANS (CDDs and CDFs)*

I. Summary

EPA increasingly is confronted with the need to determine the risks inherent in exposure to materials such as soot, incinerator flyash, industrial wastes, and soils. Exposure to these materials often involves the potential for exposure to a mixture of chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzofurans (CDFs). Recognizing that there is much to learn about these chemicals, the Chlorinated Dioxins Work Group (CDWG) is proposing an interim method for assessing the human health risks posed by mixtures of CDDs/CDFs.

The CDWG has discussed several approaches for making such assessments and has concluded that a direct biological assessment of the toxicity of complex mixtures of CDDs/CDFs is preferred. Therefore, research to develop appropriate methods of this type should be supported. In the interim, however, the CDWG believes that a reasonable estimate of the toxic risks can be made by taking into account the distribution of CDD/CDF congeners or homologues that are estimated to have the greatest toxic potential. This document describes the recommended procedure for generating the "2,3,7,8-TCDD equivalents" of complex mixtures of CDDs/CDFs, based upon congener- or homologue-specific data and for using such information in assessing risk.

* Refer to Appendix for precise nomenclature used in this paper.

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The recommendations are summarized in the right most column in Table III.

The CDWG acknowledges that this procedure is not based on a thoroughly established scientific foundation. It represents a consensus recommendation on science policy. Consequently, assessors and risk managers are urged to use informed discretion when deciding to what situations the procedure can be appropriately applied.

II. The Need for a Procedure for Assessing the Risk Associated with Exposure to Complex Mixtures of CDDs/CDFs

During the late 1970s, the Agency was faced with assessing the human health significance of exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). In preparation for the cancellation hearings for the herbicides 2,4,5-trichlorophenoxyacetic acid and silvex, the Agency generated risk assessments for several toxic responses for 2,3,7,8-TCDD. The quantitative cancer risk assessment produced by the Cancer Assessment Group was later adapted for use in the Water Quality Criteria (WQC) Document for 2,3,7,8-TCDD. In addition to carcinogenicity concerns, the WQC contains an assessment of systemic toxicity, based on reproductive effects produced by 2,3,7,8-TCDD. The Agency's concern for CDDs and CDFs has expanded more recently. For example, the current draft of the Health Assessment Document prepared for the Air Program contains a quantitative risk assessment for a mixture of hexachlorodibenzo-p-dioxins (HxCDDs), based upon carcinogenicity studies conducted by the National Cancer Institute.

However, as early as the late 1970s, it became clear that exposure situations existed in the country which involved more than simply

2,3,7,8-TCDD. Specifically, data on emissions from combustion sources (e.g., hazardous waste and municipal waste incinerators) and contents of waste from certain industrial production processes indicated that the majority of the 75 CDDs and 135 CDFs can be detected in the environment.

Given the high potency and strong structure-activity relationships exhibited in in vivo and in vitro studies of CDDs and CDFs, the CDWG recognizes that the potential risks posed by the congeners other than 2,3,7,8-TCDD need to be addressed.* Detailed consideration of the toxicity of the vast majority of the CDDs/CDFs is limited by the lack of toxicology studies on most of the congeners. Further, it is unlikely that many expensive long-term test results will be available soon. For example, research on 2,3,7,8-TCDD has been underway for more than two decades at an estimated cost in the hundreds of millions of dollars. Although this chemical has been investigated to a much greater extent than any of the other CDDs/CDFs, unanswered questions remain. As noted below, the CDWG believes that it would be unwise, uneconomical and unnecessary to conduct such extensive testing on each of the CDD/CDF congeners prior to conducting an assessment of their risks.*

* In the early 1980s, the Agency developed an approximate method for assessing the risks of the emission of CDDs/CDFs associated with the high temperature incineration of PCBs and combustion of municipal waste (USEPA, 1980; USEPA, 1981); cf. Table III. The procedure presented in this document is a refinement of that approach.

III. Approaches to Hazard Assessment for CDD/CDF Mixtures

A. Overview.

1. Preferred Practical Approach -- Toxicity Assay of Mixtures

In the first instance, an assessment of the toxicity of a mixture of chemicals is best accomplished by direct evaluation of its toxic effects, e.g., by determining the effects of chronic exposure in an experimental animal. Such an assessment is time consuming and costly and would theoretically have to be performed for each of the many mixtures of environmental importance. Therefore, this idealized approach is not likely to be achieved in the near future.

An alternative, practical approach to hazard assessment of a mixture is an assay that indirectly provides a measure of the mixture's potential toxicity. In the case of mixtures containing CDDs and CDFs, short term assays are under development that directly determine the 2,3,7,8-TCDD-like response which can be used as a measure of the toxicity of the mixture as a whole. Such assays, which take advantage of the similar toxic manifestations induced by CDDs and CDFs, have been used to assess the potential health hazards of exposure to CDD/CDF-contaminated soot from PCB fires (Eaton, 1982; Gierthy, 1984; Gravitz, 1983), and predicting the potential toxicity of incinerator flyash (Sawyer, 1983). The development of such "mixture assays" is progressing rapidly. While additional work is required to more fully validate the assay findings for specific toxic endpoints, especially chronic effects, data have been presented that indicate

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correlations with subchronic effects of CDDs/CDFs (Safe, 1984). The CDWG recognizes the importance of this approach in implementing its regulatory strategy for 2,3,7,8-TCDD-like chemicals and encourages research in this area.

2. Alternative Approach -- Additivity of Toxicity of Components

In the absence of more fully developed "mixture assays", however, the CDWG recognizes the viability of a second approach to assessing the risk posed by a mixture of CDDs/CDFs. First, components in a mixture of CDDs and CDFs are identified and quantified. Then, the toxicity of the mixture is estimated by adding the toxicity contributed by each of its components.

In the case of most environmental mixtures, however, this method cannot be directly applied, since congener-specific analyses for the 75 CDDs and 135 CDFs potentially present in the mixture are seldom available. In addition, there is little information available on the toxic potency of most of these congeners. Therefore, this approach is not viable at this time and is not likely to be feasible in the near future.

3. An Interim Approach -- 2,3,7,8-TCDD Toxicity Equivalence Factors (TEFs)

The CDWG recognizes a third alternative for estimating the risks associated with exposure to complex mixtures of CDDs/CDFs. First, as in approach #2, information is obtained on the concentrations of homologues and/or congeners present in the mixture. Then, reasoning on the basis of structure-activity relations and results of short term tests, the toxicity of each of the components is estimated and expressed as an "equivalent amount of 2,3,7,8-TCDD". Combined with

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estimates of exposure and known toxicity information on 2,3,7,8-TCDD, the risks associated with the mixture of CDDs/CDFs can be assessed. Key to the approach are the 2,3,7,8-TCDD Toxicity Equivalence Factors (TEFs) which are derived in Section IV below.

The general approach of TEFs outlined here is not unique: several organizations have used similar approaches; cf. Table III.

The CDWG recommends that the TEF procedure be adopted as a matter of science policy on an interim basis. The approach will enable the Agency to deal with many, but not all, of its problems; e.g., which Superfund sites should be given administrative priority, to what extent a hazardous waste site should be cleaned up, which manufacturing wastes can be delisted as EPA hazardous wastes, and how to estimate the risks associated with the emission of CDDs/CDFs from combustion sources.

The remainder of this document discusses the TEF approach in greater detail, illustrates its use in risk assessment, and identifies additional research, the results of which would strengthen the basis of this interim approach.

IV. The 2,3,7,8-TCDD Toxicity Equivalence Factors (TEFs) Approach to Assessing the Toxicity of Complex Mixtures of CDDs/CDFs

2,3,7,8-TCDD is one of 75 CDDs. Exceptionally low doses of this compound elicit a wide range of toxic responses in many animals; e.g., adverse reproductive effects, thymic atrophy, and a "wasting syndrome" leading to death. EPA's Cancer Assessment Group (CAG) has determined that there is sufficient evidence to treat 2,3,7,8-TCDD qualitatively as a potential human carcinogen. The CAG quantitative assessment indicates that the chemical is the most potent animal carcinogen evaluated by the Agency to date. Limited data suggest that some of the 74 other CDDs may have similar toxic effects, again at low doses.

Moreover, these toxicity concerns are not restricted to CDDs. Limited experimental data, supplemented by strong structure/activity relationships in in vitro tests that are correlated with in vivo toxic effects of these compounds, indicate that some CDFs exhibit "2,3,7,8-TCDD-like" toxicity (Bandiera, 1984; Safe, 1984).

The cellular biochemical mechanisms leading to the toxic response resulting from exposure to CDDs and CDFs are not known in complete detail. However, over the last few years experimental data have accumulated which suggest that an important role is played by an intracellular protein, the Ah receptor. This receptor binds halogenated polycyclic aromatic molecules, including CDDs and CDFs. In animals, the binding of 2,3,7,8-TCDD-related compounds to this receptor has been correlated with the expression of several systemic toxic effects including sensitivity to acute toxic effects (LD₅₀ values), thymic involution, chloracne-like

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response, and the induction of several enzyme systems, some of which have been linked to carcinogenic pathways (Poland and Knutson, 1982; Bandiera et al., 1984).

Table I contains information on a variety of endpoints: acute toxicity, carcinogenicity, reproductive effects, receptor binding, enzyme induction, and in vitro cell transformations. The data are normalized to unity for 2,3,7,8-TCDD. For example, 2,3,7,8-substituted HxCDDs have about 5% the Ah receptor binding strength of 2,3,7,8-TCDD, they are about 70% as potent in the ability to induce the enzyme AHH; and their carcinogenic potency is about 4% that of 2,3,7,8-TCDD. For these effects the LOELs or NOELs for 2378-congeners are about one hundred-fold lower than those for the non-2378 congeners. Kociba (1984) has recently presented similar data.

The structure/activity generalizations based on the data in Table I bear out the generalizations in the literature concerning the congeners that are most likely to be of toxic concern (Poland, 1982; Gasiewicz, 1982; Bandiera et al., 1984). That is, congeners which are substituted in the lateral 2, 3, 7, and 8 positions are likely to exhibit toxic effects at lower doses than other congeners. This includes the fifteen tetra-, penta-, hexa- and heptachlorinated CDDs and CDFs listed in Table II.*

* The CDWG is aware that some investigators (e.g., Grant, 1977; Olie, 1982; Commoner, 1983; and Ontario, 1983) have broadly defined the congeners of concern to include all those tri- to hepta- congeners

which are substituted with at least three chlorines in the four lateral (2,3,7 and 8) positions. The CDWG has reviewed the toxicity data and does not find it to argue strongly for this extended range of concern. Further, the increased level of complexity invoked by including these additional congeners is to suggest a greater level of accuracy and resolution than the CDWG believes is warranted.

The CDWG is also aware that receptor binding data suggest a relatively high toxicity for 1,2,4,6,7-PeCDF. Examination of stereochemical models point out that the 4/6 positions on CDFs are arguably "more lateral" than the 2/8 positions (Bandiera et al, 1984). However, this increased receptor binding activity is not reflected in an increased potency of 1,2,4,6,7-PeCDF as an enzyme inducer (cf. Table I), an endpoint which has been shown to correlate with subchronic toxicity (Safe, 1984). Therefore, the CDWG is not treating 1,2,4,6,7-PeCDF as a "2378-congener" at this time; however, additional data could lead to a change in this position.

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The associated "2,3,7,8-TCDD equivalent factors" were assigned as follows. The relative carcinogenicity responses (Table I) for 2,3,7,8-TCDD and the mixture of two 2378-HxCDDs* provide the TEF for 2378-HxCDD. The relative toxicity of 2378-PeCDD was taken to be the root mean square of the 2378-TCDD and 2378-HxCDD values. The remaining assignments in Table II and Table III (righthand column) are based on a rough assessment of the data in Table I, subject to these constraints:

1. The CDFs are likely to be less toxic than their corresponding CDDs, based on comparative toxicity data of 2,3,7,8-TCDD and 2,3,7,8-TCDF in various species (Moore, et al, 1979).
2. As a matter of judgment, the CDWG believes that the uncertainties in the procedure limit discrimination of relative toxicity to order of magnitude estimates.

In the same vein, TEFs for the non-2378 isomers are assigned values which are 1% of the TEFs of the 2378-isomers in the same homologous group.

While it could be argued that the hepta- congeners are of lesser concern, the CDWG recognizes that in some mixtures the hepta congeners predominate; therefore, they are not entirely excluded.

The general approach of estimating relative toxicities discussed here has been taken by other groups in reaching decisions regarding risk. Table III lists the TEFs used by these other workers.

* Refer to Appendix for nomenclature

The TEFs assigned (except for the HxCDDs) do not rest on the results of long term animal studies. Generally, they are based on estimates of the relative toxicity in in vitro tests whose relationship to the chronic effects of concern is largely presumptive. However, experimental results continue to supplement the view that the short term assays are providing important fundamental information on the toxicity of the CDDs/CDFs. For example, for the higher chlorinated CDFs, induction of certain enzymes correlates rather well with thymic atrophy and body weight reduction noted in subchronic rat studies (Bandiera et al., 1984; Safe, 1984).

It should also be noted that the structure/activity relationships are not uniformly consistent and cannot be said to have established, at this point, a causal relationship between the Ah receptor and all forms of toxicity of CDDs and CDFs. For instance, it has recently been noted that the development of porphyria in mice does not correlate with Ah phenotype and that genes other than Ah influence the development of 2,3,7,8-TCDD-induced hepatotoxicity in mice (Greig, 1984).

In summary, in the view of the CDWG, there is a sufficient scientific support for the TEF approach to estimating risks associated with CDDs/CDFs that the Agency should adopt the approach, on an interim basis, as a matter of science policy.

V. Applications to Risk Assessment

In general, an assessment of the risk to human health of a mixture of CDDs and CDFs involves the following steps:

1. Analytical determination of CDDs and CDFs in the sample.
2. Multiplication of congener concentrations in the sample by the TEFs in Table III express the concentration in terms of 2,3,7,8-TCDD equivalents.
3. Summation of the products in step 2 to obtain the "2,3,7,8-TCDD equivalence" of the sample.
4. Determination of human exposure to the mixture in question, expressed in terms of equivalents of 2,3,7,8-TCDD.
5. Combination of exposure from step 4 with toxicity information on 2,3,7,8-TCDD (usually carcinogenicity and/or reproductive effects) to estimate risks associated with the mixture.

In cases in which the concentrations of the fifteen congeners of concern are known:

$$\begin{aligned} \text{2,3,7,8-TCDD Equivalents} = & \sum (\text{TEF of each 2378-CDD/CDF congener} \\ & \times \text{the concentration of the respective congener}) + \\ & \sum (\text{TEF of each non-2378 CDD/CDF congener} \\ & \times \text{the concentration of the respective congener}) \end{aligned}$$

samples of this calculation for several environmental mixtures are provided in Table IV.

In cases where only the concentration of homologous groups is known; i.e., no isomer-specific data are available, different approaches are possible. For example, the assumption that the 2378-congeners of concern constitute all of the CDDs and CDFs present in the mixture is likely to provide an upper bound estimate of the toxicity. Alternatively, one could assume that the occurrence of each of the congeners in the

mixture has equal probability (Olie, 1982; Commoner, 1982). For instance, 2,3,7,8-TCDD is one of 22 possible TCDDs and would constitute about 4% of a mixture of equally probable isomers. In other situations, particular knowledge of chemical reaction parameters, process conditions, and results from related studies, (e.g., congener distributions in emissions from combustion sources) might enable one to estimate the relative occurrence of 2378-congeners. However, one must be careful to explicitly explain and justify whatever assumptions are made.

The calculated "2,3,7,8-TCDD equivalents" can then be used to assess the health risk of a mixture. As an explicit example, consider a municipal solid waste (MSW) combustor whose particulate emissions, the CDD/CDF mixture in question, were exactly like the electrostatic precipitator (ESP) catch cited in columns 5 and 6 of Table IV. The sample is estimated to contain 28 ppb 2378-TCDD equivalents; i.e., 28 picograms of 2378-TCDD equivalents per milligram of mixture. Suppose that an exposure analysis indicates that a person living downwind from the incinerator receives an average daily dose of 1 ng of the mixture/kg body weight. This exposure estimate is combined with the upper bound carcinogenic potency of 2,3,7,8-TCDD (1.6×10^5 per mg/kg-day (U.S. EPA 1984)) to generate the upper 95% limit of the excess risk of developing cancer for a person living downwind from the facility emitting the mixture under consideration, assuming lifetime exposure:

Upper 95% limit of

$$\begin{aligned} \text{excess cancer risk} &= [\text{potency}] \times [\text{exposure}] \\ &= [1.6 \times 10^5 \text{ per mg TCDD/kg-day}] \times [28 \text{ pg TCDD/} \\ &\quad \text{mg mixture} \times 10^{-9} \text{ mg TCDD/pg TCDD} \times 1 \text{ ng} \\ &\quad \text{mixture/kg-day} \times 10^{-6} \text{ mg mixture/ng mixture}] \\ &= 10^{-9} \end{aligned}$$

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Use of the different assumptions regarding relative toxicities (see Table III) influence the calculation of 2,3,7,8-TCDD equivalents only slightly. For example, using analytical data from an Agency study on emissions from a particular municipal waste combustor (EPA 1984), the 2,3,7,8-TCDD equivalents calculated using the assumptions listed in Table III are generally within an order of magnitude.

VI. Comparison with Other Approaches to Determining 2,3,7,8-TCDD Equivalents

A limited number of in vivo and in vitro approaches have been employed in assessing the toxicity of complex mixtures of CDDs and CDFs. While the results from these attempts are not definitive, it is instructive to compare those results with the results from the TEF approach proposed here.

Fadon (1982) investigated the toxicity of CDD/CDF contaminated soot associated with a fire involving PCB containing electrical equipment. Using the results from acute in vivo toxicity (LD₅₀) studies in which the soot was the test substance, the researchers determined that the soot had the acute toxicity expected of material containing about 60 times the amount of 2,3,7,8-TCDD actually found by GC/MS analysis.

Table V illustrates the results of employing the TEF approach through three different procedures, each of which depends upon the results of GC/MS analysis of the soot. In the first instance (A, in Table V), the analytical data have been consolidated to totals with a homologous class. These concentrations are treated as if they consisted completely of 2378-members of the class and, therefore, are multiplied by the TEF appropriate for the 2378-members of the class. The resulting 2,3,7,8-TCDD equivalent estimate from this procedure is about 80.

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In procedure B, the assumption is made that the occurrence of each of the congeners in a homologous class is equally probable; e.g., the concentration of 2,3,7,8-TCDD is 1/22 (about 5%) of the concentration of the total TCDDs. This approach leads to an estimate of the total 2,3,7,8-TCDD equivalents of 8.

A rather unique data base exists in the case of the soot from this fire in that an extensive isomer-specific analysis of the sample is available (as cited in DesRosiers, 1984). Therefore, the full array of TEFs from Table III can be applied. This procedure (C in Table V) results in an estimate of roughly 40 for the total 2,3,7,8-TCDD equivalents in the sample.

As might be expected, the most conservative of these procedures, A, leads to the highest estimate. The fact that the approach, B, leads to a lower estimate than the isomer-specific results, C, reflects the fact that the 2378-congeners are present in somewhat higher than "equal probability" proportions. Given the complexity of the analysis involved, the approximate nature of the TEF method, and the vagaries of the bioassay, a major feature of note in Table V regarding the soot samples is that the results of procedures A, B, and C span a range of only one order of magnitude and bracket the bioassay estimate.

In a separate study, Sawyer et al. (1983) published results of homologue-specific CDD and CDF concentrations in flyash from four municipal solid waste combustors (MSW) which are amenable to treatment by the TEF methodology. In addition, extracts from the flyash samples were analyzed by three bioassay techniques (AHH induction, EROD induction, and receptor binding).

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These data, taken in toto, suggest that the TEF approach is likely to be a useful, interim tool for the rough estimation (1-2 orders of magnitude, of the toxicity of complex mixtures of CDDs and CDFs. Additional scrutiny should accompany the application of these particular TEF procedures (i.e., A,B or C) to any specific sample.

VII. Research Needs

As noted above, the CDWG recommends that research be conducted to develop bioassays that will directly assess the toxicity of complex mixtures of CDDs/CDFs. In addition, research should be conducted which will provide a firmer basis for the TEF approach and guide appropriate modifications thereof. This research should be aimed at

1. Validating and completing the entries in Table I.
2. Investigating additional short term assays which can test the mechanistic hypothesis which underlies the TEF approach; of Section IV.
3. Investigating correlations between the short term assays, longer term assays, and human health effects.

APPENDIX

The following terminology and abbreviations are used in this document:

1. The term "congener" refers to any one particular member of the same chemical family; e.g., there are 75 congeners of chlorinated dibenzo-p-dioxins.
2. The term "homologue" refers to a group of structurally related chemicals which have the same degree of chlorination. For example, there are eight homologues of CDDs, monochlorinated through octochlorinated.
3. The term "isomer" refers to substances which belong to the same homologous class. For example, there are 22 isomers that constitute the homologues of TCDDs.
4. A specific congener is denoted by unique chemical notation. For example, 2,4,8,9-tetrachlorodibenzofuran is referred to as 2,4,8,9-TCDF.
5. Notation for homologous classes is as follows:

Dibenzo-p-dioxin D

Dibenzofuran F

<u>No. of Halogens</u>	<u>Abbreviation</u>	<u>Example</u>
2	D	2,4-DCDD
3	Tr	
4	T	1,4,7,8-TCDD
5	Pe	
6	Hx	
7	Hp	
8	O	CDDs and CDFs
1 through 8	CDDs and CDFs	

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6. Dibenzo-p-dioxins and -dibenzofurans that are chlorinated at the 2,3,7 and 8 positions are denoted as 2378 congeners; e.g., 1,2,3,7,8-PeCDF and 2,3,4,7,8-PeCDF are both referred to as "2378-PeCDFs".

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TABLE I

POTENCIES OF DIOXINS RELATIVE TO 2,3,7,8-TCDD

CHEMICAL	QUINEA PIG CARCINO- GENICITY LD ₅₀ (ref)	REPROD. TER. EFFECTS (ref)	RECEPTOR BINDING (ref)	ENZYME INDUCTION AHH (ref)	CELL KERATIN. (ref)	PLAT (XB) CELL ASSAY (ref)
CODs:						
Mono thru tri	<10 ⁻⁴ (e)	--	.001-.01(e)	<.001(f)	--	.01(e)
2378-TCDD	1 (a)	1(c)	1(f)	1(e)	1(g)	1(j)
TCDDs	<.001(a)	<.001(k)	<.01-.16(e)	<.001-.02(g)	--	<.001-.01(e)
2378-PeCDD	.67 (a)	--	1(e)	.02-.2(g)	--	.5(e)
PeCDDs	.002(a)	--	--	<.001(g)	--	--
2378-HxCDDs	.03 (a)	.04(b)	.05(e)	.001-.1(g)	--	.005(e)
HxCDDs	--	--	--	<.001(g)	--	--
2378-HpCDDs	.004(a)	--	--	.002-.004(g,f)	--	--
HpCDDs	.002(a)	--	--	<.001(f)	--	--
OCDD	--	<.00001(k)	--	<.001(f)	--	--
CDFs:						
Mono thru tri	--	--	<.001-.02(d,h)	<.001(d)	<.001(d)	<.001(e)
2378-TCDF	.28;.5(a)	.03-.13(i,k)	.3/.25(e/h)	.01-.04(f,h)	.1(h)	.05(e)
TCDFs	--	--	.001-.05(d,e)	<.001(d)	<.005(d)	--
2378-PeCDF	--	--	.13/.7/.6(d/e/h)	<.3(d)	.1(d)	--
12467PeCDF	--	--	.15(h)	.002(h)	<.001(h)	--
PeCDFs	--	--	.001-.1(d,e)	<.001(d)	<.001(h)	--
2378-HxCDFs	.017(a)	--	.04-.5(e,h)	.05-.2(h)	.1-.5(h)	--
HxCDFs	--	--	.001(e,h)	.002(h)	.006(h)	--
2378HpCDFs	--	--	--	.004(g)	--	--
HpCDFs	--	--	<.001(h)	<.001(f)	--	--

a. McKinney and McConnell, 1982; b. USEPA 1984a; c. Murray et al., 1979; Schwetz et al., 1973; Weber et al., 1984; d. Bandiera et al., 1983; e. Knutson and Poland, 1980; f. Bradlaw et al., 1979; g. Bradlaw et al., 1980; h. Bandiera et al., 1984; i. Nassoun et al., 1984; j. Gierthy and Crane, 1985; k. Weber et al., 1984;

TABLE II
CDD/CDF ISOMERS OF MOST TOXIC CONCERN^{a/}

DIOXIN		DIBENZOFURAN	
Isomer	TEF ^{b/}	Isomer	TEF
2,3,7,8-TCDD	1	2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDD	0.2	1,2,3,7,8-PeCDF	0.1
		2,3,4,7,8-PeCDF	0.1
1,2,3,6,7,8-HxCDD	0.04	1,2,3,6,7,8-HxCDF	0.01
1,2,3,7,8,9-HxCDD	0.04	1,2,3,7,8,9-HxCDF	0.01
1,2,3,4,7,8-HxCDD	0.04	1,2,3,4,7,8-HxCDF	0.01
		2,3,4,6,7,8-HxCDF	0.01
1,2,3,4,6,7,8-HpCDD	0.001	1,2,3,4,6,7,8-HpCDF	0.001
		1,2,3,4,7,8,9-HpCDF	0.001

^{a/} In each homologous group the relative toxicity factor for the isomers not listed above is 1/100 of the value listed above.

^{b/} TEF = toxic equivalency factor = relative toxicity assigned.

TABLE III

SOME APPROACHES TO ESTIMATING RELATIVE TOXICITIES OF PCDDs and PCDFs

BASIS/ COMPOUND/	SWISS ^a	GRANT ^b OLIE ^c COMMONER ^d	NEW YORK STATE ^e	ONTARIO ^f	FDA ^g	CAL ^h	EPA ⁱ 1982	EPA Current Recommen.
(Basis)	enzyme		LD50	various effects	various effects			Carcin.
Mono and di	0	0	0	0	0	0	0	0
237-TCDD	0	0.1*	0	1*	0	0	0	0
other TCDDs	0	0	0	0	0	0	0	0
2378-TCDD	1	1*	1	1*	1	1	1	1
other TCDDs	0.01	0	0	0.01	0	0	1	0.01
2378-PeCDDs	0.1	0.1*	1	1*	-**	1	0	0.2
other PeCDDs	0.1	0	0	0.01	-**	0	0	0.002
2378-HxCDDs	0.1	0.1*	0.03	1*	0.02	1	0	0.04
other HxCDDs	0.1	0	0	0.01	0.02	0	0	0.0004
2378-HpCDDs	0.01	0.1*	0	1*	0.005	1	0	0.001
other HpCDDs	0.01	0	0	0.01	0.005	0	0	0.00001
OCDD	0	0	0	0	<0.00001	0	0	0
2378-TCDFs	0.1	0.1*	0.33	0.02*	0	1	0	0.1
other TCDFs	0.1	0	0	0.0002	0	0	0	0.001
2378-PeCDFs	0.1	0.1*	0.33	0.02*	0	1	0	0.1
other PeCDFs	0.1	0	0	0.0002	0	0	0	0.001
2378-HxCDFs	0.1	0.1*	0.01	0.02*	0	1	0	0.01
other HxCDFs	0.1	0	0	0.0002	0	0	0	0.0001
2378HpCDFs	0.1	0.1*	0	0.02*	0	1	0	0.001
other HpCDFs	0	0	0	0.0002	0	0	0	0.00001
OCDF	0	0	0	0	0	0	0	0

*: congeners with chlorine atoms at 3 of the 4 lateral positions.

**: these isomers were not considered.

a = Swiss government, 1982

b = Grant, 1977

c = Olie et al., 1982; 1983

d = Commoner, 1984

e = Eadon, 1982

f = Ontario, 1982

g = USDHHS, 1983

h = California, 1982

i = USEPA, 1981

TABLE IV
PCDDs/PCDFs IN SOME ENVIRONMENTAL SAMPLES

ISOMER	TEF	AIR PARTICS St. Louis Conc.	MSW ESP DUST 5 Conc. TCDD Eqts.	LAKE SEDIMENT 5 Conc. TCDD Eqts.	1982 MILORGANITE 4 Conc. TCDD Eqts.	MSW FLYASH 6 ONTARIO OSLO Conc. TCDD Eqts.
		(ppb)	(ppb)	(ppb)	(ppt)	(ppt)
TCDDs	1	0.2	5	0	206	541
PeCDDs	0.2	1	10	0.1	-	467
HxCDDs	0.04	1.2	160	0.34	110.7	93
HpCDDs	0.001	25	120	0.5	7600	591
OCDD	0	170	260	1.3	-	24
TCDFs	0.1	-	40	0.13	-	434
PeCDFs	0.1	-	80	0.14	-	467
HxCDFs	0.01	-	280	0.38	-	-
HpCDFs	0.001	-	160	1.13	-	-
OCDF	0	-	40	0.14	-	-
Total TCDD Eqts.		0.5	29	0.07	324	658
						4

1. USEPA 1984b.
2. Cooper Engineers, 1984.
3. Rappe, 1984.
4. Lamparski et al., 1984
5. Czuma and Hites, 1984.
6. Tong et al., 1984
7. des Rosiers, 1984.

TABLE IV (Continued)

THERMAL DEGRADATION PRODUCTS FROM DIELECTRIC FLUIDS 1				JAP. MSN ²		COMMERCIAL CPS		SOUT FROM PCB PCB FIRE ⁷	
ISOMER	TEF	Run 8-13-40	Run 8-30-61 ASKL	Pt. A TEF	Pt. B TEF	246TCP ³	PCP ³		
TCDDs		Conc. TCDD Eqts. (ng)	Conc. TCDD Eqts. (ugl)	Conc. TCDD Eqts. (lb/MMBTU)(x10 ⁻⁶)	Conc. TCDD Eqts. (ppm)	Conc. TCDD Eqts. (ppm)	Conc. TCDD Eqts. (ppm)	Conc. TCDD Eqts. (ppm)	Conc. TCDD Eqts. (ppm)
2378	1	0	0	0	0.1	0.1	0.58	0.58	<.1 -
other	0.01								0.6 0.6
PeCDDs									0.6 .01
2378	0.2	0	0	0	0.07	0.014	0.47	0.094	<.1 -
other	0.002								2.5 .5
HxCDDs									2.5 .01
2378	0.04	0	0	0	0.04	0.002	0.36	0.014	<.1 -
other	0.0004								1.1 .04
HpCDDs									3.6 0
2378	0.001	0	330	0.33	0.02	<.001	0.08	<.001	175 0.18
other	0.00001								3 0
OCDD	0	0	37	0	0.01	0	0.04	0	4 0
									2 -
TCDFs									
2378	0.1	690	69	1400	140	1.31	0.131	1.25	0.125
other	0.001								<.1 -
PeCDFs									12 1.2
2378	0.1	43	4.3	6400	640	0.38	0.038	0.46	0.046
other	0.001								16 .01
HxCDFs									358 35.8
2378	0.01	7	0.07	910	9.1	0.06	0.006	0.06	0.006
other	0.0001								312 .3
HpCDFs									670 6.7
2378	0.001	0	29	0.029	0.01	<.001	0.02	<.001	295 .03
other	0.00001								285 .29
OCDF	0	0	3.4	0	0.004	0	0.01	0	172 0
									40 -
Total TCDD Eqts.		73	789	0.3	0.87	5.5	0.3	45	

TABLE

ISOMER	TEF	PROP. FACTOR	PCB FIRE SOOT ^a (ppm)				MSW FLYASH (ppb) ^b			
			Conc.		TCDD Eqts.		SAMPLE 1		SAMPLE 2	
			AC	B	C	CD	Conc.	TCDD Eqts.	Conc.	TCDD Eqts.
							A	B	A	B
Total TCDDs	1	1	1.2	1.2			85	85	2.7	2.7
2378 TCDD	1	0.05	1.2		0.2	0.6	85			
other TCDDs	0.01	0.95	1.2		- e	-	85	4.3	2.7	0.1
Total PeCDDs	0.2	1	5.0	1.0			213	0.8	2.7	-
2378 PeCDDs	0.2	0.07	5.0		0.1	0.5	213	42.6	6.6	1.3
other PeCDDs	0.002	0.93	5.0		-	-	213	3.0	6.6	0.1
Total HxCDDs	0.04	1	4.7	0.2			213	0.4	6.6	-
2378 HxCDDs	0.04	0.3	4.7		0.1	-	354	14.2	11.6	0.5
other HxCDDs	0.0004	0.7	4.7		-	-	354	4.3	11.6	0.1
Total HpCDDs	0.001	1	7	-			354	0.1	11.6	-
2378 HpCDDs	0.001	0.5	7		-	-	184	0.2	5.7	-
other HpCDDs	0.00001	0.5	7		-	-	184	0.1	5.7	-
Total TCDFs	0.1	1	28	2.8			184	-	5.7	-
2378 TCDFs	0.1	0.03	28		0.1	1.2	209	20.9	7.0	0.7
other TCDFs	0.001	0.97	28		-	-	209	0.6	7.0	-
Total PeCDFs	0.1	1	670	67			209	0.2	7.0	-
2378 PeCDFs	0.1	0.07	670		4.7	35.8	549	54.9	17.8	1.8
other PeCDFs	0.001	0.93	670		0.6	0.3	549	3.8	17.8	0.1
Total HxCDFs	0.01	1	965	9.7			549	0.5	17.8	-
2378 HxCDFs	0.01	0.19	965		1.8	6.7	1082	10.8	32.1	0.3
other HxCDFs	0.0001	0.81	965		0.1	-	1082	2.1	32.1	0.1
Total HpCDFs	0.001	1	460	0.5			1082	0.1	32.1	-
2378 HpCDFs	0.001	0.25	460		0.1	0.3	499	0.5	10.9	-
other HpCDFs	0.00001	0.75	460		-	-	499	0.1	10.9	-

TOTAL TCDD EQUIVALENTS (TEF):

TEF estimate:	84	8	45	229	20	7	1
MH bioassay:	-	-	-	4	-	-	-
ROD bioassay:	-	-	-	5	-	-	-
receptor binding bioassay:	-	-	-	32	-	-	-
acute toxicity bioassay:	58	-	-	-	-	-	-

RELATIVE TCDD EQTS. (TEF/Bioassay):

MH bioassay:	-	-	-	57	5	-	-
ROD bioassay:	-	-	-	46	4	-	-
receptor binding bioassay:	-	-	-	7	0.6	2	0.2
acute toxicity bioassay:	1.4	0.1	0.8	-	-	-	-

des Rosiers, 1984, assuming only homologue-specific concentrations are known (for isomer-specific analyses see Table IV).

Sawyer et al., 1983.

A = estimated assuming 2378-isomers constitute 100 % of a homologous group.

B = estimated assuming occurrence of all isomers in a homologous group is equally probable (thus using the proportionality factor in column three).

estimated by utilizing isomer-specific analyses (see Table IV)

values rounding off to less than 0.1 are omitted.

TABLE V - continued

ISOMER	TEF	PROP. FACTOR	MSW FLYASH (ppb) ^b					
			SAMPLE 3			SAMPLE 4		
			Conc.	TCDD	Eqts.	Conc.	TCDD	Eqts.
				A	B		A	B
Total TCDDs	1	1	12.9	12.9		2.4	2.4	
2378 TCDD	1	0.05	12.9		0.6	2.4		0.1
other TCDDs	0.01	0.95	12.9		0.1	2.4		-
Total PeCDDs	0.2	1	37.5	7.5		7.9	1.6	
2378 PeCDDs	0.2	0.07	37.5		0.5	7.9		0.1
other PeCDDs	0.002	0.93	37.5		0.1	7.9		-
Total HxCDDs	0.04	1	75	3		9.7	0.4	
2378 HxCDDs	0.04	0.3	75		0.9	9.7		0.1
other HxCDDs	0.0004	0.7	75		-	9.7		-
Total HpCDDs	0.001	1	41.9	-		9.1	-	
2378 HpCDDs	0.001	0.5	41.9		-	9.1		-
other HpCDDs	0.00001	0.5	41.9		-	9.1		-
Total TCDFs	0.1	1	8.2	0.8		4.4	0.4	
2378 TCDFs	0.1	0.03	8.2		-	4.4		-
other TCDFs	0.001	0.97	8.2		-	4.4		-
Total PeCDFs	0.1	1	19.8	2.0		21.0	2.1	
2378 PeCDFs	0.1	0.07	19.8		0.1	21.0		0.1
other PeCDFs	0.001	0.93	19.8		-	21.0		-
Total HxCDFs	0.01	1	38.7	0.4		21.6	0.2	
2378 HxCDFs	0.01	0.19	38.7		0.1	21.6		-
other HxCDFs	0.0001	0.81	38.7		-	21.6		-
Total HpCDFs	0.001	1	20.6	-		16.6	-	
2378 HpCDFs	0.001	0.25	20.6		-	16.6		-
other HpCDFs	0.00001	0.75	20.6		-	16.6		-
TOTAL TCDD EQUIVALENTS (TEF):								
TEF estimate:				27	2		7	0.4
AHH bioassay:				4	-		2	-
EROD bioassay:				5	-		2	-
Receptor binding bioassay:				65	-		11	-
Acute toxicity bioassay:				-	-		-	-
RELATIVE TOTAL TCDD EQTS. (TEF/BIOASSAY):								
AHH bioassay:				7	0.5		4	0.2
EROD bioassay:				5	0.4		4	0.2
Receptor binding bioassay:				0.4	0.03		0.6	0.04
Acute toxicity bioassay				-	-		-	-

Thursday
September 12, 1985

Environmental
Protection
Agency

Part V

**Environmental
Protection Agency**

40 CFR Parts 261 and 271
Hazardous Waste Management System;
Identification and Listing of Hazardous
Waste; Proposed Rule and Request for
Comments

ENVIRONMENTAL PROTECTION
AGENCY

40 CFR Parts 261 and 271

[SWH-FRL 2861-4]

Hazardous Waste Management
System; Identification and Listing of
Hazardous WasteAGENCY: Environmental Protection
Agency.ACTION: Proposed rule and request for
comments.

SUMMARY: The Environmental Protection Agency (EPA) is today proposing to amend the regulations for hazardous waste management under the Resource Conservation and Recovery Act (RCRA) by modifying the listing for certain dioxin-containing wastes to designate as toxic (rather than acute hazardous) wastes derived from the incineration or thermal treatment of these wastes by fully permitted incinerators or by interim status incinerators or thermal treatment units that have been certified to burn these wastes. The effect of this rule, if promulgated, would be to allow these wastes to be managed in accordance with the general waste management standards contained in 40 CFR Parts 264 and 265.

DATES: EPA will accept comment on this proposal until October 28, 1985. Any person may request a hearing on this proposal by filing a request with Eileen B. Clausen, whose address appears below, by September 27, 1985. The request must contain the information prescribed in 40 CFR 260.20(d).

ADDRESSES: Comments should be sent to the Docket Clerk, Office of Solid Waste (WH-562), U.S. Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460. Requests for a hearing should be addressed to Eileen B. Clausen, Director, Characterization and Assessment Division, Office of Solid Waste (WH-562), U.S. Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460.

Communications should identify the regulatory docket number "Section 3001/Dioxin Residues."

The public docket for this proposal is located in Room S-212, U.S. Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460, and is available for viewing from 9:00 AM to 4:00 PM, Monday through Friday, excluding holidays.

FOR FURTHER INFORMATION CONTACT: RCRA Hotline, toll-free at (800) 424-9346 or (202) 382-3000. For technical information contact: Dr. Judith S. Bellin, Office of Solid Waste (WH-562B), U.S.

Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460, (202) 382-4761.

I. Background

On January 14, 1985, EPA promulgated a final rule ("the dioxin rule") designating as acute hazardous wastes certain wastes containing tetra-, penta-, and hexachlorinated dioxins (CDDs), -dibenzofurans (CDFs), and certain chlorinated phenols and their derivatives. See 50 FR 1978-2005. These wastes were designated as acute hazardous wastes because of their chlorinated dioxin and -dibenzofuran content. These regulations also specified certain management standards for these wastes. Among other things, the regulations limit the burning of these wastes in fully permitted incinerators, or in interim status incinerators or thermal treatment units that have been certified by the Assistant Administrator for Solid Waste and Emergency Response to burn these wastes; incinerators or thermal treatment units that burn these wastes must achieve 99.9999% (six 9s) destruction and removal efficiency (DRE) of tetra-, penta-, and hexachlorinated dioxins (CDDs) and -dibenzofurans (CDFs) or on a compound more difficult to incinerate than the CDDs and CDFs.

Under 40 CFR 261.3(c), any residue derived from the treatment of a hazardous waste is a hazardous waste (unless otherwise designated or deleted under the provisions of 40 CFR 268.20 and 268.22); i.e., the residue has the same hazardous properties as the waste from which it is derived until the generator shows otherwise (see 40 FR 33098, May 19, 1980). EPA has interpreted this to mean that the residues resulting from the incineration of acute hazardous wastes (e.g., dioxin wastes) are acute hazardous wastes, unless otherwise designated, or deleted.

In the January 14, 1985 dioxin regulation, the Agency designated the residues resulting from six 9s DRE incineration or thermal treatment of dioxin-contaminated soils as RCRA toxic (not acute hazardous) wastes (EPA Hazardous Waste No. F028). Persons disposing of these residues therefore do not have to comply with the special management standards (i.e., this waste can be managed at interim status facilities), and these wastes need not be land disposed pursuant to a waste management plan. However, residues resulting from the incineration or thermal treatment of other dioxin-containing wastes are still considered to be acute hazardous wastes and must be managed in accordance with the special management requirements.

This determination regarding the management of wastes resulting from the incineration or thermal treatment of dioxin-containing wastes is now judged to be unnecessarily restrictive, and inhibitory of the result desired: proper, safe, and effective management of CDDs and CDFs. It is also extremely resource intensive for the government and the regulated community, and will create needless demands on the limited resources available to the Agency and the regulated community.

II. Basis for This Proposed Regulation

This proposed regulation covers residues¹ resulting from the incineration or thermal treatment of EPA Hazardous Waste Nos. F020, F021, F022, F023, F024, and F027 (dioxin wastes (excepting F028) (residues from incineration of dioxin-contaminated soil)) containing 10 ppm or less of TCDD equivalents.² The proposed rule would designate such residues as RCRA toxic (rather than acute hazardous) wastes. As noted above, the Agency already designated the residues resulting from the incineration or thermal treatment of dioxin-contaminated soil as a toxic hazardous waste (EPA Hazardous Waste No. F028), allowing the treatment, storage, or disposal of such residues at facilities meeting the normally applicable Parts 264 and 265 standards (i.e., for these residues, the Agency did not require the special standards mandated for other dioxin-containing wastes, such as the secondary containment requirements for non-liquid wastes, or a waste management plan for land disposal). The Agency made that determination based on the characteristics of the residues resulting from the incineration of materials such as PCB capacitors, sewage treatment sludges, and carbon adsorbents (see 50 FR 1994-1995). Those data show that the residues resulting from the incineration or thermal treatment at six 9s DRE contain PCBs at levels about four orders of magnitude less than those contained in the waste before incineration.

More recent data shown even greater levels of destruction. The results of a

¹ This term includes liquid residues such as scrubber water.

² "TCDD equivalence" of a mixture of chlorinated dioxins and -dibenzofurans is an estimate of the toxicity of the mixture expressed as the equivalent toxicity of 2,3,7,8-TCDD. It is calculated by applying specific weighting factors to the concentration of individual isomers or homologous classes of CDDs and CDFs. See USEPA, Chlorinated Dioxins and Dibenzofurans, Draft Report, Intermittent Assessment Procedures for mixtures of chlorinated dioxins and -dibenzofurans (CDDs and CDFs), July 1984. This issue is discussed in detail in Section III of this preamble.

trial burn of dioxin-containing waste in EPA's mobile incinerator, data submitted in support of an incineration facility requesting certification to burn dioxin-containing wastes in a stationary hazardous waste incinerator; and data submitted by the operators of a hazardous waste incinerator show that the residues resulting from the incineration at six 9s DRE of CDDs and CDFs,² and PCBs^{3,4} contain these toxicants at concentrations about five to seven orders of magnitude less than those of the starting material.

Thus, solid residues resulting from the incineration or thermal treatment at six 9s DRE of dioxin-containing wastes containing 10 ppm TCDD equivalents of CDDs and CDFs or less are expected in all cases to contain less than 0.1 ppb TCDD equivalents,^{5,7} and in some cases, orders of magnitude less than this concentration. These levels of CDDs and CDFs (less than 0.1 ppb TCDD equivalents) are less than a tenth of the value determined to be "a reasonable level at which to begin consideration of action to limit human exposure to contaminated soil."⁸ As EPA determined in the January 14 rulemaking, this concentration is no longer considered to be a substantial concentration of a potent carcinogen within the meaning of § 263.13(a)(2). See 50 FR 1985. In light of the diminished risk posed by these reduced concentrations, and because the wastes will continue to be managed in a controlled setting, EPA does not

believe that these wastes are still acute hazardous wastes requiring heightened regulatory controls, and therefore proposes to list the solid residues resulting from the incineration or thermal treatment of dioxin-containing wastes containing less than 10 ppm TCDD equivalents as hazardous wastes.⁹ These residues include bottom ash, kiln residue, air pollution control residues such as CHEAF filters, fly ash, and emission control dust.

In addition to the solid residues discussed above, incinerators also generate a liquid waste, scrubber water. This waste arises from the scrubbing of the hot exit gases with water containing caustic or lime, entraining flyash. It therefore contains particulate matter (flyash), as well as dissolved organic compounds that are removed to some extent by subsequent treatment of the scrubber effluent. This untreated scrubber water also is proposed to be listed as a toxic hazardous waste rather than an acute hazardous waste. The reasons for this determination, as is the case for the solid residues of incineration, is that the scrubber effluent is expected to contain CDDs and CFS at levels five to seven orders of magnitude less than are present in the waste feed to the incinerator, so that the water no longer contains high concentrations of potent carcinogens.

The treatment of the scrubber water results in the formation of several solid residues. Sludges are created in cooling ponds by natural settling aided by treatment with flocculants. The cooling/ settling ponds are periodically dug out to remove these solids (sludges), which are often landfilled or incinerated on-site. The clarified scrubber water may be filtered by use of a particulate filter or a filter press, and is sometimes passed through a carbon adsorbent. Treatment of scrubber water thus gives rise to sludges (settling sludges, filter solids, spent carbon, or particulate filters) that contain particles derived from flyash. These residues from treating scrubber water resulting from the incineration of wastes containing less than 10 ppm TCDD equivalents also would be classified as toxic hazardous wastes, since they are derived from treating a toxic waste (the scrubber

water). See 40 CFR 261.2(c). This application of the "derived from" rule is factually justified because these residues would not be expected to contain higher concentrations of dioxins and furans than the flyash, since these residues in essence consist of flyash that has become entrained in the scrubber water.¹⁰

In changing the status of these wastes, EPA is also determining that the special management standards for other listed dioxin-containing wastes are not necessary for these wastes. The special management standards were premised on the high concentrations of potent carcinogens typically found in these listed wastes (50 FR at 1983, 1984-1985). When these concentrations are greatly reduced, as here, the residual wastes present much less risk, and can be safely managed in the same manner as other hazardous wastes. (Id. at 1985.)

Notably, however, that EPA's conclusion is that these wastes still require the same level of management as other hazardous wastes. This is of particular relevance with respect to secondary containment requirements for tank storage of these wastes, since secondary containment is not presently required for tank storage of toxic hazardous wastes, and so would not presently be required for these dioxin-containing residues. However, if EPA finalizes its proposal to require secondary containment for all new tanks storing hazardous wastes and for all existing tanks not adopting the ground-water monitoring alternative (see 50 FR 20444, June 28, 1985), EPA would necessarily conclude that secondary containment is appropriate for these particular hazardous wastes. Thus, today's proposal should not be viewed as finding that these residues require less regulatory control than other hazardous wastes.

III. Issues Related to This Regulation

A. Whether These Wastes Should Be Considered Non-Hazardous

In evaluating the wastes proposed to be designated as toxic (rather than acute) hazardous wastes, EPA also

² Delisting petition for treated wastewater, ash, filter media, and other waste from the U.S. EPA mobile incineration system Gold Carcinomata in Orinney Farm, McDowell, MD. April 19. See also 50 FR 20271, July 23, 1985.

³ *Ballou Co. Application for incinerator permit* April 12, 1985.

⁴ C. D. Combs (ENSCO) to M. Sorens (USEPA), May 14, 1985.

⁵ Concentration of CDDs and CDFs in the residues equals the amount in the waste feed times the fraction remaining. For example, if 10 mg/kg (10⁻⁶ to 10⁻⁷ residues) is in the feed, then 1 to 100 ppb. This estimate assumes that the net formation of CDDs and CDFs in the course of incineration is negligible. (This assumption is warranted because the conditions necessary to cause six 9s DRE are presumably consistent with conditions to minimize the formation of products of incomplete combustion. It also assumes that the net distribution of CDDs and CDFs will not change in such a way as to substantially change the TCDD equivalent per mass of CDDs and CDFs.)

⁶ This concentration is less than the limit of detection (DL) of total CDDs and CDFs in such residues. For example, in bile ash, the DL is 0.07-0.2 ppb for each congener or congener group, and 0.27-1.00 ppb (average 0.4 ppb) for total CDDs and CDFs. In Cleanable High Efficiency Filter (CHEAF) material, which contains trapped flyash, particulates, the DL for total CDDs and CDFs were reported as 0.1 ppb.

⁷ Kimbrough, R. L. et al. *Health Implications of 2,3,7,8-chlorodibenzodioxins (TCDD) contamination of residential soil*. J. Toxicol. Env. Health 14:47-60: 1984.

⁸ It should be noted that the levels of destruction of the wastes burned in EPA's mobile incinerator achieved CDD and CDF levels that EPA believes are below those of regulatory concern. See 50 FR 1987, July 23, 1985. While EPA is not prepared to generalize that results to all dioxin wastes in the absence of actual operating data, these findings support the conclusion that residues from burning dioxin-containing wastes using six 9s DRE should not remain acute hazardous wastes.

¹⁰ Particulates filtered from scrubber water from a hazardous waste incinerator contained 2.1 ppm of 2,3,7,8-TCDD; filtered scrubber water contained 1 ppt of the same isomer. (See R.L. Bush et al. *Trace chemistry of filter: a source of chlorinated dioxins*. Science 210:385-387, 1983). The efficiency of the incinerator's operating conditions, and its waste feed composition are not known. These data are thought not to be indicative of concentrations of residues from hazardous waste incinerators. Incinerating wastes containing 10 ppm TCDD equivalents of CDDs and CDFs at six 9s DRE, in light of the significant levels of destruction of organic pollutants achieved by such incineration.

considered whether they should still be considered hazardous (i.e., whether they should be excluded from regulatory control altogether). The Agency is not proposing to designate these wastes as non-hazardous because information directly showing the concentration of other hazardous constituents—particularly chlorophenols and their derivatives and other toxicants, such as the polynuclear aromatic compounds—is at present very limited. Moreover, the levels of CDDs and CDFs that might conceivably be in some of these wastes are orders of magnitude higher than those occurring in the residues from the mobile incinerator that were recently delisted (50 FR 30271, July 23, 1985). Thus, the Agency believes it's inappropriate to make a generic determination as to delisting at this time.

B. Whether This Rule Should Be Extended to All Incineration Residues

The Agency also considered whether this rule should be extended to residues resulting from the incineration of wastes containing more than 10 ppm TCDD equivalents of CDDs and CDFs. However, at the present time there is not sufficient information to make a determination on this issue. When sufficient data to enable proper evaluation of this issue becomes available (e.g., from delisting petitions, permitting data, and as public comment on this proposal), it is possible that the Agency will be able to justify further modification of the hazardous waste status of the residues from six 9s DRE incineration or thermal treatment of wastes with higher concentrations of TCDD equivalents.

C. Concerning the Application of a Proposed Method for Estimating the Toxicity of Mixtures of CDDs and CDFs

The concept of TCDD equivalence (see footnote 2) used in this proposed regulation is based on the application of an interim method proposed by the Agency's Chlorinated Dioxin Workgroup (CDWG). The CDWG has considered several approaches for assessing the human health risks posed by mixtures of CDDs and CDFs. This approach was selected as an interim measure to estimate the toxic risks by taking into account the distribution of the CDD/CDF congeners or homologues that are estimated to have the greatest toxic potential. This proposed regulation relies on the interim approach recommended by the CDWG, i.e., the use of "2,3,7,8-TCDD Toxicity Equivalence Factors (TEFs)" to assess the toxicity of complex mixtures of CDDs and CDFs. In this approach,

information is obtained on the concentrations of homologues and/or congeners present in the mixture. Then, reasoning on the basis of structure-activity relations and results of short-term tests, the toxicity of each of the components is estimated and expressed as an "equivalent amount of 2,3,7,8-TCDD". Combined with estimates of exposure and known toxicity information on 2,3,7,8-TCDD, the risks associated with the mixture of CDDs and CDFs can be assessed. Key to the approach are "2,3,7,8-TCDD Toxicity Equivalence Factors" (TEFs). The CDWG Position Document (see footnote 2) lists them as follows:

Homologue/Congener	Proposed TEF ¹
Mixtures through incineration of chlorinated hydrocarbons	0
2,3,7,8-TCDD ²	1.0
2,3,7,8-PeCDD	0.2
2,3,7,8-PeCDDs	0.04
2,3,7,8-HxCDDs	0.001
2,3,7,8-HxCDD	0.1
2,3,7,8-PeCDFs	0.1
2,3,7,8-HxCDFs	0.01
2,3,7,8-HxCDFs	0.0001
Other chlorinated dioxins and chlorofurans	0

¹ TEFs proposed in the CDWG Position Document (see footnote 2).

² "2,3,7,8" refers to a dioxin or chlorofuran having chlorine atoms substituted at the 2,3,7, and 8 positions.

³ In each case the TEFs for the homologues of congeners are substituted in the 2,3,7, and 8 positions and are higher than those listed above. In cases where only the concentration of one homologue is known, i.e., no congener-specific data are available, the assumption that the 2,3,7,8-substituted congener contributes all of the CDDs and CDFs present in the mixture is likely to provide the most conservative estimate of toxicity.

⁴ Although the CDWG Document suggests that the HxCDDs and HxCDFs be considered in evaluating the toxicity of the mixture, the proposed regulation does not consider these congeners and only those of the 2,3,7,8-substituted congeners. Because they are not likely to be present in the residue resulting from the DRE incineration in a congener or congener-specific manner, and in light of the high levels of destruction achieved.

The CDWG Position Document discusses the basis for the above assignments. The procedure is not based on a thoroughly established scientific foundation, but represents a consensus recommendation on science policy.

The approach has undergone considerable scientific comment within the Agency, and has been submitted for review and comment to scientists from the academic, environmental, and industrial community, as well as to scientists from other government agencies. Public comment is also solicited in this Notice.

As a result of such comment, the TEFs listed above may be altered in the final version of this regulation. (Therefore, the TEFs are not listed in the regulatory language of this proposed regulation; they will be specifically enumerated in the promulgated listing.)

It is also possible that the TEFs may change in the future if new data show that the scientific basis for their assignment makes further revision desirable. If such revision is made after

the final promulgation of this regulation, the Agency may, if warranted, amend the TEF values assigned with the promulgated version of this regulation, by amending it.

IV. State Authority

A. Applicability of Rules in Authorized States

Under Section 3008 of RCRA, EPA may authorize qualified States to administer and enforce the RCRA program within the State. (See 40 CFR Part 271 for the standards and requirements for authorization.) Following authorization EPA retains enforcement authority under Sections 3008, 7003, and 3013 of RCRA, although authorized States have primary enforcement responsibility.

Prior to the Hazardous and Solid Waste Amendments of 1984 (HSWA) amending RCRA, a State with final authorization administered its hazardous waste program entirely in lieu of the Federal program. The Federal requirements no longer applied in the authorized State, and EPA could not issue permits for any facilities in the State which the State was authorized to permit. When new, more stringent Federal requirements were promulgated or enacted, the State was obligated to enact equivalent authority within specified time frames. New Federal requirements did not take effect in an authorized State until the State adopted the requirements as State law.

In contrast, under newly enacted section 3008(g) of RCRA, 42 U.S.C. 6929(g), new requirements and prohibitions imposed by the HSWA take effect in authorized States at the same time that they take effect in nonauthorized States. EPA is directed to carry out those requirements and prohibitions in authorized States, including the issuance of permits, until the State is granted authorization to do so. While States must still adopt HSWA-related provisions as State law to retain final authorization, the HSWA applies in authorized States in the interim.

Today's rule would be added to Table 1 in § 271.1(j), which identifies the Federal program requirements that are promulgated pursuant to HSWA. The Agency believes that it is extremely important to clearly specify which EPA regulations implement HSWA since these requirements are immediately effective in authorized States. States may apply for either interim or final authorization for the HSWA provisions identified in Table 1 as discussed in the following section of this preamble.

3. Section 271.1(j) is amended by adding the following entry to Table 1 in chronological order by date of publication:

TABLE 1.—REGULATIONS IMPLEMENTING THE
HAZARDOUS AND SOLID WASTE AMEND-
MENTS OF 1984

Date	Title of regulation	FEDERAL REGISTER reference
(insert date of publi- cation)	Redesignation of residues derived from the incineration of dioxin or treatment of dioxin-containing wastes from solid hazardous wastes to toxic wastes.	50 FR (insert page number)

[FR Doc. 85-21897 Filed 9-11-85; 8:45 am]

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APPENDIX
B



MATERIAL SAFETY DATA SHEET

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(518) 377-8855



NO 115
SODIUM HYPOCHLORITE
AQUEOUS SOLUTION
(5-12%)
DATE February 1983

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: SODIUM HYPOCHLORITE, AQUEOUS SOLUTION (5-12%)
OTHER DESIGNATIONS: Soda Bleach Liquor Bleach Solution, Hypochlorite Solution, NaOCl Solution, SUNNY SOL Bleach (Jones Chemicals), Household Bleach (i.e. CLOROX[®], PUREX[®])
MANUFACTURER: Available from many suppliers, including:
Canadian Industries Limited Jones Chemicals, Inc.
Chemicals 100 Sunny Sol Blvd
Box 10 Caladonia, NY 14423
Montreal, Quebec H3C 2R3 Tel: (716) 538-2311

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Sodium hypochlorite (CAS #007 681 529)	ca 5-12	No TLV Established
Water, sodium chloride and sodium hydroxide (if present in excess). (Excess NaOH will pose an increased alkalinity hazard.)	Balance	Rat. Oral (12% Solution)
*Solution concentration can also be stated in terms of "available chlorine" which is about 95% of NaOCl content by weight.		LD ₅₀ ca 12 mg/kg
		*5% soln is reported to be much less toxic.

SECTION III. PHYSICAL DATA

Boiling point --- decomposes (see Sect V)	Specific gravity (20/4C):
Vapor pressure, 20 C, mm Hg ----- 17.5	5.25% (Household bleach) - 1.09
Water solubility ----- complete	8.0% ----- 1.15
pH ("neutral" solution)* ----- 9-10	12.0% ----- 1.21
Molecular weight ----- 74.4	Freezing point, 12.0%, deg C - ca -25

Appearance & Odor: Clear, pale yellow or greenish liquid with a chlorine odor.

*Some products may contain an excess of NaOH and have a higher pH.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
Nonflammable			---	---

Use extinguishing media that is appropriate for surrounding fire. Use water spray from a safe distance to cool fire-exposed containers, to dilute liquid, and control vapors. It is an oxidizing agent. Vigorous reactions can occur with oxidizable materials in a fire situation. It can be decomposed by heat. Chlorine liberated on contact with acid.

If safe, remove containers from fire area to prevent pressure rupture.

Firefighters should wear full protective clothing and self-contained breathing apparatus. (Protection is needed against corrosive fumes and liquid if released.)

SECTION V. REACTIVITY DATA

Anhydrous material is unstable, but these water solutions can be satisfactorily stable for months under proper storage conditions. Rate of decomposition increases with the concentration and with the temperature. (12% NaOCl solution decomposes slowly at 40 C to yield NaCl and NaClO₂). Exposure to sunlight accelerates decomposition.
It is incompatible with acids (liberates chlorine), ammonia, urea, oxidizable materials, and metals such as nickel, copper, tin, manganese and iron (which cause liberation of oxygen).

NO. 115

SECTION VI. HEALTH HAZARD INFORMATION	TLV None Established
Toxicity due to alkalinity, possible chlorine generation, and the oxidant properties. Ingestion of a few ounces at 12% conc. can cause corrosion of mucous membranes, perforation of esophagus and stomach, and laryngeal edema; may lead to convulsion, coma, death. (At 5% conc. effects are much less damaging.) Inhalation of mist or fumes can cause bronchial irritation, cough, difficult breathing, stomatitis, nausea, and pulmonary edema. Additional effects have included circulatory collapse and delirium. Liquid contact can produce irritation of the the eyes or skin with blistering and eczema (especially at 12%). FIRST AID: Eye Contact: Irrigate eyes with running water for at least 15 minutes, including under eyelids. Then contact physician at once (ophthalmologist preferred). Skin Contact: Remove contaminated clothing. Flush affected areas with copious amounts of water, or shower. If irritation persists or if large areas of body are affected, contact physician. Treat burns as needed. Inhalation: Remove to fresh air and obtain medical help. Ingestion: Have physician contacted immediately. Rinse mouth with water. Give large quantities of water or milk to drink. Induce vomiting. Repeat. Do not use acidic antidotes or sodium bicarbonate. An ounce of 1% sodium thiosulfate or milk of magnesia is helpful.	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Notify safety personnel of major spill. Clean-up personnel need protection against contact with liquid and inhalation of mists and fumes. Contain spill and pick up when possible for recovery or disposal. Keep concentrated hypochlorite solutions out of sewers and waterways. Do not use combustible absorbents (such as sawdust) to pick up hypochlorite solutions. Small spills and residues can usually be flushed to a suitable holding area, and then with high dilution to the sewer. DISPOSAL: When necessary hypochlorite can be neutralized with weak reducing agents, and then the waste landfilled. Follow Federal, State and Local regulations. EPA (CWA) RQ is 100 lb. (40 CFR 117). Hypochlorite can be harmful to aquatic life.	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide general and local exhaust ventilation in the workplace to maintain fumes and mists at a minimum. (Workers should not have irritation effects from exposure.) Respiratory devices should be available for use in non-routine or emergency situations. Use canister-type respirators suitable for chlorine (See MSDS 53) with mist filters. Avoid eye contact by use of chemical safety goggles. Use rubber gloves, apron, and other protective clothing appropriate for the work situation to prevent skin contact. Clothing contaminated with liquid to be removed promptly and rinsed with water. Launder before reuse. Eyewash fountains, washing facilities and safety showers should be available in areas of handling and use.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in closed, vented containers in a cool, (below 85°F), dry, well-ventilated area away from direct sunlight, heat and incompatible materials (see Sect V). Keep separate from acids and organics. Use adequate ventilation. Protect containers from physical damage. Do not mix with acidic cleaning agents which can liberate chlorine gas.* Avoid inhalation of vapors, mists and fumes. Prevent eye and skin contact. DOT Classification: <7% Available Chlorine, * ORM-B I.D. No. NA 1791 Label: None (49 CFR 172.101) >7% Available Chlorine, CORROSIVE, I.D. No UN 1791 Label: CORROSIVE 7% Available Chlorine is about 7.35% NaOCl. *Incompatible with bowl cleaners containing DATA SOURCE(S) CODE: 1,3-11,14,25,34,37,48,49 bisulfates.	
NOTES: As to the liability of information herein to purchaser's business, the purchaser assumes responsibility. Therefore, although Genium Publishing Corporation warrants the information herein, it does not warrant the accuracy of such information as to the reliability of such information for application in the design of products or processes or the determination of its use.	APPROVALS: MIS/CRD <i>J.M. Newman</i> INDUST. HYGIENE/SAFETY <i>JW</i> 2-22-83 MEDICAL REVIEW: 9 March 1983

MATERIAL SAFETY DATA SHEET

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NO 518

PETROLEUM "ETHER"

DATE October 1983

SECTION I. MATERIAL IDENTIFICATION				
MATERIAL NAME: PETROLEUM "ETHER" DESCRIPTION: Low boiling liquid fraction of petroleum, mainly pentanes and hexanes. OTHER DESIGNATIONS: Light Ligroin(e), Petroleum Spirit, CAS #008 030 306 <u>Applicable more general terms:</u> Petroleum Naphtha, Petroleum Distillate, Naphtha, CAS #008 032 324 (applies to cuts of C ₅ -C ₁₂ aliphatic hydrocarbons) MANUFACTURER: Available from several suppliers.				
SECTION II. INGREDIENTS AND HAZARDS		%	HAZARD DATA	
			8-hr TWA, ppm OSHA PEL ACGIH(1983) TLV	
Petroleum Distillate (Aliphatic Naphtha, C ₅ to C ₇)		100	500 --	
Pentanes			1000 600	
Hexanes (except n-Hexane)			500 500	
n-Hexane			500 50*	
Heptanes			500 400	
*Because of unique neurotoxicity of n-hexane metabolites (see MSDS #397), base control on n-hexane in the mixture. NIOSH (1977) recommended 10-hr TWA of 350 mg/m ³ ; 15 minute Ceiling of 1800 mg/m ³ (500 ppm hexanes or 600 ppm pentanes).				
SECTION III. PHYSICAL DATA				
Dist.Range, 1 atm, deg C ----- 30-90*		Specific gravity, 25/4C ---- 0.635-0.68*		
Vapor density, (Air=1) ----- ~3		Melting point, deg C ----- < -73		
Solubility in water ----- Insoluble		Evaporation rate (BuAc=1) -- > 1		
		Volatile, % by Volume ----- 100		
Appearance & Odor: Clear, colorless, volatile liquid. Slight, characteristic odor.				
*Exact values depend on the particular petroleum "ether" cut used. Narrower distillation cuts within this distillation range are frequently used.				
SECTION IV. FIRE AND EXPLOSION DATA			Lower	Upper
Flash Point and Method	Autoignition Temp.	Flammability Limits in Air		
< -20F (TCC)	>400 F (estimate)	% by Volume	>1.1	-
Extinguishing Media: Dry chemical, carbon dioxide, foam. Use smothering technique to put out fires. Water spray may be ineffective in extinguishing fire and forced water stream could scatter fire. Use water spray to cool surroundings and fire-exposed containers (violent rupture possible). Remove container from fire area if safe. It can readily volatilize even below room temperature to form explosive vapor-air mixtures. Vapors can flow along surfaces to a distant ignition source and flash back. Firefighters should use self-contained breathing apparatus and full protective clothing.				
SECTION V. REACTIVITY DATA				
This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not polymerize. This OSHA Class 1A or 1B flammable liquid (depending on the boiling point of the cut used) is incompatible with strong oxidizing agents. It must be kept away from sources of heat or ignition. Thermal-oxidative degradation products include partial oxidation products of hydrocarbons, carbon monoxide and carbon dioxide.				

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NO. 518

SECTION VI. HEALTH HAZARD INFORMATION	TLV (Depends on n-hexane content) See Sect. II
Excessive vapor inhalation irritates respiratory system & causes headache, dizziness, nausea, inebriation, and CNS depression. Chronic excessive exposure to n-hexane can cause peripheral neuropathy. Contact with high vapor levels or with liquid irritates the eyes. Liquid contact with skin is defatting and irritating; prolonged or repeated contact can cause dermatitis. Ingestion is irritating to mouth, throat and GI tract with coughing, vomiting, blurred vision, diarrhea as symptoms. It will tend to vaporize quickly on ingestion or aspiration. In the lungs this could give profound anoxia by displacing oxygen, with possible cardiac arrest and/or brain damage (based on animal studies). FIRST AID: <u>Eye Contact:</u> Flush with running water, including under eyelids. <u>Skin Contact:</u> Remove contaminated clothing. Wash affected area with soap and water. Get medical help if large areas of body are exposed or if irritation persists. <u>Inhalation:</u> Remove to fresh air. Restore and/or support breathing. Have trained person administer oxygen if necessary. Call a physician. <u>Ingestion:</u> Contact physician! Aspiration hazard! Do not induce vomiting. If spontaneous vomiting occurs, hold victim's head lower than hips to resist pulmonary aspiration.	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Establish plans and provide training prior to any emergency situation. When spills occur exclude workers from area except those assigned to clean-up who must have proper protection against inhalation of vapors or contact with liquid (see Sect VIII). Provide maximum explosion-proof ventilation. Eliminate ignition sources. Stop leak & contain spill if safe. Flush away from sensitive areas with a cold water spray. (Flush to ground or open collection area not to sewer, waterway or enclosed area!) Small amounts of liquid (or solid-absorbed liquid) can be allowed to evaporate with good ventilation or in a hood or open area; large spills should be picked up in a safe and appropriate manner for disposal. Handle like gasoline! Avoid environmental pollution. DISPOSAL: Scrap material can be carefully burned in an approved incinerator in accordance with Federal, State and Local Regulations.	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Use explosion-proof general ventilation and local exhaust ventilation (or hood) to keep workplace vapors at a low level and all vapors below 25% of LEL. Above the TLV use an organic vapor canister gas mask or an air-supplied or self-contained respirator with full facepiece. Use approved gloves to prevent repeated or prolonged contact with liquid and safety glasses for eye protection where splashing is possible. Conditions of use may require additional protection against body contact with liquid. Provide an eyewash station, washing facilities and a safety shower. Promptly remove and isolate clothing wet with this material (flammability as well as health considerations), and be sure clothing is solvent-free before reuse.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in closed containers in a well-ventilated, cool area, away from oxidizing agents and sources of heat or ignition. No smoking in areas of use. Electrically bond and ground containers for transfers to prevent static sparks. Near this material use explosion-proof electrical services and equipment. Handle and store as an OSHA Class 1A or 1B flammable liquid (depending on the boiling point). Use only with ventilation. Follow good hygienic practice. Avoid prolonged or repeated skin contact and breathing of vapors or mists. Do not ingest. DOT Classification: FLAMMABLE LIQUID. I.D. No. UN1271 Label: FLAMMABLE LIQUID DATA SOURCE(S) CODE: 1,2,4-7,9,12,14,31,34,48	
Approved as to the accuracy of information herein for purchase & purposes and necessary precautions & responsibilities. Therefore, although responsible care has been taken in the preparation of such information, Genium Publishing Corporation makes no warranty, makes no representation and assumes no responsibility as to the accuracy or quality of such information for application in any other or different purposes or for consequences of its use.	APPROVALS: MIS/CRD <i>J. M. Nisum</i> INDUST. HYGIENE/SAFETY <i>W.D. N.J. 13</i> MEDICAL REVIEW: 8 October 1983

MATERIAL SAFETY DATA SHEET

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No. 9

SULFURIC ACID,
CONCENTRATED

REVISION B

Date October 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: SULFURIC ACID, CONCENTRATED
OTHER DESIGNATIONS: Oil of Vitriol, Hydrogen Sulfate, H_2SO_4 , CE Material D4A2,
CAS #007 664 939
DESCRIPTION: Material consists of about 93-98% H_2SO_4 with water and traces of
impurities.
MANUFACTURER: Available from many suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Hydrogen Sulfate (H_2SO_4)
Water

93-98
Balance*

HAZARD DATA

TLV 1 mg/m³ for
sulfuric acid†

Human, mist inhal.
TCLo 3 mg/m³, 24 wk
(Toxic Mouth Effects)

Rat, Oral
LD₅₀ 2140 mg/kg

*Material is obtained by the reaction of SO_3 and water.
Can contain low impurity levels, such as 0.02% max of
iron as Fe. Properties vary with H_2SO_4 content.

†Current OSHA standard and ACGIH (1980) TLV. NIOSH has
a 10-hr-TWA, 40 hr work week, of 1 mg/m³.

SECTION III. PHYSICAL DATA

	93.19% H_2SO_4	98.33% H_2SO_4	100% H_2SO_4
Boiling point, 1 atm, deg C	ca 281	ca 338	ca 330 (dc)
Specific gravity (60/60 F)	1.8354	1.84	1.84
Deg. Baume	66	—	—
Volatiles, % at 340 C	ca 100	ca 100	ca 100
Melting point, deg C	ca -34	ca 3	10.4
Vapor press, mm Hg @ 100 F	<1	—	—

Water solubility: Completely miscible.

Appearance & Odor: Clear, colorless, hygroscopic oily liquid with no odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
None - nonflammable	N/A	N/A	N/A	N/A

Even though sulfuric acid is nonflammable, it is hazardous when present in a fire area.
Small fires may be smothered with suitable dry chemical. Cool exterior of storage
tanks of H_2SO_4 with water to avoid rupture if exposed to fire. Do not add water or
other liquid to the acid! The acid, especially when diluted with water, can react
with metals to liberate flammable hydrogen gas.

Sulfuric acid mists and vapors from a fire area are corrosive. (See Sect. V.)

Firefighters to wear self-contained breathing equipment and full protective clothing.

SECTION V. REACTIVITY DATA

Sulfuric acid is stable under normal conditions of use and storage. It does not undergo
hazardous polymerization.

It is a strong mineral acid reacting with bases and metals. The concentrated acid is a
strong oxidizing agent and can cause ignition of combustible materials on contact.
The concentrated acid is also a dehydrating agent, picking up moisture readily from
the air or other materials.

Reacts exothermically with water. (Acid should always be added slowly to water.
Water added to acid can cause boiling and uncontrolled splashing of the acid.)

Sulfur oxides can result from decomposition and from oxidizing reactions of sulfuric acid.

SECTION VI. HEALTH HAZARD INFORMATION	TLV 1 mg/m ³
Concentrated sulfuric acid is a strong mineral acid, an oxidizing agent, and a dehydrating agent that is rapidly damaging to all human tissue with which it comes in contact. Ingestion may cause severe injury or death. Eye contact gives severe or permanent injury. Inhalation of mists can damage both the upper respiratory tract and the lungs. FIRST AID: <u>Eye Contact:</u> Immediately flush eyes with plenty of running water for at least 15 minutes (including under the eyelids). Speed in diluting and rinsing out acid with water is extremely important if permanent eye damage is to be avoided. Obtain medical help as soon as possible. <u>Skin Contact:</u> Immediately flush affected areas with water, removing contaminated clothing under the safety shower. Continue washing with water and get medical attention. <u>Inhalation:</u> Remove to fresh air. Restore breathing. Call a physician immediately. <u>Ingestion:</u> Dilute acid immediately with large amounts of milk or water, then give milk of magnesia to neutralize. Do not induce vomiting; if it occurs spontaneously, continue to administer fluid. Obtain medical attention as soon as possible. Maintain observation of patient for possible delayed onset of pulmonary edema.	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Prevent contact with the acid. Provide adequate ventilation to control workplace concentrations. Minor leaks or spills can be diluted with plenty of water and neutralized with soda ash or lime. If water is not available, cover contaminated area with sand, ashes, or gravel and neutralize with soda ash or lime. Major spills must be handled by a predetermined plan. Contact supplier for assistance in this planning and to meet local requirements and disposing of large amounts. DISPOSAL: Follow Federal, State, and local regulations.	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide general ventilation to meet current TLV requirements in the workplace. Where mists are up to 50 mg/m³, a high efficiency particulate respirator with full facepiece is warranted; a Type C supplied air respirator with full facepiece operated in pressure demand mode is used to 100 mg/m³. Avoid eye contact by use of chemical safety goggles or face shield where splashing may occur. Imperious protective clothing, such as rubber gloves, aprons, boots, and suits are recommended to avoid body contact with this acid. Eyewash fountain and safety showers with deluge type heads should be readily available where this material is handled or stored. Comprehensive preplacement and annual medical examinations with emphasis on dental erosion, cardiopulmonary system, and mucous membrane irritation and cough.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Sulfuric acid in carboys or drums should be stored in clean ventilated storage areas having acid resistant floors with good drainage. Keep out of direct sunlight, do not store above 32 C. Storage facilities to be separate from metallic powders, chromates, chlorates, nitrates, carbides, oxidizables, etc. Soda ash, sand or lime should be kept in general storage or work areas for emergency use. Protect containers against physical damage. Glass bottles need extra protection. Sulfuric acid is highly corrosive to most metals especially below 77% H₂SO₄. Avoid breathing mist or vapors. Avoid contact with skin or eyes. Do not ingest. Do not add water to concentrated acid. Do not smoke. Use nonsparking tools and vapor-proof type electrical fixtures.	
DATA SOURCE(S) CODE: 2-12, 19, 20, 24, 26, 31, 37-39	APPROVALS: HIS CRD <i>J.M. Kien</i>
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MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
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NO. 517

PENTACHLOROPHENOL

DATE October 1983

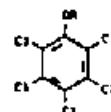
SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: PENTACHLOROPHENOL

DESCRIPTION: Wood preservative and fungicide, algicide in cooling towers.

OTHER DESIGNATIONS: PCP, Phenchlorol, Penta, CAS #000 087 865, C_6Cl_5OH

MANUFACTURER: Available from several suppliers.



SECTION II. INGREDIENTS AND HAZARDS

Pentachlorophenol (Purified)*

*Composition varies with each industrial batch.
PCP is about 90% for commercial material with major impurities tetrachlorophenol and hydroxychlorodiphenyl ethers. Low level contamination by certain chlorinated dioxins and dibenzofurans may be responsible for some toxic effects of commercial PCP, such as chloroacne.*

*Current OSHA PEL and ACGIH (1983) TLV. The ACGIH STEL is 1.5 mg/m. *2,3,7,8-TCDD is not a contaminate.

3-hr TWA 0.5 mg/m³
(skin)**

Human, Oral
LDLo 29 mg/kg

Rat, Oral
LD₅₀ 50 mg/kg

Rat, Inhalation
LD₅₀ 1170 ug/kg

Rat, Oral, 9D preg.
TDLo 60 mg/kg TFX:TER

SECTION III. PHYSICAL DATA

Boiling point, 1 atm deg C (decomposes) - 310 Specific gravity, 22/4C ----- 1.978*
Vapor pressure, mm Hg @ 20C ----- 0.0001 Melting point, deg C ----- 191*
@ 100C ----- 0.12 Molecular weight ----- 266.35
Vapor density (Air=1) ----- 9.2 Log octanol/water
Solubility in water, ppm @ 20C ----- 14 partition coeff. ----- 5.01
Appearance and Odor: White flake, needle-like crystals or block form; pungent odor only when hot. (Technical grades dark grey to brown). Good warning properties
(irritation of eyes and nose) at 1 mg/m³
*Purified PCP. Values for typical commercial products can be SG 1.85 and m.p. 188-189C

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Auto-ignition Temp.	Flammability Limits in Air	Lower	Upper
None*		Not combustible*		

Extinguishing media: Use that appropriate for surrounding fire: Dry chemical, carbon dioxide, foam, water spray. Use water spray to cool fire-exposed containers. When involved in a fire, it emits toxic fumes.

Firefighters should wear self-contained breathing apparatus and full protective clothing.

*The neat material is not combustible. However, wood treating is performed using 5% PCP soln. in petroleum solvents (mineral spirits, kerosene) which are combustible.

SECTION V. REACTIVITY DATA

This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not polymerize.
A weak acid which forms salts in alkaline solutions.
Solutions subjected to sunlight or ultraviolet light undergo photochemical degradation. Thermal-oxidative degradation products include vapors of hydrogen chloride and chlorine-containing compounds.

NO. 517

SECTION VI. HEALTH HAZARD INFORMATION	TLV 0.5 mg/m ³ (skin) (See Sect II)
Unacclimated individuals exposed to dust or sprays (conc. >1.0 mg/m³) can experience irritation to the upper respiratory tract (coughing & sneezing), eyes (tearing) and skin. <u>Readily absorbed through the skin</u> causing systemic injury. The risk of serious intoxication is increased in hot weather. Skin contact causes irritation, dermatitis, and acneiform (believed mainly from impurities in PCP). Solutions as dilute as 1% can cause skin irritation upon prolonged or repeated contact. Symptoms from excessive exposure include anorexia, fever, profuse sweating, increased respiration, muscular weakness, hyperglycemia, weight loss and heart failure.	
FIRST AID: <u>Eye Contact:</u> Flush thoroughly with running water for 15 min. including under eyelids. <u>Skin Contact:</u> Remove contaminated clothing! Wash affected area with soap and water. <u>Inhalation:</u> Remove to fresh air. <u>Ingestion:</u> Give several glasses of water to drink. Induce vomiting. Control rising body temp. with ice-cold towels or cold water bath. Get prompt medical help for further treatment, observation and support after first aid.	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Notify safety personnel. Provide ventilation. Clean-up workers need full protection against inhalation of vapors and contact with solid or solution. Collect solution spill with absorbent solid and place in metal container for disposal. Wash residue with soap and water. Prevent spills from entering sewers, streams, and open waters. DISPOSAL: Waste material can be buried in an approved landfill or dissolved in a flammable solvent, and burned in an approved, high temperature (>600C) incinerator using an afterburner and scrubber for HCl abatement. Follow Federal, State, and Local regulations. EPA(CWA) RQ is 10 lbs (40 CFR 117); EPA(RCRA) HW No. U242 (40CFR261). AQUATIC TOXICITY TLm 24 (fathead minnow): 0.33 mg/L	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide general and local exhaust ventilation to meet TLV requirements. When needed a chemical cartridge respirator with a dust, mist and fume filter and organic vapor cartridge can be used to 25 mg/m³; a full facepiece is needed >2.5 mg/m³. Approved, self-contained, positive pressure, breathing apparatus can be used to 150 mg/m³. Use impervious gloves, boots, protective clothing, etc. to avoid skin contact with liquid. Use chemical safety goggles with a faceshield if splashing is possible. Contaminated clothing to be removed and laundered before reuse. Showering after workshift with a complete change to street clothes is desirable. Use separated lockers for street clothes. Eyewash stations and washing facilities should be available near use areas. Preplacement and periodic physical exams should emphasize cardiovascular system, eyes, upper respiratory tract, liver, kidneys and skin. Provide training to those working with PCP.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in closed containers in a cool, dry, well-ventilated, low fire hazard area away from sources of heat and combustible materials. Protect containers from physical damage. Outside or detached storage preferred. Accumulated sludge at the bottom of dipping tanks may concentrate toxic impurities at much higher levels than original product. Avoid inhalation of vapors, dust or fumes. Avoid eye or skin contact. Do not ingest. Wash thoroughly after handling and follow good personal hygiene practices. PCP can be embryotoxic and teratogenic in test animals. No safe exposure level for pregnant women is established at this time. (See AHA Journal 43, pp 799-810, 1982). DOT Classification: ORM-E I.D. No. NA2020 Label: POISON	
DATA SOURCE(S) CODE: 2-14, 16, 20, 23, 27, 31, 34, 37, 38, 46-49; DHHS(NIOSH) Publ. #83-106.	
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MATERIAL SAFETY DATA SHEET

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NO. 100

ACETONE
Revision C

DATE June 1984

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: ACETONE
OTHER DESIGNATIONS: Dimethyl Ketone, 2-Propanone, CH_3COCH_3 , GE Material DSB24, ASTM D329,
GAS #000 067 641
MANUFACTURER: Available from many suppliers, including:
The Dow Chemical Company Eastman Chemical Products, Inc.
2020 Dow Center Kingsport, TN 37662
Midland, MI 48640 Tel: (615) 247-0411
Emergency telephone: (517) 636-4400

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Acetone	ca 100	8-hr TWA 750 ppm or 1780 mg/m ³ *
*ACGIH (1983) TLV: STEL 1000 ppm. Current OSHA PEL is 1000 ppm. NIOSH (1978) recommended a 10-hr TWA of 250 ppm or 590 mg/m ³ and defined the "action level" at half this exposure.		Rat, Oral LD ₅₀ 9.75 g/kg Rabbit, Skin LD ₅₀ 20 g/kg Human, Inhalation TCLo 500 ppm Eye irritation & Eye systemic effects

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg C	~56	Specific gravity (20/4 C)	0.79
Vapor pressure, mm Hg, at 20 C	180	Volatiles, %	ca 100
at 25 C	226	Melting point, deg C	-95
Vapor density (Air=1)	2.0	Evaporation rate (n-BuAc=1)	~7.7
Water solubility	Miscible	Molecular weight	58.09

Appearance & Odor: A clear, colorless, volatile liquid with a characteristic, pleasant
sweetish odor. Odor recognition threshold (100% of test panel) 100-150 ppm (also
reported between 200 and 400 ppm); distinct odor at 680 ppm.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
-4 F (-20C) (TCC)**	>538 C	% by volume**	2.79 (at 77F)	13.2 (at 75F)

Extinguishing media: CO₂, alcohol foam, dry chemical or water spray. Water spray may not
be effective in extinguishing.* Use water to cool fire-exposed containers and to dilute
and reduce fire intensity. Class B fires; use a blanketing effect to smother flame.
Dangerous fire hazard and moderate explosion hazard when exposed to heat and flame.
Firefighters should use self-contained breathing apparatus.

*10% solution of acetone in water is reported to have ~80F flash point.

**Higher closed cup flash points, lower LEL and lower UEL also are reported.

SECTION V. REACTIVITY DATA

Acetone is stable in closed container under normal storage and use conditions. It does
not undergo hazardous polymerization.
This OSHA Class 1B flammable liquid reacts vigorously with strong oxidizing agents, such
as nitrates and perchlorates or concentrated sulfuric acid. Incompatible with nitric
and sulfuric acid mixture (can be explosive) and with nitric and acetic acid mixture.
Ignition on reaction with potassium t-butoxide.
Thermal-oxidative degradation can include carbon monoxide.

NO. 300

SECTION VI. HEALTH HAZARD INFORMATION	TLV 750 ppm (See Sect II)
Acetone is a low toxicity solvent. Irritation of mucous membranes, dryness of the mouth & throat, headache, nausea, dizziness, and narcosis can result from excessive exposure to vapors. Prolonged or repeated skin contact has a defatting effect, causing drying, irritation and mild dermatitis. Absorption through intact skin is not expected to cause systemic injury; however, possible skin absorption should be considered in meeting TLV requirements. Eye contact is irritating and can be damaging. Do not ingest.	
FIRST AID: <u>Eye Contact:</u> Flush promptly with plenty of running water for 15 minutes, including under eyelids. Contact a physician if irritation persists. <u>Skin Contact:</u> Wash off with water. Remove contaminated clothing. Get medical assistance if irritation persists or if large body areas are contacted. <u>Inhalation:</u> Remove to fresh air. If effects are more severe than a headache, contact a physician. Restore and/or support breathing if required. Consider oxygen therapy. <u>Ingestion:</u> Give water to drink to dilute. If victim is alert and large amount ingested, induce vomiting. Contact a physician!	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Report large spills to safety personnel. Provide maximum explosion-proof ventilation and eliminate sources of ignition. Clean-up personnel need protection against inhalation and liquid contact. Flush with water spray to clear area of acetone (flush to open ground, not to drains, sewers or surface water courses), or dilute with >200 parts of water and pick up with nonsparking tools for disposal.	
DISPOSAL: Incineration is a recommended method to dispose of scrap acetone. Reduce burning hazards by mixture with less flammable liquid for incineration. Follow Federal, State, and Local regulations. When amounts warrant it, consider reclaiming. EPA (RCRA) HW No. U002 (40 CFR 261)	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide explosion-proof general and local exhaust ventilation to meet TLV requirements. For nonroutine or emergency exposure above the TLV, use approved chemical cartridge or canister, gas mask (up to 5000 ppm) or self-contained respirator with full facepiece (up to 20,000 ppm). Safety glasses and butyl rubber or polyvinyl acetate gloves are recommended to avoid contact with liquid acetone. (Protective creams can also be used). Additional protective clothing may be required (boots, apron, etc.) as work conditions indicate to prevent contact with liquid. Remove contaminated clothing promptly (fire and health hazard) and clean and dry before reuse. An eyewash station and safety shower should be available near the workplace where splashing is possible. Sprinkler fire protection is desirable in areas of storage, handling and use. NIOSH recommends preplacement and medical exams for those regularly exposed above "action level".	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in closed containers (carbon steel recommended) in a cool, clean, well-ventilated fire-resistant area, away from oxidizing agents and sources of heat or ignition. Bond and ground containers and equipment for transfers to avoid static sparks. Use labeled safety cans for small amounts. Protect containers from physical damage. Acetone must be stored and handled as an OSHA Class 1B flammable liquid. Electrical services must meet codes. No smoking in storage or use areas. Use with adequate ventilation. Avoid prolonged or repeated contact with liquid. DOT Classification: FLAMMABLE LIQUID I.D. No. UN1090 Label: FLAMMABLE LIQUID	
DATA SOURCE(S) CODE: 1-12, 14, 16, 19-21, 23-26, 31, 38, 47	
Adjustments do to the accuracy of information herein for purposes of purchase are exclusively purchased a responsibility. Therefore, although information care has been taken in the preparation of such information, Genium Publishing Corporation assumes no responsibility, makes no representations and warrants no responsibility as to the accuracy or reliability of such information for application to any other than a personal purchase of the contents of the book.	APPROVALS: MIS/CRD <i>J. M. Niden</i> INDUST. HYGIENE/SAFETY <i>JW 6-8-84</i> MEDICAL REVIEW: 15 June 1984

MATERIAL SAFETY DATA SHEET

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No. 303

METHYL ETHYL KETONE
REVISION B

Date September 1979

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: METHYL ETHYL KETONE
OTHER DESIGNATIONS: MEK, Butanone, 2-Butanone, Ethyl Methyl Ketone, $\text{CH}_3\text{COCH}_2\text{CH}_3$,
ASTM D740, GE Material D5B40, CAS# 000 078 933
MANUFACTURER: Available from many suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Methyl Ethyl Ketone ($\text{C}_4\text{H}_8\text{O}$)

ca 100

8-hr TWA 200 ppm*
or 590 mg/m³

*Current OSHA and ACGIH (1979) TLV.
NIOSH (1978) proposed a 10-hr TWA of 200 ppm.

Human, Inhalation
TCLo 300 ppm
(peripheral nervous
syst.)

Rat, oral LD₅₀
3.6 g/kg

Rabbit, skin LD₅₀
13 g/kg

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg F (C) — 176 (80) Specific gravity (20/4 C) — 0.805
Vapor pressure at 25 C, mm Hg — 100 Volatiles, vol.1 — ca 100
Vapor density (Air=1) — 2.5 Evaporation rate (Ether=1) — 2.7
Solubility in water at 20 C, wt.1 — 27.1 Molecular weight — 72.12

Appearance & Odor: Colorless liquid with a moderately sharp, fragrant, mint-like odor.
Unfatigued, odor recognition threshold (100% of test panel) is 6-10 ppm.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
20 F (-6.7 C) (Closed Cup)	960 F (516 C)	1 by Vol.	1.8	10.0

Extinguishing Media: "Alcohol" foam, CO₂, dry chemical. Water may be ineffective. A stream of water can scatter flames. Use a water spray to cool fire-exposed metal containers.

This volatile liquid can readily form explosive or flammable mixtures with air. Vapors can flow along surfaces to distant ignition sources and flash back.

Self-contained breathing apparatus is required for those fighting fires in enclosures in which this material is involved.

SECTION V. REACTIVITY DATA

This material is stable under normal storage and use conditions. It is a highly flammable liquid (OSHA Class IB) and must be kept away from sparks, open flames, hot surfaces, and all sources of heat and ignition. Strong oxidizing agents can cause spontaneous ignition and violent reaction. Ignition on reaction with potassium *t*-butoxide.
This solvent can attack many plastics, resins and rubber.

NO. 303

SECTION VI. HEALTH HAZARD INFORMATION		TLV 200 ppm or 590 mg/m ³
Below the TLV vapors may cause some irritation to the nose and throat. Above the TLV irritation of the mucous membranes, headache, dizziness, upset stomach, and vomiting can occur. At high concentrations MEX can produce unconsciousness. Liquid contact will defat and irritate the skin and can produce dermatitis. Eye contact may cause irritation and burning sensations of the eyelid. Ingestion can irritate the digestive tract; ingestion of several ounces can cause narcosis. FIRST AID: Skin Contact: Wash area of contact with soap and water. Remove contaminated clothing immediately. If irritation persists get medical attention. Eye Contact: Immediately wash with plenty of water, including under the eyelids. If irritation persists get medical attention. Inhalation: Remove victim to fresh air. If required, restore breathing. Keep warm and at rest. Get immediate medical attention! Ingestion: If victim is conscious and medical help is not readily available, give 3 glasses of water or milk to drink and induce vomiting. Get medical help as soon as possible.		
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES		
Notify safety personnel. Remove all ignition sources. Provide optimum available explosion-proof ventilation. Those involved in clean-up should use protective equipment. Contain liquid and pick up for disposal or absorb on vermiculite or other absorbent solid. Scrape up solid with a nonsparking scoop and place in a covered metal container for disposal. DISPOSAL: Dispose of solid absorbed scrap by burning in a remote open pit or by depositing in an approved sanitary landfill. Liquid wastes can be atomized into an incinerator or disposed of via a licensed disposal company. Follow Federal, State, and local regulations.		
SECTION VIII. SPECIAL PROTECTION INFORMATION		
Provide general and exhaust ventilation to meet TLV requirements. Exhaust hoods should have a min. of 100 fpm face velocity. Exhaust fans and other electrical services must be of explosion-proof construction. For emergency and nonroutine work above the TLV an approved, full facepiece, organic vapor canister gas mask is recommended; but for unknown conc. or above about 3000 ppm self-contained or air-supplied type respirators (positive pressure) are needed. Use safety goggles where liquid contact with the eyes is possible. Do not use contact lenses when working with solvents. Use impervious gloves. Where splashing may occur, use a face shield, apron and other protective clothing as needed to prevent skin contact. An eyewash station must be available near the workplace. Safety shower desirable when large amounts are used.		
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS		
Store in tightly closed drums or metal safety cans in a cool, well-ventilated storage area away from ignition sources and strong oxidizing agents. Storage facility must be of the OSHA approved type for a Class IB liquid. Prevent container damage. Ground and bond metal containers when dispensing. Use only nonsparking tools near the solvent. No smoking in areas of storage or use. Medical surveillance of workers should include preplacement and (at least) annual examinations. DOT Classification - COMBUSTIBLE LIQUID.		
DATA SOURCE(S) CODE: 2-9, 12, 19-21, 23, 26, 27		APPROVALS: HHS, CRD <i>J. M. Nielsen</i> Industrial Hygiene and Safety <i>04/6</i>
ADDITIONAL: As to the accuracy of information herein for purposes of the regulatory provisions of the OSHA Act, the user is advised that the information is not intended to be used for purposes of the OSHA Act. The user is advised that the information is not intended to be used for purposes of the OSHA Act. The user is advised that the information is not intended to be used for purposes of the OSHA Act.		MEDICAL REVIEW: 12/79

MATERIAL SAFETY DATA SHEET

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No. 327

ACETIC ACID, GLACIAL

Revision B

Date December 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: ACETIC ACID, GLACIAL

OTHER DESIGNATIONS: Ethanoic Acid, Anhydrous Acetic Acid, Methane Carboxylic Acid, CH_3COOH , GE Material D5C26, CAS #000 064 197

MANUFACTURER: Available from many suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Acetic Acid (CH_3COOH)99.5%
minimum8-hr TWA 25 mg/m³ or
10 ppm*

*Current OSHA standard and ACGIH (1980) TLV.

Human, oral
TDLo 1470 ug/kgGastrointestinal
Tract Effects

SECTION III. PHYSICAL DATA

Boiling pt, 1 atm, deg F (C) — 244 (118)

Specific gravity, 20/4 C — 1.05

Vapor pressure at 25 C, mm Hg — 14.8

Freezing point, deg F (C) — 62 (16.5)

Vapor density (Air=1) — 2.07

Molecular weight — 60.06

Solubility in water — Soluble

Appearance & Odor: Clear, colorless, mobile liquid with a characteristic, sharp and pungent, vinegar-like odor which is perceptible (unfatigued) above 1 ppm.

SECTION IV. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method

Autoignition Temp.

Flammability Limits in Air

4

16

112 F (44.5 C) (TOC)

800 F (427 C)

% by volume

19.9 @ 200

Extinguishing Media: Use water spray, dry chemical, alcohol foam, or CO_2 . Water spray can be used to flush spills away from exposures and to dilute spills to nonflammable mixtures. Use water to keep fire-exposed containers cool. Glacial acetic acid is a combustible liquid.

Water diluted acid can react with metals to produce hydrogen gas.

Firefighters to wear self-contained breathing apparatus to protect against suffocating and corrosive vapors when this material is involved in a fire situation.

SECTION V. REACTIVITY DATA

This material is a stable chemical when stored and handled properly.

It may react violently with such chemicals as ammonium nitrate, phosphorous trichloride, potassium hydroxide and other alkaline materials, and strong oxidizing agents.

Reacts readily with most common metals (except aluminum), basic salts, amines, etc., to form water-soluble salts. Reacts with alcohol to form esters.

Nitric acid or chromic acid can explode with acetic acid if not kept cold.

Mixing chlorosulfonic acid, 2-aminoethanol, oleum, or ethylene diamine with acetic acid in a closed container can cause the temperature and pressure to increase.

Contracts slightly on freezing.

NO. 327

SECTION VI. HEALTH HAZARD INFORMATION

TLV 10 ppm or 25 mg/m³

Inhalation of vapor concentrations over 50 ppm intolerable, resulting in irritation of the eyes, nose, throat, and lungs. Repeated exposure to high concentrations may produce congestion of the pharynx. Neither odor nor degree of irritation are adequate to indicate vapor concentrations. Skin contact can produce deep burns, with skin destruction. High vapor concentrations may blacken the skin, produce skin sensitization, conjunctivitis, and erosion of exposed teeth. Eye contact will cause immediate burns and possible permanent damage. Ingestion is improbable as the odor would be extremely irritating; but severe intestinal irritation would result with burns to the mouth and the upper respiratory tract.

FIRST AID:

Eye Contact: Irrigate with water immediately for at least 15 minutes, including under eyelids.

Skin Contact: Wash immediately with copious water.

Inhalation: Remove victim to fresh air; rinse mouth and nasal passages. Administer artificial respiration or oxygen if needed.

Ingestion: Rinse mouth. Give 3 glasses milk or water. Do not incubate stomach or stimulate vomiting.

Get prompt medical help for further treatment, observation and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel. Provide adequate ventilation. Personnel cleaning up large spills should wear self-contained breathing apparatus and equipment to prevent contact with the liquid. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect men attempting to stop a leak. Liquid surfaces of small spills or residue should be covered with sodium bicarbonate and flushed with a large excess of water to the sewer. Contain and pick up large spills, if possible, for waste disposal.

DISPOSAL: Dispose of waste material by incineration; or dispose of neutralized waste in a landfill. Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate exhaust ventilation to meet TLV requirements. Exhaust hoods should have air velocity of 100 fpm minimum. Wear rubber gloves, aprons, etc to prevent skin contact. Splash proof goggles or face shields should be worn to prevent any eye contact. Gas tight goggles may also be required to prevent vapor irritation of the eyes. Eyewash stations and showers must be readily available where this material is handled. Respirators should be available for nonroutine or emergency use. Where fumes are below 500 ppm, a chemical cartridge organic vapor respirator with full facepiece or a self-contained breathing apparatus with full facepiece is warranted; fumes up to 1000 ppm require a Type C air-supplied respirator with full facepiece operated in pressure-demand mode.

Preclude from exposure individuals with disease of eyes, skin and respiratory tract.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Use with adequate ventilation. Exhaust ducts for ventilation should be acid resistant. Detached storage preferred. Store in sealed containers away from oxidizing agents and combustible materials. Glass, polyethylene, Type 316 stainless steel containers are suitable. Prevent skin and eye contact as this acid is highly corrosive to body tissues. Olfactory detection at 1 ppm is well below the TLV; however, documentation shows workers can tolerate up to 200 ppm, probably due to olfactory fatigue. Suspected areas of high acetic acid concentrations or variable concentrations should be tested before employee exposure.

DOT Classification - CORROSIVE MATERIAL, LABEL: CORROSIVE

DATA SOURCE(S) CODE: 2-12, 15, 23-26, 31, 34, 37-39

APPROVALS: MIS
CRD

Industrial Hygiene
and Safety

MEDICAL REVIEW: 16 Dec. 1980

MATERIAL SAFETY DATA SHEET

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NO. 317

TOLUENE

Revision C

Date August 1979

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: TOLUENE
OTHER DESIGNATIONS: Toluol, Methylbenzene, Phenylmethane, $\text{CH}_3\text{C}_6\text{H}_5$, GE Material D5B11, ASTM D362 and D841, CAS# 000 108 883
MANUFACTURER: Available from many suppliers, including Shell Chemical Co. and Sun Oil Co.

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Toluene	ca 100	8-hr TWA 100 ppm (skin)* or 375 mg/m ³ Human, inhalation TCLo 200 ppm (central nervous syst.) Rat, inhalation LCLo 4000 ppm/4 hr Rat, oral LD ₅₀ 5000 mg/kg

*ACGIH (1978): (skin) notation indicates a potential contribution to overall exposure via skin absorption. OSHA/NIOSH (1976) proposed an 8-hr TWA of 100 ppm, with a 15-minute ceiling of 200 ppm, and an action level of 50 ppm. Current OSHA TLV is 200 ppm.

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg F (C) — 231 (110.6) Specific gravity (Water=1) — 0.866
Vapor pressure @ 25 C, mm Hg — 28 Volatiles, % — 100
Vapor density (Air=1) — 3.2 Evaporation rate (BuAc=1) — 1.9
Solubility in water, % — 0.05 Molecular weight — 92.15
Appearance & Odor: Water white liquid with a characteristic aromatic odor, whose recognition threshold (unfatigued) is 2-5 ppm (100% of test panel). Odor detection is unsatisfactory for safety because of fatigue.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
40 F (4.4 C) Closed cup	(536 C) 997 F	% by volume	1.2	7

Extinguishing Media: Carbon dioxide, dry chemical, foam, and water fog. Water may be ineffective for putting out fire, but use spray to cool fire-exposed containers.
At room temperature, toluene emits vapors that can form flammable mixtures with air. It is a dangerous fire hazard and a moderate explosion hazard when exposed to heat and flame. Vapors can flow along surfaces to distant ignition sources, then flash back. Firefighters should wear self-contained breathing apparatus and eye protection when fighting toluene fires.

SECTION V. REACTIVITY DATA

Toluene is a stable material under normal storage and handling. It does not undergo hazardous polymerization.
Since toluene is a flammable liquid, avoid contact with heat, sparks or open flames. Avoid contact with strong oxidizing agents. Nitric acid and toluene, especially in combination with sulfuric acid, will produce nitrated compounds which are dangerously explosive.
Oxidation in air can form oxides of carbon and nitrogen.

NO. 117

SECTION VI. HEALTH HAZARD INFORMATION	TLV 100 ppm (skin) (See Sect. II)
Vapor inhalation can produce headache and slight drowsiness at 100 ppm, fatigue, nausea and itching skin at 100-200 ppm, anesthetic effects and respiratory tract and eye irritation above 200 ppm. Absorption can occur through the skin, and liquid contact will cause defatting of the skin, with possible dermatitis from repeated or prolonged contact. Eye contact is irritating and can be damaging (corneal burns). Ingestion irritates the digestive tract and results in systemic effects from absorption.	
FIRST AID:	
<u>Eye Contact:</u> Immediately irrigate with water for 15 minutes. Get medical help.	
<u>Skin Contact:</u> Wash area with soap & water; remove contaminated clothing promptly.	
Get medical help if irritation persists or if large areas of skin were exposed.	
<u>Inhalation:</u> Remove to fresh air; restore breathing and give oxygen if needed. Get medical help!	
<u>Ingestion:</u> Get medical help as soon as possible! When victim is conscious, give USP mineral oil to drink. (Aspiration is a potential hazard if vomiting occurs!)	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Report large spills to safety personnel. Remove ignition sources; provide explosion-proof ventilation. Those involved in clean-up must use protection against liquid contact and vapor inhalation. Pick up liquid when feasible, or absorb on vermiculite or sand and scoop up with nonsparking tools into a metal container with cover. Liquid can be flushed with a water spray to an open holding area for handling. Do not flush to sewer, to a confined space, or to a watercourse!	
<u>DISPOSAL:</u> Consider reclaiming by distillation or disposal via a licensed waste disposal company. Scrap may be incinerated under properly controlled conditions. Follow Federal, State and local regulations.	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide general and exhaust ventilation to meet TLV requirements. Ventilation fans & other electrical service must be nonsparking and explosion proof. Exhaust hoods should have >100 fpm face velocity and be designed to capture heavy vapors. Exposure above the TLV for nonroutine and emergency situations requires use of an organic chemical cartridge respirator up to 200 ppm; above 200 ppm a full face piece is required with an approved canister-type gas mask or self-contained breathing equipment. Safety goggles or glasses should be worn in areas of use. Impermeable (neoprene has been recommended) gloves and apron, face shield, and other protective clothing may be needed to prevent skin contact during use, especially where splashing may occur. An eyewash station should be available if splashing is possible. A safety shower and washing facilities should be available.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in cool, clean, well-ventilated area away from sources of heat and ignition and away from oxidizing agents. Area must meet requirements of OSHA Class IB liquid. No smoking in areas of storage or use. Nonsparking tools should be used near toluene. Use safety cans for handling small amounts. Ground and bond metal containers for liquid transfers to prevent static sparks. Protect containers from physical damage. Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart and blood should be provided. At least an annual exam is recommended for workers exposed above the action level (50 ppm). Use of alcohol can aggravate the narcotic effect and blood effects of toluene.	
DATA SOURCE(S) CODE: 1-9,12,20,21,24,26	APPROVALS: MIS. <i>J. M. [Signature]</i> CRD Industrial Hygiene and Safety <i>[Signature]</i> MEDICAL REVIEW: 12/79
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MATERIAL SAFETY DATA SHEET

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No. 6A

HYDROFLUORIC ACID
AQUEOUS (47-70%)

Revision B

Date May 1981

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: HYDROFLUORIC ACID, AQUEOUS (47-70%)
DESCRIPTION: A solution hydrogen fluoride gas in water. Properties vary with concentration.

OTHER DESIGNATIONS: GE Material D4A7, CAS #007 664 393

MANUFACTURER: Available from many suppliers, including Harshaw Chemical Company, and E.I. duPont de Nemours Co., Inc.

SECTION II. INGREDIENTS AND HAZARDS

Hydrogen fluoride (HF)

Water

x HAZARD DATA

47-70 8-hr TWA 2 mg/m³ or
Balance 3 ppm*

*Current OSHA Standard and ACGIH (1980) TLV (as HF).
NIOSH has recommended 10-hr TWA of 2.5 mg (as F)/m³
and a ceiling level of 5.0 mg/m³ (15 min. sample).
TLV set at level to minimize irritation of eyes and
nose and to prevent fluorosis. DuPont recommends that
this level be treated as a ceiling limit.

SECTION III. PHYSICAL DATA

48% acid

70% acid

Boiling point, 1 atm	225 F (107 C)	152 F (66 C)	Volatiles, %	ca 100
Weight % HF in vapor at BP	ca 80	ca 98	Water solubility	Complete
Vapor pressure at 20 C, mm Hg	ca 25	ca 125	pH	<2
Specific gravity (D/4 C)	1.18	1.27		
Freezing point	ca -35 F	ca -95 F		

Appearance & Odor: Colorless, or nearly colorless, fuming liquid with a pungent, irritating odor above 5 ppm.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
N/A	N/A	N/A		

Extinguishing Media: Water or carbon dioxide. Keep upwind of fire.
This material is nonflammable; however, flammable and explosive hydrogen gas may be formed when HF reacts with certain metals.
Dangerous when heated; emits toxic corrosive fumes. Avoid getting water into tanks or drums, can cause generation of heat and possible spattering.
Firefighters should wear self-contained breathing apparatus, eye protection, and complete body protection equipment when fighting an HF fire.

SECTION V. REACTIVITY DATA

Hydrofluoric acid is a stable chemical when used and stored under proper conditions. This acidic material will attack glass, concrete, certain metals, silica-containing materials, natural rubber, leather, and many organics. It reacts with silica to produce SiF₄, a hazardous colorless gas. Reaction with cyanides or sulfides may cause release of poisonous cyanide or hydrogen sulfide gas.

Keep 50% acid in tightly closed polyethylene, TEFLON, lead, wax, or paraffin coated containers. >60% HF concentrations can be handled in passivated steel containers and piping of appropriate design.

NO. 6A

SECTION VI. HEALTH HAZARD INFORMATION

TLV 1 ppm or 2 mg/m³ (as HF)

HF is not detected by smell at 3 ppm but is immediately irritating to mucous membranes at over 5 ppm. Inhalation of vapors can cause extreme irritation of respiratory tract, pulmonary edema, congestion, and fluorosis. Breathing 50 ppm for 30-60 min. may be fatal. Eye contact can cause permanent damage. Skin contact causes severe burns, which may not be immediately painful or visible; concentrations below 50% may not produce symptoms for 8 hours or longer. Ingestion can cause throat burns and severe swelling of windpipe.

FIRST AID:

Eye Contact: Immediately flush with water for 15 min. or more, including under eyelids.*

Skin Contact: Wash acid from the skin. Remove contaminated clothing. Continue washing 2-4 hours with water; or preferably if available, soak in ice Zephiran (0.13%), epsom salt, or 70% denatured ethyl alcohol solution for 1-4 hours, depending on severity of burns.*

Inhalation: Immediately remove to fresh air. Admin. 100% O₂ and repeat 1/2 hr intervals.*

Ingestion: Do not induce vomiting. Give large quantities of milk or water with milk of magnesia.*

*Get medical attention promptly for all affected persons. First aid procedures should be planned before beginning work with HF. Consider hospitalization.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel, provide adequate ventilation, and remove ignition sources since hydrogen may be generated by reactions with metals. Use protective clothing & equipment. HF vapor should be passed through a packed tower scrubber. Spills should be covered with lime to form a slurry. Do not flush to sewers or waterways.

DISPOSAL: The neutralized slurry can be scraped up for disposal in an approved landfill.

Liquid wastes may be neutralized in a trench with lime in a remote location away from buildings and people. Then fill the trench with earth and cover with lumber or sheet metal until the earth settles. Follow Federal, State, and Local regulations.

NOTE: Porous materials (concrete, wood, plastic, etc.) will absorb HF and become a hazard for an indefinite time. Such spills to be cleaned and neutralized immediately.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Exhaust hoods should be a noncorroding construction, with a face velocity minimum of 100 fpm. Respirators should be available for nonroutine and emergency use above the TLV. An air-supplied respirator or a self-contained breathing apparatus with full facepiece is recommended when vapors/fumes are above exposure limits, up to 20 ppm.

Wear protective clothing, including boots or safety shoes with polyvinyl chloride (PVC), neoprene or composition soles; chemical goggles and/or a full face shield; coveralls with long sleeves; gauntlets and gloves of PVC or neoprene. A high degree of protection obtained with an air-inflated suit with mask and safety belt. Protective clothing not to be worn or carried beyond operation areas. Use protection suitable for conditions.

Chemical showers and eyewash stations to be readily available to areas of use. Immediately shower with copious amounts of water within seconds after contact, and completely remove all clothing while in shower.

Contact with dilute HF solutions (below 20% in water) may not produce immediate pain or visible damage; but after several hours, the burns will be manifest.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Maintain adequate ventilation. Use forced draft ventilation and scrubbers for fume control. Keep containers tightly closed. Storage facilities to be constructed for containment and dilution/neutralization of spills.

Use nonsparking tools around tanks & pipes where hydrogen gas may collect.

Handling and storage of HF requires special materials technology for containers, pipes, valves, gaskets, etc., which is available from suppliers. TEFLON TFE or FEP fluorocarbon resins are resistant to all conc. of HF up to 500 F and 400 F respectively. Do not inhale HF mists or vapors! Preclude from exposure workers with kidney disease, osteofluorosis, or impaired pulmonary function.

DOT Classification - CORROSIVE MATERIAL.

I.D. No. UN1790

DATA SOURCE(S) CODE: 1-11, 17, 20, 26, 31, 37, 38, 43 MSDS #6

APPROVALS: MIS
CRD

Industrial Hygiene
and Safety

MEDICAL REVIEW: 14 May 1981

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No. 318

XYLENE
(mixed isomers)

Revision C

Date November 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: XYLENE (mixed isomers)
OTHER DESIGNATIONS: Xylol, Dimethylbenzene, $C_6H_4(CH_3)_2$; ASTM D843, D845 and D846;
GE Material D589, CAS #001 330 207.
MANUFACTURER: Available from many suppliers, including EXXON Company USA and
Shell Chemical Company.

SECTION II. INGREDIENTS AND HAZARDS

	I	HAZARD DATA
Xylene (o, m, p-isomers) Other C_7 to C_9 Hydrocarbons*	>90 <10	8-hr TWA 100 ppm (skin)** or 435 mg/m ³ Xylene Typical Human, inhalation TCLo 200 ppm (Irritation Effects) Rat, oral LD ₅₀ 4.3 g/kg Human, oral LDLo 50 mg/kg

*Material may contain ethylbenzene (8-hr TWA 100 ppm) and traces of toluene and C_9 aromatic and aliphatic hydrocarbons. Some commercial products may contain over 10% non-xylene hydrocarbons, mostly ethylbenzene.
**Current OSHA standard and ACGIH (1980) TLV. NIOSH has proposed a 10-hr TWA of 100 ppm with a 200 ppm ceiling level (10 min. sample).
STATUS: NCI bioassay for carcinogenesis study 9/78. TLV set to prevent irritant effects and CNS depression.

SECTION III. PHYSICAL DATA

Boiling range, 1 atm, deg C	135-145*	Specific gravity ($H_2O=1$)	0.86-0.87
Vapor pressure at 20 C, mm Hg	ca 6	Volatiles, %	ca 100
Vapor density (Air=1)	3.7	Evaporation rate (BuAc=1)	0.6
Solubility in water	Negligible	Molecular weight	106.18

Appearance & Odor: Light colored or colorless, mobile liquid with an aromatic odor.
The recognition threshold (100% of test panel) is about 0.3 ppm in air (unfatigued) for xylene.

*Wider and narrower boiling range materials are commercially available.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
>77 F (TCC)	867 F	Volume %	1	7

Extinguishing Media: Use dry chemical, foam, CO_2 , and water fog or steam to provide a smothering effect on fire. A water stream can scatter flames. A spray of water may be used to cool fire-exposed containers.

This flammable liquid is a dangerous fire hazard and a moderate explosion hazard when exposed to heat or flame. Heavier-than-air vapors can flow along surfaces to distant ignition sources and flash back.

Firefighters should use self-contained breathing apparatus.

SECTION V. REACTIVITY DATA

This material is stable in closed containers at room temperature. It does not polymerize.

It is flammable (OSHA Class IC liquid) and can form explosive mixtures with air. Keep away from sources of heat, sources of ignition and strong oxidizing agents. Thermal-oxidative degradation in air can produce toxic vapors and gases, including carbon monoxide and oxides of nitrogen.

MATERIAL SAFETY DATA SHEET

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NO. 30A

HYDROCHLORIC ACID
Revision A

DATE June 1984

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: HYDROCHLORIC ACID

DESCRIPTION: This material is a water solution of hydrogen chloride gas.

OTHER DESIGNATIONS: Muriatic Acid, Concentrated Hydrochloric Acid, GE Material D4A3, CAS# 007 647 010, Aqueous Hydrochloric Acid

MANUFACTURER: Available from many suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Hydrogen Chloride (HCl)

Impurities (depends on acid grade)

Water

%

HAZARD DATA

<38
Traces
Balance

8-hr TWA 5 ppm or 7 mg/m³ (C)Human, Inhalation
LC₅₀ 1300ppm/30 M

Rabbit, Oral

LD₅₀ 900 mg/kg

Rat, Oral (200Be')

LD₅₀ 700 mg/kg

Rabbit, Skin (200Be')

LD₅₀ >5g/kg, 24 H-C

*Current OSHA PEL and ACGIH (1983) TLV Ceiling Level.

SECTION III. PHYSICAL DATA

18°Be'

20°Be'

22°Be'

23°Be'

Weight % HCl ----- 27.9

31.5

35.2

37.1

Boiling pt., 1 atm, deg F ----- 208

182

144

123

Freezing point, deg F (approx) -- -43

-63

-86

-101

Specific gravity, 60/60 F ----- 1.142

1.162

1.179

1.189

Vap. Press., 25C, HCl/Total, mm Hg ~7/15

~25/33

~87/92

~186/190

All materials are completely water soluble with ~100% volatiles and pH <1.

Appearance & Odor: Clear, colorless to lt. yellow, fuming* liquid with a pungent, irritating odor. 1-5 ppm HCl detected by smell; 5-10 ppm is disagreeable.

*Higher conc. tend to be fuming liquids at room temperature.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
N/A	N/A	N/A	-	-

Extinguishing media: Select that suitable for surrounding fire. Use a water spray to cool fire exposed containers to prevent rupture.

Nonflammable, but acid can react with many metals, such as iron, to produce flammable hydrogen gas. (Flammable conc. may accumulate inside metal equipment.) Neutralize acid with limestone, slaked lime or soda ash to minimize formation of potentially explosive hydrogen gas.

Firefighters should use full protective clothing and self-contained breathing apparatus when this material is involved in a fire situation.

SECTION V. REACTIVITY DATA

This material is stable when properly contained and handled. It is a strong mineral acid and is, thus, highly reactive with materials such as metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. It is highly corrosive to many materials; it must have proper containment for handling and storage.

It liberates significant levels of HCl gas by vapor pressure at room temperature when concentrated and large amounts of HCl when heated.

Reaction with most metals will produce flammable hydrogen gas.

Incompatible with materials such as cyanides, sulfides, sulfites and formaldehyde (may release HCN, H₂S, SO₂, bischloromethyl ether, respectively).

NO. 10A

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 ppm Ceiling Level (as HCl)

Aqueous HCl and its vapors are strong irritants of the eyes, mucous membranes, and skin. Severity of eye injury from splashes (from irritation to severe burns) depends on quantity, conc. and duration of contact. Excessive acute exposure to HCl vapors/mists promptly irritates the upper respiratory tract and can result in coughing, burning of the throat, choking sensation and, if inhaled deeply, pulmonary edema. Prolonged or repeated low level exposure may cause teeth erosion. Skin exposure can cause burns; repeated or prolonged exposure to dilute soln. may cause dermatitis. Ingestion can cause severe burns and possible laryngeal spasm.

FIRST AID:
Eye Contact: Contact physician! Immediately flush with running water for 15 min. including under eyelids.
Skin Contact: Flush affected area well with water. Remove grossly contaminated clothing under safety shower. Get medical help if large skin area contacted or if irritation persists.
Inhalation: Remove to fresh air. Restore and/or support breathing as needed. Use O₂ therapy for coughing, difficult breathing. Get medical help. Keep warm and at rest.
Ingestion: If victim is conscious, give 2-3 glasses of water, then milk of magnesia or lime water. Contact physician! Do not induce vomiting!

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Report large spills to safety personnel. Evacuation may be needed; keep upwind. Remove sources of ignition if H₂ is a hazard. Provide optimum ventilation. Those involved in clean-up of large spills must use full protective clothing, boots, and self-contained breathing apparatus.

Small spills and residues can be covered with excess of a mixture of soda ash and slaked lime to neutralize, and the slurry picked up for landfill burial or flushed with much water.

Contain large spills. Collect or flush with water to holding area for neutralization. Do not flush directly to sewer or surface waters.

DISPOSAL: Dispose of acid via licensed contractor or neutralize with limestone, soda ash or slaked lime. Flushing to sewer depends on allowable neutral salt concentrations in effluent water. Follow Federal, State and Local Regulations. Consider use of waste acid to neutralize alkaline wastes. EPA (CWA) NO. is 5000 15.140 CFR 117)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate exhaust ventilation to meet TLV requirements. Face velocity of hoods should exceed 100 fpm. Use approved respirator or self-contained breathing apparatus for emergency or non-routine conditions with full facepiece above 50 ppm.

Those handling hydrochloric acid should use protective clothing and equipment to prevent body contact with the liquid. Use rubber gloves or gauntlets, apron, boots, long sleeved shirt, body suit, etc. Use chemical safety goggles and/or face shield for eye protection against splashing of acid.

An eyewash station, washing facilities, and safety shower must be readily available to areas of use and handling.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store closed containers out of direct sunlight, in a clean, cool, open or well-ventilated area, away from oxidizing agents, away from alkaline material and sources of heat. Area should have acid resistant floor and approved drainage. Protect containers from physical damage. Use nonsparking tools in areas around tanks and pipes where hydrogen might be generated.

Use with good ventilation. Avoid inhalation of HCl vapors. Odor of HCl gives adequate warning for a prompt voluntary withdrawal from excessive exposure. Do not get in eyes or on skin or clothing. Wash thoroughly after handling.

Provide emergency neutralization materials and equipment near storage and use areas.

DOT Classification: CORROSIVE MATERIAL I.D. No. UN1789 Label: CORROSIVE
 IMD Class 8

DATA SOURCE(S) CODE: 1-12, 14-16, 27, 31, 34, 37, 38, 47-49

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APPROVALS: MHS/CRO

INDUST. HYGIENE/SAFETY

MEDICAL REVIEW:

15 June 1984

MATERIAL SAFETY DATA SHEET

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NO 311
INHIBITED
1,1,1-TRICHLOROETHANE
REVISION D
DATE August 1983

SECTION I. MATERIAL IDENTIFICATION			
MATERIAL NAME: INHIBITED 1,1,1-TRICHLOROETHANE OTHER DESIGNATIONS: Methyl Chloroform, MC, CCl_3CH_3, CE Material D5679, CAS# 000 071 556, α-Trichloroethane TRADE NAMES & MANUFACTURER: BLACO-THANE (Baron-Blakeslee), CHLOROTHENE NU & VC (Dow), INHIBISOL (Penetone Corp.), TRI-ETHANE (PPG Ind. Inc), TRITHENE (SRS, Inc.)			
SECTION II. INGREDIENTS AND HAZARDS		%	HAZARD DATA
1,1,1-Trichloroethane Inhibitor, typical* *Inhibitors used are proprietary. Commercial materials contain up to about 5% inhibitor and are designed for cold cleaning or vapor degreasing use or both. **Current OSHA PEL and ACGIH (1983) TLV. ACGIH STEL 450 ppm. NIOSH (1976) proposed a 10-hr TWA of 200 ppm with a 350 ppm ceiling (15 minute sample) and has recommended caution in use		>95 < 5	8-hr TWA 350 ppm** Unknown Human, Inhalation LCLo 27 gm/m³ 10 min TCLo 920 ppm/70 min (CNS effects) Human, Oral TDLo 670 mg/kg (GI effects)
SECTION III. PHYSICAL DATA			
Boiling point, 1 atm, deg F ----- ca 165* Vapor pressure, 20 C, cm Hg ----- 100 Vapor density (Air=1) ----- 4.55 Water solubility, g/100ml H₂O @20C - 0.09		Specific gravity, 25/25C --- 1.3-1.336* Volatiles, % ----- ca 100 Melting point, deg C ----- -32 Evaporation rate (CCl₄=1) -- 1 Molecular weight ----- 133.41	
Appearance & Odor: Colorless liquid with a mild, sweetish, pleasant, ether-like odor which may be just perceptible (unfatigued) at about 100 ppm in air. *Properties depend on the inhibitor and inhibitor level.			
SECTION IV. FIRE AND EXPLOSION DATA			
Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower Upper
None	537 C (998 F)	(High energy ignition source at 25C). Vol. %	8.07 10.5%
This material is nearly nonflammable. High energy, such as electric arc, is needed for ignition, and the flame tends to go out when the ignition source is removed. Material involved in a fire can emit toxic and irritating fumes. Water fog, carbon dioxide, dry chemical, or foam may be used to fight fires. Use self-contained or air-supplied breathing apparatus for protection against suffocating vapors and toxic and corrosive decomposition products.			
SECTION V. REACTIVITY DATA			
This material can be hydrolyzed by water to form hydrochloric acid and acetic acid. It will react with strong caustic, such as caustic soda or caustic potash to form flammable or explosive material. Attacks natural rubber. It requires inhibitor content to prevent corrosion of metals; and when inhibitor is depleted, it can decompose rapidly by reaction with finely divided white metals, such as aluminum, magnesium, zinc, etc. Do not use these metals for storage containers or in pressurized spraying equipment where MC is involved. It will decompose at high temperature upon contact with hot metal, or under ultra-violet radiation to produce toxic and corrosive gases (hydrogen chloride, dichloroacetylene, chlorine and some phosgene).			

NO. 311

SECTION VI. HEALTH HAZARD INFORMATION

TLV 350 ppm or 1900 mg/m³

Brief exposure at 900-1000 ppm causes mild eye irritation and loss of coordination due to the early effects of MC on the CNS. Excessive exposure gives headache, drowsiness, impaired judgement, unconsciousness. Defats skin on contact, can produce irritation and dermatitis; can be absorbed through the skin. Eye contact gives pain and irritation. Considered low in toxicity among the chlorinated hydrocarbons.

FIRST AID:

Eye contact: Flush eyes well with plenty of running water for 15 min, including under eyelids and soap. Get medical attention for irritation.

Skin contact: Remove solvent-wet clothing promptly. Wash contact area with warm water and soap. Get medical attention for irritation.

Inhalation: Remove to fresh air. Restore and/or support breathing as needed. Get medical assistance. (Note: Advise physician not to use adrenalin.)

Ingestion: Contact physician. Aspiration a hazard! Possible spontaneous vomiting. (If medical help not readily available and amount swallowed was appreciable, give milk or water to drink and induce vomiting. Repeat. Estimated lethal dose for 150 lb man is 0.5 to 1 pint.)

PHYSICIAN: Avoid using sympathomimetic amines in treatment.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

For small spills in ventilated area, mop, wipe or soak up with absorbent material avoiding inhalation and contact. Evaporate outdoors or in an exhaust hood.

For large spills, inform safety personnel and evacuate area. Use protective equipment during clean-up (see Sect. VIII). Ventilate area. Contain liquid, pick up and place in closed metal containers. Do not allow to enter drains and water ways.

DISPOSAL: Dispose of via a licensed waste solvent disposal company, or reclaim by filtration and distillation procedures. Follow Federal, State and Local regulations.

Aquatic toxicity TLM 96: 100-10 ppm.

EPA hazardous waste number under RCRA is U226 (40CFR261).

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Air-supplied or self-contained respirator should be available for non-routine or emergency use. A chemical cartridge-type respirator can be used for a limited time below 1000 ppm. A full facepiece is needed above 500 ppm.

Chemical goggles or a face shield should be worn if splashing is possible. Gloves and apron (of neoprene, polyethylene or polyvinyl alcohol) should be worn when needed to avoid skin contact. Remove solvent-wet clothing promptly. A safety shower and eyewash station should be available to use area if splashing is probable.

Preplacement and periodic medical examinations should consider cardiovascular, liver, CNS functions, and skin.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, well-ventilated area. Keep water-free. Monitor inhibitor level for vapor degreasing use. Use caution in cleaning operations involving white metal fines (see Sect. V). Trichloroethylene contamination may cause decomposition when aluminum is degreased.

Provide medical monitoring of those regularly exposed to MC in the workplace. Preclude those with CNS, liver, or heart disease from exposure. Personnel using this solvent should avoid drinking alcoholic beverages shortly before, during, or soon after exposure. NIOSH (1976 Crit. Doc.) expressed concern because of possible birth defects from high level pregnant rat exposures. Since 1976, directed studies have been negative. At occupational physicians' seminar on "Reproductive Hazards in the Workplace," Washington, DC (4/25/83), no physician was aware of data to substantiate the NIOSH concern.

DOT Classification: ORM-A I.D. No. UN2831

DATA SOURCE(S) CODE: 1-12, 14, 20, 23, 25, 26, 30, 31, 34, 37, 38, 45-49, 53

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APPROVALS: MJS/CRD

INDUST. HYGIENE/SAFETY

MEDICAL REVIEW: 1 August 1983

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1835 USA
(518) 377-8855



NO. 313

PERCHLOROETHYLENE

Revision C

Date November 1978

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: PERCHLOROETHYLENE

OTHER DESIGNATIONS: Perchloroethylene, Tetrachloroethylene, Ethylene Tetrachloride,
 $\text{Cl}_2\text{C}-\text{CCl}_2$, GE Material DSB84, CAS# 000 127 184

MANUFACTURER &

TRADENAME: BLACO-PER (Baron-Blakeslee); PERCHLOR (PPG); PERK (Stauffer); PERCLEN
(Diamond Shamrock)

SECTION II. INGREDIENTS AND HAZARDS

Perchloroethylene plus stabilizer*

X

HAZARD DATA

ca 100

8-hr TWA 100 ppm**

with

200 ppm Ceiling

and

300 ppm 5 minute

peak in any 3 hrs

*Stabilized material usually contains a small amount of amine and/or phenolic stabilizer. Stabilizers and levels used vary with the grade and the supplier.

**Current OSHA levels. ACGIH TLV (1978) is 100 ppm (skin). In 1976 NIOSH proposed a 10-hr TWA of 50 ppm with a 100 ppm ceiling (15 minute sample).

NIOSH (1978) has warned of possible carcinogenicity based on animal tests.

Rat, inhalation

LCLo 4000 ppm/4 hrs

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg F (C) --- 250 (121)

Specific gravity 20/4°C --- 1.623

Vapor pressure at 22 C, mm Hg --- 15.8

Volatiles, % --- ca 100

Vapor density (Air=1) --- 5.83

Evaporation rate ($\text{CCl}_4=1$) - 0.27

Water solubility --- Negligible

Molecular weight --- 165.83

Appearance & Odor: Colorless liquid with pleasant ethereal odor whose recognition threshold (100% of rest panel, unfatigued) is 4.68 ppm in air.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method

Autoignition Temp.

Flammability Limits in Air

LOWER

UPPER

Not Combustible

None

N/A

N/A

N/A

Extinguishing Media: Use that which is suitable for the surrounding fire. Although not combustible, perchloroethylene can be hazardous in a fire situation because of vapor generation and from thermo-oxidative degradation at high temperature to phosgene (highly toxic) and hydrogen chloride (corrosive).

Firefighters should use self-contained breathing apparatus when this material is involved in a fire situation.

SECTION V. REACTIVITY DATA

Perchloroethylene is considered a stable compound under normal storage and handling conditions. However, vapor exposure to high temperature or electric arcs may cause decomposition to hydrogen chloride and phosgene (highly toxic).

Avoid mixing with caustic soda or potash. Do not allow hydrochloric acid build-up to occur in degreasing tanks (stabilizer exhausted).

Prolonged exposure to sunlight (UV) can degrade unstabilized material.

SECTION VI. HEALTH HAZARD INFORMATION

TLV 100 ppm (skin) (See Sect II)

Perchloroethylene may cause dermatitis through prolonged or repeated skin contact with liquid and irritation, lachrymation, and burning sensation of the eyes by liquid or vapor contact. Loss of coordination, narcosis, tremors, abdominal cramps, irritation of the respiratory tract, and nausea may result from inhalation of excessive airborne concentrations. (600 ppm for 10 minutes may effect the central nervous system.) Very high exposures produce unconsciousness and even death.

FIRST AID:

Eye contact: Wash eyes with copious amounts of running water to relieve irritation.

Skin contact: Remove contaminated clothes. Wash exposed skin with soap and water.

Inhalation: Remove patient to fresh air; restore breathing if necessary. Promptly contact physician. Advise doctor not to administer adrenalin.

Ingestion: If taken internally, induce vomiting. Contact physician promptly; Advise doctor not to administer adrenalin.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Supply maximum ventilation. Confine spill to small area; do not allow run off into sewer. Those involved in clean-up need protection from liquid contact and vapor inhalation. Pick up spill on absorbent solid.

DISPOSAL: Place in covered container for disposal. Chlorinated solvents in large amount should be burned in an approved incinerator with appropriate fume scrubbing. Also, consult licensed waste disposal company in your locality and consider recovery of perchloroethylene solvent by distillation. Scrap solvent and distillation residues must be handled as toxic waste. Follow Federal, State and local regulations for waste disposal.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Airborne levels should be kept below TLV levels by use of general ventilation and local exhaust ventilation. Provide floor level ventilation to remove these vapors.

For emergency and non-routine exposure above the TLV approved full facepiece respirators should be used - cartridge and canister types up to 500 ppm, and air-supplied or self-contained types above 500 ppm.

Neoprene, Viton, PVA or PVC coated gloves should be used to prevent skin exposure. Where splashing is possible, aprons and protective clothing may be indicated. Appropriate eye and face protection should be used. Where eye contamination is possible, an eye wash fountain should be readily available.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in a cool, dry, well-ventilated place in closed containers away from fire hazards. High temperature (700°C) or intense UV light can decompose perchloroethylene to toxic and corrosive materials. Smoking, open flame, welding, etc. should not be permitted in area of use or storage.

It is recommended that workers with blood pressure, heart, liver, kidney or pulmonary problems, with nervous system disorders, with excessive obesity, or with alcohol consumption problems should not work in proximity to this or other chlorinated solvents. One study has indicated possible teratogenic effects. NIOSH has recommended that this material be handled as if it were a human

carcinogen. (Current Intelligence Bulletin

No. 20, 1978)

DATA SOURCE(S) CODE: 1-9, 12, 21

Judgments as to the suitability of information herein for purchase or purchase are necessary purposes is recommended. This does, although resources can not cover them in the preparation of such information. Current Publishing Corporation assumes no responsibility, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchase or purchase purposes or for consequences of its use.

APPROVALS: MIS.

Industrial Hygiene
and Safety

Corporate Medical
Staff

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855



NO. 1A

AMMONIUM HYDROXIDE
(28-30%)

Date April 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: AMMONIUM HYDROXIDE (28-30%)
OTHER DESIGNATIONS: Aqua Ammonia, Ammonium Hydrate, Ammonia Water (Strong),
"Spirit of Hartshorn", NH_4OH , GE Material D482, CAS #001 336 216
MANUFACTURER: Available from many suppliers, including:
J.T. Baker Chemical Corp. Canadian Industries Limited
222 Red School Lane Chemicals, Box 10
Philipsburg, NJ 08865 Montreal, QUE., Canada H3C 2R3

SECTION II. INGREDIENTS AND HAZARDS

	X	HAZARD DATA
Ammonia, Anhydrous (See MSDS #1)	28-30	8-hr TWA 50 ppm* or 35 mg/m ³
Water	70-72	Human, oral LDLo 43 mg/kg
Material is prepared by dissolving ammonia in water under controlled conditions. Purity depends on the purity of the ammonia and of the water used.		Human, inhalation LCLo 5000 ppm
*Current OSHA value; ACGIH (1979) TLV is 25 ppm. NIOSH has proposed a <u>ceiling level</u> of 50 ppm for ammonia.		Rat, oral LD ₅₀ 350 mg/kg

SECTION III. PHYSICAL DATA

Temperature at which solution is saturated with NH_3 at 1 atm, deg F ----- ca 80-85 Specific gravity (15.5/4 C) - 0.90
Vapor pressure of NH_3 , 15.5 C, mm Hg - 420-475 Formular weight, NH_4OH ----- 35.09
Water solubility ----- Completely Soluble Moles NH_3 /liter of solution - ca 15
Freezing point, deg C ----- >-73

Appearance & Odor: A clear, colorless liquid with a strong, pungent odor of ammonia.
The odor, which is detectable at 5 ppm and irritating at 25-50 ppm of NH_3 , provides a warning of hazardous concentrations in air.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
- N/A	1204 F (as NH_3)	Volume % (NH_3)	16	27

Extinguishing Media: Use media appropriate to surrounding fire conditions. Use cold water spray to control vapors and cool fire-exposed containers.

When heated, material will emit NH_3 vapors which necessitates respiratory and eye protection for firefighters. Use protective clothing.

SECTION V. REACTIVITY DATA

Material is stable in cool storage in closed containers. It does not polymerize. Ammonium hydroxide is strongly alkaline and is incompatible with acid materials and with copper, tin, zinc, aluminum, and their alloys and with galvanized surfaces. Violent reactions can occur, for example, with dimethyl sulfate, or fluorine. Explosive materials can result from reaction with iodine or with several silver compounds.
Adding NaOH to this material and/or heating will volatilize NH_3 .

NO. 1A

SECTION VI. HEALTH HAZARD INFORMATION	TLV 25 ppm/50 ppm (See Sect. II)
Ammonium hydroxide is irritating and corrosive to body tissues. Excessive inhalation of vapors is irritating to the mucous membranes of the respiratory tract and can result in headache, coughing, severe lung congestion (edema and difficulty in breathing). Skin contact with liquid can irritate, redden and cause burns. Liquid contact with the eye can be severely damaging and can result in loss of vision. Ingestion is corrosive to the digestive tract.	
FIRST AID:	
Eye Contact: Immediately flush with lots of running water for at least 15 min., including under the eyelids; then contact physician immediately, preferably an ophthalmologist. Speed and thoroughness in rinsing eyes is important to avoid permanent injury.	
Skin Contact: Immediately flush with lots of water while removing contaminated clothing and shoes. Get medical help promptly if large areas are affected or irritation persists.	
Inhalation: Remove to fresh air. Restore breathing if required and/or have trained person administer oxygen if breathing is difficult. Keep warm and at rest. Contact physician promptly.	
Ingestion: If conscious, promptly give lots of water or dilute vinegar or citrus juice to drink, followed by milk. Do not induce vomiting. Contact physician.	
SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES	
Prepare written plans for emergency. Inform safety personnel of large spills and evacuate area. Provide ventilation. Those involved in clean up need protection against contact with liquid and inhalation of mist or vapors. Contain spill for recovery when feasible or flush with water to holding area for neutralization (do not flush directly to sewer or surface water.)	
DISPOSAL: Follow Federal, State and Local regulations for pH, NH_3 content, and salts content for effluents. Ammonium hydroxide can be diluted with water, neutralized as required with dilute HCl or dilute H_2SO_4, and then lightly diluted with water for discharge. Suitable scrap ammonium hydroxide might be considered for use in neutralizing acidic wastes. If desired, aqueous NH_3 can be recovered from scrap for use or sale.	
SECTION VIII. SPECIAL PROTECTION INFORMATION	
Provide general and local exhaust ventilation as required to meet TLV. For emergency and nonroutine conditions above the TLV a chemical cartridge respirator with a full-facepiece respirator is suitable for exposures below 300 ppm; above 300 ppm or if concentration unknown use approved self-contained respirator with full facepiece.	
Use splash-proof, chemical safety goggles, and where needed, a faceshield or mask to protect against splashes and from mists and NH_3. Use a rubber suit, boots, gloves, apron, or other protective clothing as required for workplace conditions to prevent contact with ammonium hydroxide solutions.	
An eyewash station and a safety shower must be immediately accessible to workers where this material is used or handled. Washing facilities and large amounts of clean water must be available for emergency use where spills may occur.	
SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS	
Store in a cool (below 80 F to avoid pressurization above 1 atm) area in closed containers, away from sources of heat, direct sunlight, and incompatible materials (see, for example, Sec. V). Handle as a corrosive liquid. Prevent damage to containers. Above 50 F, the ammonia vapor from this material can be a serious hazard in a spill situation. Use caution in opening sealed containers for proper pressure relief. Drain emptied containers well & flush with water before discarding.	
Work practices and equipment must be arranged to prevent contact of ammonium hydroxide with the worker's body and to avoid inhalation of vapors. Train workers in proper handling of ammonium hydroxide.	
Preplacement and periodic medical exam is recommended for ammonia workers and additional exams should be provided if excessive exposure occurs. Keep records. Preclude from exposure workers with eye or pulmonary diseases.	
DATA SOURCE(S) CODE: 1-12, 14, 34	APPROVALS: MLS, <i>J. M. Nelson</i> Industrial Hygiene and Safety <i>JW</i> 5-16-80
Judgments as to the suitability of information herein for purchase & use are the responsibility of the user. Therefore, although reasonable care has been taken in the preparation of such information, GENIUM PUBLISHING CORPORATION makes no warranties, express or implied, and assumes no responsibility as to the accuracy or suitability of such information for application to particular purposes or to consequences of its use.	MEDICAL REVIEW: June 1980

WIPE SAMPLE PROCEDURES

The following procedure is used for all wipe samples, unless noted otherwise: (100 cm² area wipe samples)

EQUIPMENT NEEDED:

Latex Sample Gloves
Teflon-Coated Forceps
11 cm diameter Whatman GF/A filter paper (glass microfibre)
8 ounce glass sample containers
Teflon-lined bakelite caps
Hexane
Teflon rinse bottle
Sample labels

1. Sampler puts on a clean pair of disposable latex sample gloves and removes one GF/A filter.
2. Sampler folds GF/A filter in half three times. (1/8)
3. Sampler places pre-hexane rinsed forceps onto GF/A filter, holding filter with the forceps approximately 1 cm away from and parallel to the triple folded edge of the filter.
4. The filter paper is then saturated with hexane from teflon rinse bottle.
5. The surface (sample surface) is wiped 10 times horizontally and 10 times vertically in two swaths each direction (horizontally and vertically).

Each swath is 5.5 cm wide, overlapping .5 cm, and approximately 9.5 cm long. (This method of wiping surface areas provided for a consistent wipe sample area [100 cm²], and eliminates cross-contamination of surface areas resulting from pre-measuring and marking areas to be sampled.)

6. After the surface area has been wiped, any torn fragments from the GF/A filter (resulting from rough surfaces) are dabbed from the sample surface with the filter, to prevent loss of recovery from the sample area.

WIPE SAMPLE PROCEDURES CONTINUED

7. The filter is then placed into a 8-ounce glass sample container. Holding the forceps over the container, they are rinsed into the jar with hexane, removing any residual sampled surface contaminant that may have been picked up by the forceps.
8. The container is then sealed with a teflon-lined screw-on type cap.
9. The container is immediately labeled, identifying sample number, sample location, personnel who collected sample, sample description, time and date of sampling. This and other information is also recorded in the sample log and field notebooks.



66 190
California Analytical Laboratories, Inc.
2544 Industrial Boulevard • West Sacramento, CA 95691 • (916) 372-1393

October 3, 1985

Paul Sawyer
OH Materials
90 Almon Road
Covington, GA 30209

Dear Mr. Sawyer:

Sample 22275 (Your ID 3057-7; PCP Dip Tank) was re-analyzed per your request for 2,3,7,8 - substituted isomer specific results for hexa and hepta dioxin and furans. The results are listed below.

<u>FURANS</u>		<u>DIOXINS</u>	
<u>Compound</u>	<u>Amount</u>	<u>Compound</u>	<u>Amount</u>
1,2,3,4,7,8-Hexa	710 ng/mL	1,2,3,4,7,8-Hexa	ND
1,2,3,4,6,7,8-Hepta	56,000 ng/mL	1,2,3,6,7,8-Hexa	4760 ng/mL
		1,2,3,4,6,7,8-Hepta	87,000 ng/mL

If you have any questions, please call.

Sincerely,

Michael J. Mille, PhD
Director of GC/MS Services

NJM/lms

' 6 191

California Analytical Laboratories, Inc.

POLYCHLORINATED DIOXIN/FURAN ANALYSIS

TICKET NO. 22275

CLIENT ID: METHOD BLANK

Date Analyzed: 9/18/85

CAL ID: 22275MB

Volume: 0.1 ml

FURANS	AMOUNT FOUND (ng/ml)	DETECTION LIMIT (ng/ml)
tetra (total) (2,3,7,8*)	ND ND	0.90 0.90
penta	ND	1.6
hexa	ND	1.5
hepta	ND	9.6
octa	ND	20
DIOXINS		
tetra (total) (1234 + 2378)	ND ND	1.6 1.6
penta	ND	6.1
hexa	ND	3.0
hepta	ND	20
octa	ND	37

‡ Accuracy 37Cl-TCDD = 103‡

ND = Not Detected

*Includes 1,2,4,9; 1,2,7,9; 2,3,4,6; 2,3,4,7; 2,3,4,8

PREPARED BY: *[Signature]*

APPROVED BY: *[Signature]*

DATE: 9-19-85

California Analytical Laboratories, Inc.

POLYCHLORINATED DIOXIN/FURAN ANALYSIS

TICKET NO. 22275

CLIENT ID: PCP DIP TANK

Date Analyzed: 9/18/85

CAL ID: 22275

Volume: 0.1 ml

FURANS	AMOUNT FOUND (ng/ml)	DETECTION LIMIT (ng/ml)
tetra (total) (2,3,7,8*)	ND ND	2.0 2.0
penta	ND	3.0
hexa	3830	-
hepta	91600	-
octa	116000	-
DIOXINS		
tetra (total) (1234 + 2378)	ND ND	2.5 2.5
penta	ND	11
hexa	624	-
hepta	58400	-
octa	128000	-

‡ Accuracy 37Cl-TCDD = 97%

ND = Not Detected

*Includes 1,2,4,9; 1,2,7,9; 2,3,4,6; 2,3,4,7; 2,3,4,8

PREPARED BY: APPROVED BY: DATE:



Environmental Consultants

October 15, 1985

Mr. Fred Choske
OH Materials
% Rodeway Inn
2949 Air Way Boulevard
Memphis, Tennessee 38116

Dear Mr. Choske:

Enclosed are the analytical results for the samples from the DLA site. The analysis were performed under OH Materials P.O. No. 3057-32325 and 3057-40243. Table 1 contains the TCDD results for samples from shipments under COCR numbers 8974 and 8975. Table 2 contains the dioxin furan results for samples from shipments under COCR numbers 8972, 8977 thru 8980, and 8984. The metals, pesticides, PCB and PCP results are contained in the two letters which are attached.

Subsequent results will be sent to you as they become available. If you have any questions, please call.

Sincerely,

Robert V. Collins
Vice President

RVC/lj

cc: Mr. Paul Sawyer, Covington, GA

York Research Consultants

938 Quail Street, Denver, Colorado 80215. Phone (303) 233-1513

TABLE 1
TCDD DATA SUMMARY

COCR	SAMPLE	TOTAL TCDD	2378 TCDD
8974	3057-62	0.3	<.05
8974	3057-63	<.05	<.05
8974	3057-64	<.05	<.05
8974	3057-65	5.3	0.87
8974	3057-66	0.85	0.36
8974	3057-67	<.05	<.05
8975	3057-68	<.05	<.05
8975	3057-69	5.6	2.9
8975	3057-70	<.05	<.05
8975	3057-71	<.05	<.05
8975	3057-72	<.05	<.05
8975	3057-73	<.05	<.05
8975	3057-74	<.05	<.05

Concentrations are in units of ug/kg.

TABLE 2
DIOXIN/FURAN DATA SUMMARY

COCR	SAMPLE	TCDD	TCDF	PCDD	PCDF	HxCDD	HxCDF	HpCDD	HpCDF	OCDD	OCDF
8972	3057-103	<.05	<.05	<.1	<.1	<.2	<.2	3.9	<.4	17	11
8972	3057-104	<.05	<.05	<.1	<.1	<.2	<.2	<.4	<.4	25	25
8972	3057-105	<.05	<.05	<.1	<.1	<.2	<.2	<.4	<.4	25	14
8972	3057-106	11	31	38	48	12	24	0.6	<.4	0.9	<.5
8972	3057-107	0.6	<.1	4.3	3.5	63	28	>2200	340	>4300	310
8972	3057-108	<.05	<.05	<.1	<.1	<.2	<.2	31	9.6	130	14
8972	3057-109	<.05	<.05	<.1	<.1	<.2	<.2	3.1	<.4	13	5
8972	3057-110	0.4	1.0	3.7	6.8	91	63	>3300	>2200	>7600	>1400
8972	3057-111	2.3	7.9	16	19	280	390	>9800	>7500	>8700	>3100
8972	3057-112	<.05	<.05	0.9	2.1	30	220	>3400	>6200	>7700	>5100
8972	3057-113	>10	>10	10	16	>10	>10	>280	2000	0.14	0.14
8977	3057-114	0.1	0.3	<.1	<.1	10	9.2	230	190	1600	230
8977	3057-115	0.1	<.05	0.4	<.1	5.4	11	59	47	54	21
8977	3057-116	0.1	<.05	<.1	<.1	2.4	8.4	38	67	100	20
8977	3057-117	0.3	<.05	1.6	<.1	7.5	20	82	70	190	30
8977	3057-118	0.5	<.05	2.2	<.1	3.5	23	91	120	720	120
8977	3057-119	<.05	<.05	<.1	<.1	1.6	1.8	15	7.3	35	3.3
8977	3057-120	<.05	<.05	<.1	<.1	3.7	5.7	63	50	330	48
8977	3057-121	<.05	<.05	<.1	<.1	1.6	1.4	22	16	110	14
8977	3057-122	<.05	<.05	<.1	<.2	<.2	<.2	6.1	4.9	21	4.9
8977	3057-123	0.1	0.2	<.1	<.1	3.1	6.7	46	37	180	31
8978	3057-124	<.05	<.05	<.1	<.1	0.6	1.1	8.9	7.4	53	9.1
8978	3057-125	<.05	<.05	<.1	<.1	<.2	<.2	49	36	270	34
8978	3057-126	0.4	0.7	<.1	<.1	2	13	76	220	240	120
8978	3057-127	1.1	3	<.1	<.1	<.1	1.1	4.8	10	10	6
8978	3057-128	<.05	0.2	0.2	0.5	2.7	15	62	150	150	77
8978	3057-129	<.1	<.1	<.1	<.1	2	13	66	120	310	80
8979	3057-130	<.05	<.05	<.1	<.1	<.2	<.2	0.5	0.4	2.8	1.3
8980	3057-133	<.06	<.05	<.1	<.1	<.2	<.2	1.8	1.3	9.2	2.2
8980	3057-134	<.05	<.05	<.1	<.1	<.2	<.2	<.4	<.4	8.8	25
8980	3057-135	0.09	<.05	0.3	<.1	4.0	6.7	25	53	120	64
8980	3057-136	<.05	<.05	<.1	<.1	0.2	<.2	2.5	3.6	14	6.3
8980	3057-137	<.06	<.05	<.1	<.1	<.2	<.2	1.3	<.1	11	3.8
8984	3057-148	<.3	<.1	<.1	<.4	<.3	<.3	<.3	<.3	3.1	1.7
8984	3057-149	0.6	0.1	<.1	1.9	1.8	13	10	15	40	32
8984	3057-150	0.6	0.2	0.1	1.1	1.5	7.8	5.5	6	20	13
8984	3057-151	0.6	2.9	1.9	14.8	22	110	440	810	>2000	>700

Unless otherwise noted, the concentrations for solid samples are in units of ug/kg, and wipe samples are in units of total ng present.

WESTON

York Research Consultants (O.H. Materials)

Lab No. 85-09-029

Analysis of Metals Leached by the EP Toxicity Method

September 30, 1985

Metal	Detection Limit, mg/L	Maximum EP Toxicity Limit, mg/L	Concentration, mg/L				
			3057-45	3057-46	3057-47	3057-48	3057-49
Arsenic	0.002	5.0	ND	ND	ND	ND	ND
Barium	10.	100.	ND	ND	ND	ND	ND
Cadmium	0.01	1.0	ND	ND	ND	ND	ND
Chromium	0.05	5.0	ND	ND	ND	ND	ND
Lead	0.05	5.0	ND	ND	ND	ND	ND
Mercury	0.001	0.2	ND	ND	ND	ND	ND
Selenium	0.001	1.0	ND	ND	ND	ND	ND
Silver	0.02	5.0	ND	ND	ND	ND	ND

ND = Not detected at the detection limit

WESTON

Tork Research Consultants (O.H. Materials)

Lab No. 85-09-029

Analysis of Metals leached by the EP Toxicity Method (Cont'd)

September 30, 1985

Metal	Detection Limit, mg/L	Maximum EP Toxicity Limit, mg/L	Concentration, mg/L				
			3057-51	3057-52	3057-53	3057-54	3057-55 3057-56
Arsenic	0.002	5.0	ND	ND	ND	ND	ND
Barium	10.	100.	ND	ND	ND	ND	ND
Cadmium	0.01	1.0	ND	ND	ND	ND	ND
Chromium	0.05	5.0	ND	ND	ND	ND	ND
Lead	0.05	5.0	ND	ND	ND	ND	ND
Mercury	0.001	0.2	ND	ND	ND	ND	ND
Selenium	0.001	1.0	ND	ND	ND	ND	ND
Silver	0.02	5.0	ND	ND	ND	ND	ND

ND = Not detected at the detection limit

WESTON

6 198

York Research Consultants (O.H. Materials)

Lab No. 85-09-029

Analysis of Metals Leached by the EP Toxicity Method (Cont'd) September 30, 1985

Metal	Detection Limit, mg/L	Maximum EP Toxicity Limit, mg/L	Concentration, mg/L			
			3057-57	3057-58	3057-59	3057-60
Arsenic	0.002	5.0	ND	ND	ND	0.008
Barium	10.	100.	ND	ND	ND	ND
Cadmium	0.01	1.0	ND	ND	ND	ND
Chromium	0.05	5.0	ND	ND	0.10	ND
Lead	0.05	5.0	ND	ND	1.6	ND
Mercury	0.001	0.2	ND	ND	ND	ND
Selenium	0.001	1.0	ND	ND	ND	ND
Silver	0.02	5.0	ND	ND	ND	ND

ND = Not detected at the detection limit

WESTON

York Research Consultants (O.H. Materials)

Lab No. 85-09-029

Pesticide and PCB Analysis

September 30, 1985

Compound	Detection Limit, ug/kg	Concentration, ug/kg						
		3057-45	3057-46	3057-47	3057-48	3057-49	3057-50	3057-51
Aldrin	5.0	ND	ND	9.0	ND	ND	ND	ND
Alpha-BHC	5.0	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	5.0	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	5.0	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	5.0	ND	ND	ND	ND	ND	ND	ND
Chlordane	50.	ND	ND	ND	ND	ND	ND	ND
P,p'-DDD	5.0	12.	21.	21.	22.	21.	21.	14.
P,p'-DDE	5.0	6.8	5.3	28.	5.3	9.8	18.	20.
P,p'-DDT	5.0	54.	42.	38.	71.	69.	1200.	160.
Dieldrin	5.0	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	5.0	ND	ND	ND	7.7	11.	ND	ND
Endosulfan II	5.0	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	5.0	ND	ND	ND	ND	ND	ND	ND
Endrin	5.0	ND	ND	ND	5.9	ND	ND	ND
Endrin aldehyde	5.0	ND	ND	ND	ND	ND	ND	ND
Heptachlor	5.0	ND	ND	5.7	ND	ND	5.6	ND
Heptachlor Epoxide	5.0	ND	ND	ND	ND	ND	ND	ND
Toxaphene	500.	ND	ND	ND	ND	ND	ND	ND
PCB-1016	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1221	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1232	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1242	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1248	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1254	100.	ND	ND	ND	ND	ND	ND	ND
PCB-1260	100.	ND	ND	ND	ND	ND	ND	ND

WESTON

York Research Consultants (O.H. Materials)

Lab No. 85-09-029

Pesticides and PCB Analysis

September 30, 1985

Compound	Detection Limit, ug/kg	Concentration, ug/kg							
		3057-52	3057-53	3057-54	3057-55	3057-56	3057-57	3057-58	
Aldrin	5.0	5.2	ND	37.	37.	54.	21.	ND	
Alpha-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	
Beta-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	
Gamma-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	
Delta-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	
Chlordane	50.	ND	ND	ND	ND	ND	ND	ND	
P,p'-DDD	5.0	29.	270.	19.	140.	23.	450.	26.	
P,p'-DDE	5.0	14.	47.	56.	220.	30.	170.	44.	
P,p'-DDT	5.0	180.	1000.	240.	1100.	430.	750.	160.	
Dieldrin	5.0	ND	5.9	ND	ND	ND	ND	ND	
Endosulfan I	5.0	22.	12.	ND	110.	350.	120.	ND	
Endosulfan II	5.0	ND	ND	ND	ND	ND	ND	ND	
Endosulfan Sulfate	5.0	ND	ND	ND	ND	ND	ND	ND	
Endrin	5.0	ND	ND	ND	29.	ND	6.2	8.6	
Endrin aldehyde	5.0	ND	ND	ND	ND	ND	ND	ND	
Heptachlor	5.0	ND	ND	25.	32.	20.	22.	ND	
Heptachlor Epoxide	5.0	ND	10.	7.2	7.1	460.	13.	ND	
Toxaphene	500.	ND	ND	ND	ND	ND	ND	ND	
PCB-1016	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1221	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1232	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1242	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1248	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1254	100.	ND	ND	ND	ND	ND	ND	ND	
PCB-1260	100.	ND	ND	ND	ND	ND	ND	ND	

WESTON

York Research Consultants (O.H. Materials)

Lab No. 85-09-029

Pesticides and PCB Analysis

September 30, 1985

Compound	Detection Limit, ug/kg	Concentration, ug/kg				
		3057-59	3057-60	3057-73	3057-74	3057-112
Aldrin	5.0	6.3	15.	-	-	-
Alpha-BHC	5.0	ND	ND	-	-	-
Beta-BHC	5.0	ND	ND	-	-	-
Gamma-BHC	5.0	ND	ND	-	-	-
Delta-BHC	5.0	ND	ND	-	-	-
Chlordane	50.	ND	ND	-	-	-
P,p'-DDD	5.0	55.	160.	-	-	-
P,p'-DDE	5.0	400.	180.	-	-	-
P,p'-DDT	5.0	910.	780.	-	-	-
Dieldrin	5.0	ND	ND	-	-	-
Endosulfan I	5.0	11.	160.	-	-	-
Endosulfan II	5.0	ND	ND	-	-	-
Endosulfan Sulfate	5.0	ND	ND	-	-	-
Endrin	5.0	ND	ND	-	-	-
Endrin aldehyde	5.0	ND	ND	-	-	-
Heptachlor	5.0	ND	ND	-	-	-
Heptachlor Epoxide	5.0	ND	13.	-	-	-
Toxaphene	500.	ND	ND	-	-	-
PCB-1016	100.	ND	ND	ND	ND	ND
PCB-1221	100.	ND	ND	ND	ND	ND
PCB-1232	100.	ND	ND	ND	ND	ND
PCB-1242	100.	ND	ND	ND	ND	ND
PCB-1248	100.	ND	ND	ND	ND	ND
PCB-1254	100.	ND	ND	ND	ND	ND
PCB-1260	100.	ND	ND	ND	ND	ND

WESTON

York Research Consultants (O.H. Materials)
 Analysis for Pentachlorophenol

October 8, 1985

Lab Nos. 85-09-029
 85-09-034

Sample I.D.	Pentachlorophenol mg/kg	Comments
3057-113	220,000.	Tar-like material
3057-126	ND	
3057-127	ND	
3057-128	ND	
3057-129	14.	Total amount in wipe
3057-131	0.58 mg	
3057-132	2,800.	
Detection Limit	5.0	

WESTON

York Research Consultants (O.H. Materials)

October 8, 1985

Analysis for Pesticides

Lab No. 85-10-002

Compound	Detection Limit, ug/kg	Concentration, ug/kg									
		3057-138	3057-139	3057-140	3057-141	3057-142	3057-143	3057-144	3057-145	3057-146	3057-147
Aldrin	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	9.5	ND	ND
Beta-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	5.0	ND	ND	ND	ND	ND	110.	ND	5.4	ND	ND
Chlordane	50.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P,p'-DDD	5.0	ND	ND	ND	6.3	27.	49.	7.8	52.	7.2	ND
P,p'-DDE	5.0	ND	ND	ND	17.	98.	110.	7.5	21.	20.	ND
P,p'-DDT	5.0	11.	ND	ND	48.	1,100.	2,900.	150.	820.	170.	10.
Dieldrin	5.0	ND	ND	ND	ND	ND	ND	ND	46.	5.0	ND
Endosulfan I	5.0	ND	ND	ND	ND	14.	33.	6.9	53.	ND	ND
Endosulfan II	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfate	5.0	ND	ND	ND	ND	ND	30.	ND	40.	ND	ND
Endrin	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldehyde	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	5.0	ND	ND	ND	ND	ND	14.	ND	ND	ND	ND
Heptachlor	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Epoxide	5.0	ND	ND	ND	ND	ND	ND	ND	31.	ND	ND
Toxaphene	500.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not Detected



Environmental Consultants

6 204

November 20, 1985

Mr. Fred Choske
O.B. Materials
16406 U.S. Route 224 East
P.O. Box 551
Findlay, Ohio

Dear Fred;

Enclosed are the results for samples received in St. Louis during the period 10 October to 7 November, 1985. Table 1 lists the samples received and the basis, if any, for holding individual samples for analysis at a later time. There were several instances where verbal authorization for the elimination of the hold was given. The total number of authorized analyses for these samples was 92. Also attached are the PCP data for two high level and two low level samples which were requested verbally.

If you have any questions concerning these data, please call. We are expecting the receipt of the final samples from the DLA site Thursday and should be able to have the written report to you by 2 December.

Sincerely,

Robert V. Collins
Vice President

RVC/lj
Enclosure

York Research Consultants
938 Quail Street, Denver, Colorado 80215. Phone (303) 233-1513

Table 1 page 1

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-152	WIPE	8987	10/10/85	NONE
3057-153	SOIL	8987	10/10/85	NONE
3057-154	CONCRETE	8987	10/10/85	NONE
3057-155	SOIL	8987	10/10/85	NONE
3057-160	SOIL	8986	10/12/85	NONE
3057-162	SOIL	8986	10/12/85	NONE
3057-163	SOIL	8986	10/12/85	NONE
3057-164	SOIL	8986	10/12/85	NONE
3057-165	SOIL	8986	10/12/85	NONE
3057-166	WATER	8988	10/16/85	NONE
3057-167	WATER	8988	10/16/85	166
3057-168	WIPE	8989	10/17/85	NONE
3057-169	WIPE	8989	10/17/85	NONE
3057-170	WIPE	8989	10/17/85	NONE
3057-171	SOIL	8985	10/19/85	NONE
3057-172	SOIL	8985	10/19/85	NONE
3057-173	SOIL	8985	10/19/85	NONE
3057-174	SOIL	8985	10/19/85	NONE
3057-175	SOIL	8985	10/19/85	NONE
3057-177	CONCRETE	8990	10/26/86	NONE
3057-178	CONCRETE	8990	10/26/86	NONE
3057-170	CONCRETE	8990	10/26/86	NONE
3057-180	CONCRETE	8990	10/26/86	NONE
3057-181	WOOD	8990	10/26/86	NONE
3057-182	WIPE	8990	10/26/86	NONE
3057-183	WIPE	8990	10/26/86	NONE
3057-184	WIPE	8990	10/26/86	NONE
3057-185	WOOD	8991	10/29/85	NONE
3057-186	WIPE	8991	10/29/85	NONE
3057-187	WIPE	8991	10/29/85	NONE
3057-188	WIPE	8991	10/29/85	NONE
3057-176	WIPE	8991	10/29/85	NONE
3057-189	WOOD	8991	10/29/85	NONE

Table 1 page 2

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-190	SOIL	8992	10/31/85	NONE
3057-192	SOIL	8992	10/31/85	NONE
3057-194	SOIL	8992	10/31/85	NONE
3057-195	SOIL	8992	10/31/85	NONE
3057-198	SOIL	8992	10/31/85	NONE
3057-199	SOIL	8992	10/31/85	NONE
3057-191	SOIL	8992	10/31/85	190
3057-193	SOIL	8992	10/31/85	192
3057-196	SOIL	8992	10/31/85	195
3057-197	SOIL	8992	10/31/85	196
3057-200	SOIL	8992	10/31/85	199
3057-205	SOIL	8994	11/1/85	NONE
3057-201	SOIL	8994	11/1/85	NONE
3057-203	SOIL	8994	11/1/85	NONE
3057-202	SOIL	8994	11/1/85	202
3057-204	SOIL	8994	11/1/85	203
3057-206	SOIL	8993	11/2/85	NONE
3057-208	SOIL	8993	11/2/85	NONE
3057-210	SOIL	8993	11/2/85	NONE
3057-212	SOIL	8993	11/2/85	NONE
3057-214	SOIL	8993	11/2/85	NONE
3057-215	SOIL	8993	11/2/85	NONE
3057-217	SOIL	8993	11/2/85	NONE
3057-216	SOIL	8993	11/2/85	NONE
3057-218	SOIL	8993	11/2/85	NONE
3057-207	SOIL	8995	11/2/85	206
3057-209	SOIL	8995	11/2/85	208
3057-211	SOIL	8995	11/2/85	210
3057-213	SOIL	8995	11/2/85	212
3057-219	SOIL	8981	11/3/85	NONE
3057-220	SOIL	8981	11/3/85	NONE
3057-221	SOIL	8981	11/3/85	NONE
3057-223	SOIL	8981	11/3/85	NONE

Table 1 page 3

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-224	SOIL	8981	11/3/85	NONE
3057-225	SOIL	8981	11/3/85	NONE
3057-226	SOIL	8981	11/3/85	NONE
3057-227	SOIL	8981	11/3/85	NONE
3057-222	SOIL	8981	11/3/85	221
3057-228	SOIL	8982	11/5/85	NONE
3057-229	SOIL	8982	11/5/85	NONE
3057-230	SOIL	8982	11/5/85	NONE
3057-231	SOIL	8982	11/5/85	NONE
3057-232	SOIL	8982	11/5/85	NONE
3057-233	SOIL	8982	11/5/85	NONE
3057-234	SOIL	8982	11/5/85	NONE
3057-235	SOIL	8982	11/5/85	NONE
3057-236	SOIL	8982	11/5/85	NONE
3057-237	SOIL	8982	11/5/85	NONE
3057-238	SOIL	8982	11/5/85	NONE
3057-239	SOIL	11054	11/06/85	NONE
3057-241	SOIL	11054	11/06/85	NONE
3057-242	SOIL	11054	11/06/85	NONE
3057-243	SOIL	11054	11/06/85	NONE
3057-244	SOIL	11054	11/06/85	NONE
3057-245	SOIL	11054	11/06/85	NONE
3057-246	SOIL	11054	11/06/85	NONE
3057-240	SOIL	11054	11/06/85	239
3057-247	SOIL	11050	11/7/85	NONE
3057-248	SOIL	11050	11/7/85	NONE
3057-249	SOIL	11050	11/7/85	NONE
3057-250	SOIL	11050	11/7/85	NONE
3057-251	SOIL	11050	11/7/85	NONE
3057-253	SOIL	11050	11/7/85	NONE
3057-254	SOIL	11050	11/7/85	NONE
3057-255	SOIL	11050	11/7/85	NONE
3057-252	SOIL	11050	11/7/85	251

Table 2 page 1 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-152-XA	OCT1212	1.00	100	0.3	0.3	0.7	0.7
3057-153-XA	OCT1213	5.14	135	0.8	1.2	0.5	1.2
3057-155-XA	OCT1214	5.19	117	<0.1	<0.1	<0.1	<0.1
3057-160-XA	OCT1217	5.05	108	0.2	0.6	0.2	3.0
3057-162-XA	OCT1218	5.00	123	<0.1	<0.1	0.2	0.2
3057-163-XA	OCT1219	5.11	109	<0.1	<0.1	<0.1	<0.1
3057-164-XA	OCT1220	5.12	100	0.5	0.3	0.8	0.8
3057-165-XA	OCT1221	5.03	106	<0.1	<0.1	<0.1	<0.1
3057-166R-X	NOV0407	910	102	<1 ppt	<1 ppt	<1 ppt	<1 ppt
3057-168-XA	OCT1731	1.00	98	1.1	0.7	1.7	1.7
3057-169-XA	OCT1732	1.00	84	0.4	0.3	0.7	0.7
3057-170-XA	OCT1733	1.00	89	0.8	0.5	1.2	1.2
				<0.1	<0.1	<0.1	<0.1
3057-171-XA	OCT2621	1.00	85	1.0	1.3	1.7	1.8
3057-172D-XA	OCT2611	5.03	102	0.2	<0.1	3.9	2.1
3057-173-XA	OCT2612	4.93	96	1.4	2.7	2.7	1.4
3057-174-XA	OCT2613	5.27	86	<0.1	<0.1	<0.1	<0.1
3057-175-XA	OCT2614	5.02	75	4.4	5.5	1.0	1.0
3057-177-XA	OCT2615	4.86	97	1.4	2.8	10	14
3057-178-XA	OCT2616	5.34	93	0.2	0.3	1.1	1.1
3057-179-XA	OCT2617	5.25	91	<0.1	<0.1	0.2	0.9
3057-180-XA	OCT2618	5.29	94	23	62	84	220
3057-181-XA	OCT2619	4.39	87	0.7	1.4	1.1	7.2
3057-182-XA	OCT2620	3.34	91	<0.1	<0.1	<0.1	0.6
3057-183-XA	OCT2622	3.46	87	<0.1	<0.1	<0.1	0.3
3057-184-XA	OCT2623	4.01	91	<0.1	<0.1	<0.1	<0.1
3057-176-XA	OCT3007	1.00	89	0.1	0.1	0.2	0.2
3057-185-XA	OCT3003	2.67	102	<0.1	<0.1	<0.1	0.3
3057-186-XA	OCT3004	1.00	94	0.2	0.2	0.2	0.3
3057-187-XA	OCT3005	1.00	89	<0.1	<0.1	0.1	0.5
3057-188-XA	OCT3006	1.00	107	0.1	0.1	0.2	0.2
3057-189-XA	OCT3008	2.90	97	<0.1	<0.1	<0.1	0.5
3057-190-XA	OCT3117	5.37	102	0.4	0.3	0.7	0.1
3057-192-XA	OCT3118	5.20	105	0.1	0.1	0.2	0.2
3057-194-XA	OCT3121	4.93	95	0.1	0.2	3.4	3.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 2 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-195-XA	OCT3120	5.10	100	<0.1	<0.1	<0.1	<0.1
3057-198-XA	OCT3122	4.80	90	<0.1	<0.1	<0.1	<0.1
3057-199-XA	OCT3123	5.28	105	<0.1	<0.1	<0.1	0.1
3057-201-XA	NOV0104	4.90	94	<0.1	<0.1	<0.1	<0.1
3057-203-XA	NOV0105	5.32	91	<0.1	<0.1	<0.1	0.1
3057-205-XA	NOV0106	5.24	94	0.2	<0.1	<0.1	<0.1
3057-204-XA	NOV0204	5.36	106	0.2	<0.1	1.8	4.0
3057-206-XA	NOV0202	5.18	90	0.1	0.1	0.2	0.2
3057-208-XA	NOV0203	5.35	95	<0.1	<0.1	<0.1	<0.1
3057-212-XA	NOV0214	5.25	94	<0.1	<0.1	<0.1	<0.1
3057-214-XA	NOV0206	5.09	98	<0.1	<0.1	0.1	0.1
3057-215-XA	NOV0209	4.96	92	<0.1	<0.1	<0.1	<0.1
3057-216-XA	NOV0210	4.94	90	<0.1	<0.1	<0.1	<0.1
3057-217-XA	NOV0208	4.95	91	<0.1	<0.1	0.1	0.4
3057-218-XA	NOV0211	5.02	94	0.2	0.2	0.9	0.3
3057-211-XA	NOV0408	5.20	99	<0.1	<0.1	<0.1	<0.1
3057-213-XA	NOV0409	5.21	89	<0.1	<0.1	<0.1	<0.1
3057-215-XA	NOV0422	4.96	95	<0.1	<0.1	<0.1	<0.1
3057-217-XA	NOV0421	4.95	9	<0.1	<0.1	0.1	0.7
3057-218-XA	NOV0420	5.02	98	<0.1	0.1	0.1	0.2
3057-219-XA	NOV0411	5.02	91	<0.1	<0.1	<0.1	<0.1
3057-220-XA	NOV0412	4.88	94	<0.1	<0.1	<0.1	<0.1
3057-221-XA	NOV0413	5.25	89	<0.1	<0.1	<0.1	<0.1
3057-222-XA	NOV0414	5.14	99	<0.1	<0.1	<0.1	<0.1
3057-223-XA	NOV0415	5.33	95	<0.1	<0.1	<0.1	<0.1
3057-224-XA	NOV0416	4.90	90	<0.1	<0.1	<0.1	<0.1
3057-225-XA	NOV0417	5.35	93	<0.1	<0.1	<0.1	<0.1
3057-226-XA	NOV0418	5.18	96	<0.1	<0.1	<0.1	<0.1
3057-227-XA	NOV0419	5.12	92	<0.1	<0.1	<0.1	<0.1
3057-228-XA	NOV0506	5.08	93	<0.1	<0.1	0.2	0.9
3057-229-XA	NOV0507	5.36	97	<0.1	<0.1	<0.1	0.1
3057-230-XA	NOV0508	4.94	116	0.4	0.6	0.7	3.1
3057-231-XA	NOV0509	5.07	98	<0.1	<0.1	<0.1	<0.1
3057-232-XA	NOV0510	5.03	97	<0.1	<0.1	<0.1	0.1
3057-233-XA	NOV0511	5.15	96	<0.1	<0.1	<0.1	<0.1
3057-234-XA	NOV0512	4.91	88	<0.1	<0.1	<0.1	<0.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 3 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-235-XA	NOV0513	5.12	89	<0.1	<0.1	<0.1	<0.1
3057-236-XA	NOV0514	5.14	87	<0.1	<0.1	<0.1	<0.1
3057-237-XA	NOV0515	4.99	89	<0.1	<0.1	<0.1	<0.1
3057-238-XA	NOV0533	5.15	97	0.4	<0.1	<0.1	<0.1
3057-32/17ft	NOV0534	5.17	90	0.1	<0.1	<0.1	<0.1
3057-239-XA	NOV0608	5.17	101	<0.1	<0.1	<0.1	<0.1
3057-240-XA	NOV0609	5.25	98	<0.1	<0.1	<0.1	<0.1
3057-241-XA	NOV0610	5.29	104	<0.1	0.1	<0.1	0.5
3057-242-XA	NOV0612	5.07	100	<0.1	<0.1	<0.1	<0.1
3057-243-XA	NOV0613	5.10	95	<0.1	<0.1	<0.1	0.2
3057-244-XA	NOV0614	5.18	93	<0.1	<0.1	<0.1	<0.1
3057-245-XA	NOV0615	5.18	92	<0.1	<0.1	<0.1	<0.1
3057-246-XA	NOV0616	4.97	95	<0.1	<0.1	<0.1	<0.1
3057-247-XA	NOV0713	5.03	96	0.5	0.8	2.2	9.9
3057-248-XA	NOV0714	5.17	94	<0.1	<0.1	<0.1	<0.1
3057-249-XA	NOV0715	5.21	107	<0.1	<0.1	<0.1	1.0
3057-250-XA	NOV0716	4.94	97	<0.1	<0.1	<0.1	<0.1
3057-251-XA	NOV0718	4.98	90	<0.1	<0.1	<0.1	<0.1
3057-252-XA	NOV0719	4.96	88	<0.1	<0.1	<0.1	<0.1
3057-253-XA	NOV0720	5.13	99	<0.1	<0.1	<0.1	1.8
3057-254-XA	NOV0721	4.98	101	0.5	1.4	0.9	8.4
3057-255-XA	NOV0722	5.22	98	0.4	0.8	0.6	2.9

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 4 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-152-XA	1.4	1.0	2.8	2.4	2.1	8.0
3057-153-XA	1.4	5.0	28	41	110	36
3057-155-XA	<0.5	<0.5	<0.5	<.5	8.1	3.2
3057-160-XA	3.8	9.6	47	55	150	48
3057-162-XA	<0.5	<0.5	13	12	34	14
3057-163-XA	<0.5	<0.5	<0.5	<.5	3.8	<1
3057-164-XA	1.7	21	120	460	820	640
3057-165-XA	0.9	9.0	34	110	120	110
3057-166R-X	<2 ppt	<2 ppt	<3 ppt	<3 ppt	<6 ppt	<6 ppt
3057-168-XA	3.6	3.0	6.2	5.5	360	37
3057-169-XA	1.4	1.2	2.4	2.1	69	2.1
3057-170-XA	2.6	2.1	4.4	4.0	93	31
	<0.5	<0.5	<0.5	<.5	<1	<1
3057-171-XA	2.2	2.3	140	56	270	30
3057-172D-XA	14	68	420	1100	1100	750
3057-173-XA	11	19	170	140	420	110
3057-174-XA	<0.5	0.7	4.2	8.1	18	6.5
3057-175-XA	1.3	1.3	23	29	72	34
3057-177-XA	71	84	810	310	980	87
3057-178-XA	6.7	20	97	110	190	44
3057-179-XA	13	20	440	150	900	72
3057-180-XA	500	450	2900	1100	3200	290
3057-181-XA	7.1	9.8	49	31	600	17
3057-182-XA	0.9	1.3	8.2	3.7	18	2.4
3057-183-XA	<0.5	<0.5	1.4	0.5	3.0	<1
3057-184-XA	<0.5	<0.5	0.8	<.5	1.9	<1
3057-176-XA	<0.5	<0.5	5.8	5.2	11	4.1
3057-185-XA	<0.5	<0.5	1	<.5	2.5	<1
3057-186-XA	<0.5	<0.5	6.7	0.7	19	3.2
3057-187-XA	<0.5	<0.5	2.5	<.5	7.7	4.0
3057-188-XA	<0.5	<0.5	8.2	1.7	33	6.0
3057-189-XA	1.8	0.8	17	11	83	9.5
3057-190-XA	0.9	1.0	3.9	2.4	12	7.5
3057-192-XA	<0.5	<0.5	<0.5	<.5	6.3	<1
3057-194-XA	26	100	670	1300	1600	1000

notes: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 5 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-195-XA	1.3	3.5	14	26	22	17
3057-198-XA	0.9	2.6	13	20	32	18
3057-199-XA	<0.5	1.3	6.9	9.2	17	8.5
3057-201-XA	<0.5	<0.5	<0.5	0.8	1.7	<1
3057-203-XA	<0.5	<0.5	1.3	0.7	5.0	1.0
3057-205-XA	<0.5	<0.5	1.8	2.0	10	2.6
3057-206-XA	75	320	2100	2800	4600	2300
3057-208-XA	<0.5	<0.5	<0.5	<.5	12	2.9
3057-212-XA	<0.5	<0.5	<0.5	<.5	4.8	1.4
3057-214-XA	<0.5	<0.5	<0.5	<.5	1.0	<1
3057-215-XA	<0.5	<0.5	3.5	2.0	9.1	3.4
3057-216-XA	<0.5	<0.5	2.5	2.5	4.2	13
3057-217-XA	<0.5	<0.5	<0.5	<.5	2.7	<1
3057-218-XA	7.2	38	110	210	160	98
3057-219-XA	8.2	36	230	340	840	320
3057-211-XA	<0.5	<0.5	<0.5	<.5	1.6	<1
3057-213-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-215-XA	<0.5	<0.5	1.6	1.4	2.6	1.8
3057-217-XA	7.2	33	160	270	240	160
3057-218-XA	4.9	25	150	250	510	290
3057-219-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-220-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-221-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-222-XA	<0.5	<0.5	<0.5	<.5	1.8	<1
3057-223-XA	<0.5	<0.5	<0.5	<.5	2.1	<1
3057-224-XA	<0.5	<0.5	1.5	2.6	5.0	2.4
3057-225-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-226-XA	<0.5	<0.5	2.7	4.0	6.4	3.0
3057-227-XA	<0.5	3.7	23	48	73	46
3057-228-XA	7.5	35	180	280	380	300
3057-229-XA	<0.5	<0.5	1.7	1.9	6.3	3.3
3057-230-XA	24	59	270	260	260	260
3057-231-XA	<0.5	<0.5	2.4	3.4	6.6	4.1
3057-232-XA	<0.5	<0.5	1.0	1.2	2.0	1.3
3057-233-XA	<0.5	<0.5	0.8	0.5	1.9	1.5
3057-234-XA	<0.5	<0.5	0.5	<.5	2.9	1.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 6 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-235-XA	1.1	7.2	46	100	250	130
3057-236-XA	<0.5	<0.5	0.9	0.7	5.2	1.9
3057-237-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-238-XA	<0.5	<0.5	<0.5	<.5	3.0	<1
3057-32/17ft	<0.5	<0.5	<0.5	<.5	1.1	<1
3057-239-XA	<0.5	<0.5	1.1	1.3	3.5	1.7
3057-240-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-241-XA	2.2	9.8	33	53	91	41
3057-242-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-243-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-244-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-245-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-246-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-247-XA	17	52	230	110	1200	180
3057-248-XA	<0.5	<0.5	3.2	1.9	8.0	1.1
3057-249-XA	4.7	21	84	140	250	110
3057-250-XA	<0.5	1.9	7.5	13	25	10
3057-251-XA	<0.5	<0.5	<0.5	<.5	1.9	<1
3057-252-XA	<0.5	<0.5	<0.5	<.5	2.7	<1
3057-253-XA	3.8	18	110	180	400	200
3057-254-XA	11	68	130	300	250	150
3057-255-XA	8.4	66	200	580	550	500

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

YORK RESEARCH CONSULTANTS, INC.

Lab No. 85-11-008

Soils for pentachlorophenol analysis

November 12, 1985

Four soil samples were received for the determination of pentachlorophenol on November 7, 1985. The results are shown below:

<u>Sample ID</u>	<u>Pentachlorophenol</u> <u>mg/kg</u>
3057-194	2,400.
3057-194 Dup.	2,700.
3057-205	2.2
3057-230	2,400.
3057-238	ND
Detection limit	1.0

ND = None detected



Environmental Consultants

6 215

December 11, 1985

Mr. Fred Choske
OH Materials
16406 U.S. Route 224 East
Findlay, Ohio 45840

Dear Fred,

Enclosed are the analytical results for samples received on November 22 and November 26. In general, the level of interferences in these samples appeared to be greater than the previous sets. Values greater than 100 ug/kg (500 ppb for OCDD/F) are beyond the range of the method and should be used as estimates only.

Two values are reported for #273. The TA data are the result of a hot (~50°C) toluene extract, and the WA data are the result of a hot (~90°C) water extract. In both cases the spike and internal standards were added to the extract to permit quantification.

If you have any questions, please do not hesitate to call.

Sincerely,

Robert V. Collins
Vice President

RVC/lj
Enclosure

cc: Mr. Paul Sawyer

York Research Consultants
938 Quail Street, Denver, Colorado 80215, Phone (303) 233-1513



6 216
California Analytical Laboratories, Inc.
2544 Industrial Boulevard • West Sacramento, CA 95691 • (916) 372-1393

September 19, 1985
Lab No. 22275
Received: 9/6/85
Project: 3057

Paul Sawyer
OH Materials
90 Almon Road
Covington, GA 30209

One oil sample was received under chain-of-custody in 40 mL VOA vials to be analyzed for pentachlorophenol and C14-C18 dioxins and furans.

RESULTS

<u>CAL I.D.</u>	<u>Sample I.D.</u>	<u>Amount of PCP Found</u>
22275	3057-7 9-5 18:20 PCP Dip Tank	1.6%

Remaining results are on the attached data sheets.


Michael J. Mills, PhD
Director of GC/MS Services


Ben N. Buechler
GC Lab Manager

This report is for the sole and exclusive use of the client to whom it is addressed.
Samples not destroyed in testing retained a maximum of thirty (30) days unless otherwise requested.

Table 1 page 1

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	CDCR NO	DATE REC'D	HOLD BASIS
3057-152	WIPE	8987	10/10/85	NONE
3057-153	SOIL	8987	10/10/85	NONE
3057-154	CONCRETE	8987	10/10/85	NONE
3057-155	SOIL	8987	10/10/85	NONE
3057-160	SOIL	8986	10/12/85	NONE
3057-162	SOIL	8986	10/12/85	NONE
3057-163	SOIL	8986	10/12/85	NONE
3057-164	SOIL	8986	10/12/85	NONE
3057-165	SOIL	8986	10/12/85	NONE
3057-166	WATER	8988	10/16/85	NONE
3057-167	WATER	8988	10/16/85	166
3057-168	WIPE	8989	10/17/85	NONE
3057-169	WIPE	8989	10/17/85	NONE
3057-170	WIPE	8989	10/17/85	NONE
3057-171	SOIL	8985	10/19/85	NONE
3057-172	SOIL	8985	10/19/85	NONE
3057-173	SOIL	8985	10/19/85	NONE
3057-174	SOIL	8985	10/19/85	NONE
3057-175	SOIL	8985	10/19/85	NONE
3057-177	CONCRETE	8990	10/26/86	NONE
3057-178	CONCRETE	8990	10/26/86	NONE
3057-179	CONCRETE	8990	10/26/86	NONE
3057-180	CONCRETE	8990	10/26/86	NONE
3057-181	WOOD	8990	10/26/86	NONE
3057-182	WIPE	8990	10/26/86	NONE
3057-183	WIPE	8990	10/26/86	NONE
3057-184	WIPE	8990	10/26/86	NONE
3057-185	WOOD	8991	10/29/85	NONE
3057-186	WIPE	8991	10/29/85	NONE
3057-187	WIPE	8991	10/29/85	NONE
3057-188	WIPE	8991	10/29/85	NONE
3057-176	WIPE	8991	10/29/85	NONE
3057-189	WOOD	8991	10/29/85	NONE

Table 1 page 2

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-190	SOIL	8992	10/31/85	NONE
3057-192	SOIL	8992	10/31/85	NONE
3057-194	SOIL	8992	10/31/85	NONE
3057-195	SOIL	8992	10/31/85	NONE
3057-198	SOIL	8992	10/31/85	NONE
3057-199	SOIL	8992	10/31/85	NONE
3057-191	SOIL	8992	10/31/85	190
3057-193	SOIL	8992	10/31/85	192
3057-196	SOIL	8992	10/31/85	195
3057-197	SOIL	8992	10/31/85	196
3057-200	SOIL	8992	10/31/85	199
3057-205	SOIL	8994	11/1/85	NONE
3057-201	SOIL	8994	11/1/85	NONE
3057-203	SOIL	8994	11/1/85	NONE
3057-202	SOIL	8994	11/1/85	202
3057-204	SOIL	8994	11/1/85	203
3057-206	SOIL	8993	11/2/85	NONE
3057-208	SOIL	8993	11/2/85	NONE
3057-210	SOIL	8993	11/2/85	NONE
3057-212	SOIL	8993	11/2/85	NONE
3057-214	SOIL	8993	11/2/85	NONE
3057-215	SOIL	8993	11/2/85	NONE
3057-217	SOIL	8993	11/2/85	NONE
3057-216	SOIL	8993	11/2/85	NONE
3057-218	SOIL	8993	11/2/85	NONE
3057-207	SOIL	8995	11/2/85	206
3057-209	SOIL	8995	11/2/85	208
3057-211	SOIL	8995	11/2/85	210
3057-213	SOIL	8995	11/2/85	212
3057-219	SOIL	8981	11/3/85	NONE
3057-220	SOIL	8981	11/3/85	NONE
3057-221	SOIL	8981	11/3/85	NONE
3057-223	SOIL	8981	11/3/85	NONE

Table 1 page 3

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-224	SOIL	8981	11/3/85	NONE
3057-225	SOIL	8981	11/3/85	NONE
3057-226	SOIL	8981	11/3/85	NONE
3057-227	SOIL	8981	11/3/85	NONE
3057-222	SOIL	8981	11/3/85	221
3057-228	SOIL	8982	11/5/85	NONE
3057-229	SOIL	8982	11/5/85	NONE
3057-230	SOIL	8982	11/5/85	NONE
3057-231	SOIL	8982	11/5/85	NONE
3057-232	SOIL	8982	11/5/85	NONE
3057-233	SOIL	8982	11/5/85	NONE
3057-234	SOIL	8982	11/5/85	NONE
3057-235	SOIL	8982	11/5/85	NONE
3057-236	SOIL	8982	11/5/85	NONE
3057-237	SOIL	8982	11/5/85	NONE
3057-238	SOIL	8982	11/5/85	NONE
3057-239	SOIL	11054	11/06/85	NONE
3057-241	SOIL	11054	11/06/85	NONE
3057-242	SOIL	11054	11/06/85	NONE
3057-243	SOIL	11054	11/06/85	NONE
3057-244	SOIL	11054	11/06/85	NONE
3057-245	SOIL	11054	11/06/85	NONE
3057-246	SOIL	11054	11/06/85	NONE
3057-240	SOIL	11054	11/06/85	239
3057-247	SOIL	11050	11/7/85	NONE
3057-248	SOIL	11050	11/7/85	NONE
3057-249	SOIL	11050	11/7/85	NONE
3057-250	SOIL	11050	11/7/85	NONE
3057-251	SOIL	11050	11/7/85	NONE
3057-253	SOIL	11050	11/7/85	NONE
3057-254	SOIL	11050	11/7/85	NONE
3057-255	SOIL	11050	11/7/85	NONE
3057-252	SOIL	11050	11/7/85	251

Table 2 page 1 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-152-XA	OCT1212	1.00	100	0.3	0.3	0.7	0.7
3057-153-XA	OCT1213	5.14	135	0.8	1.2	0.5	1.2
3057-155-XA	OCT1214	5.19	117	<0.1	<0.1	<0.1	<0.1
3057-160-XA	OCT1217	5.05	108	0.2	0.6	0.2	3.0
3057-162-XA	OCT1218	5.00	123	<0.1	<0.1	0.2	0.2
3057-163-XA	OCT1219	5.11	109	<0.1	<0.1	<0.1	<0.1
3057-164-XA	OCT1220	5.12	100	0.5	0.3	0.8	0.8
3057-165-XA	OCT1221	5.03	106	<0.1	<0.1	<0.1	<0.1
3057-166R-X	NDV0407	910	102	<1 ppt	<1 ppt	<1 ppt	<1 ppt
3057-168-XA	OCT1731	1.00	98	1.1	0.7	1.7	1.7
3057-169-XA	OCT1732	1.00	84	0.4	0.3	0.7	0.7
3057-170-XA	OCT1733	1.00	89	0.8	0.5	1.2	1.2
				<0.1	<0.1	<0.1	<0.1
3057-171-XA	OCT2621	1.00	85	1.0	1.3	1.7	1.8
3057-172D-XA	OCT2611	5.03	102	0.2	<0.1	3.9	2.1
3057-173-XA	OCT2612	4.93	96	1.4	2.7	2.7	1.4
3057-174-XA	OCT2613	5.27	86	<0.1	<0.1	<0.1	<0.1
3057-175-XA	OCT2614	5.02	75	4.4	5.5	1.0	1.0
3057-177-XA	OCT2615	4.86	97	1.4	2.8	10	14
3057-178-XA	OCT2616	5.34	93	0.2	0.3	1.1	1.1
3057-179-XA	OCT2617	5.25	91	<0.1	<0.1	0.2	0.9
3057-180-XA	OCT2618	5.29	94	23	62	84	220
3057-181-XA	OCT2619	4.39	87	0.7	1.4	1.1	7.2
3057-182-XA	OCT2620	3.34	91	<0.1	<0.1	<0.1	0.6
3057-183-XA	OCT2622	3.46	87	<0.1	<0.1	<0.1	0.3
3057-184-XA	OCT2623	4.01	91	<0.1	<0.1	<0.1	<0.1
3057-176-XA	OCT3007	1.00	89	0.1	0.1	0.2	0.2
3057-185-XA	OCT3003	2.67	102	<0.1	<0.1	<0.1	0.3
3057-186-XA	OCT3004	1.00	94	0.2	0.2	0.2	0.3
3057-187-XA	OCT3005	1.00	89	<0.1	<0.1	0.1	0.5
3057-188-XA	OCT3006	1.00	107	0.1	0.1	0.2	0.2
3057-189-XA	OCT3008	2.90	97	<0.1	<0.1	<0.1	0.5
3057-190-XA	OCT3117	5.37	102	0.4	0.3	0.7	0.1
3057-192-XA	OCT3118	5.20	105	0.1	0.1	0.2	0.2
3057-194-XA	OCT3121	4.93	95	0.1	0.2	3.4	3.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 2 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-195-XA	OCT3120	5.10	100	<0.1	<0.1	<0.1	<0.1
3057-198-XA	OCT3122	4.80	90	<0.1	<0.1	<0.1	<0.1
3057-199-XA	OCT3123	5.28	105	<0.1	<0.1	<0.1	0.1
3057-201-XA	NOV0104	4.90	94	<0.1	<0.1	<0.1	<0.1
3057-203-XA	NOV0105	5.32	91	<0.1	<0.1	<0.1	0.1
3057-205-XA	NOV0106	5.24	94	0.2	<0.1	<0.1	<0.1
3057-201-XA	NOV0204	5.36	106	0.2	<0.1	1.8	4.0
3057-206-XA	NOV0202	5.18	90	0.1	0.1	0.2	0.2
3057-208-XA	NOV0203	5.35	95	<0.1	<0.1	<0.1	<0.1
3057-212-XA	NOV0214	5.25	94	<0.1	<0.1	<0.1	<0.1
3057-214-XA	NOV0206	5.09	98	<0.1	<0.1	0.1	0.1
3057-215-XA	NOV0209	4.96	92	<0.1	<0.1	<0.1	<0.1
3057-216-XA	NOV0210	4.94	90	<0.1	<0.1	<0.1	<0.1
3057-217-XA	NOV0208	4.95	91	<0.1	<0.1	0.1	0.4
3057-218-XA	NOV0211	5.02	94	0.2	0.2	0.9	0.3
3057-211-XA	NOV0408	5.20	99	<0.1	<0.1	<0.1	<0.1
3057-213-XA	NOV0409	5.21	89	<0.1	<0.1	<0.1	<0.1
3057-215-XA	NOV0422	4.96	95	<0.1	<0.1	<0.1	<0.1
3057-217-XA	NOV0421	4.95	9	<0.1	<0.1	0.1	0.7
3057-218-XA	NOV0420	5.02	98	<0.1	0.1	0.1	0.2
3057-219-XA	NOV0411	5.02	91	<0.1	<0.1	<0.1	<0.1
3057-220-XA	NOV0412	4.88	94	<0.1	<0.1	<0.1	<0.1
3057-221-XA	NOV0413	5.25	89	<0.1	<0.1	<0.1	<0.1
3057-222-XA	NOV0414	5.14	99	<0.1	<0.1	<0.1	<0.1
3057-223-XA	NOV0415	5.33	95	<0.1	<0.1	<0.1	<0.1
3057-224-XA	NOV0416	4.90	90	<0.1	<0.1	<0.1	<0.1
3057-225-XA	NOV0417	5.35	93	<0.1	<0.1	<0.1	<0.1
3057-226-XA	NOV0418	5.18	96	<0.1	<0.1	<0.1	<0.1
3057-227-XA	NOV0419	5.12	92	<0.1	<0.1	<0.1	<0.1
3057-228-XA	NOV0506	5.08	93	<0.1	<0.1	0.2	0.9
3057-229-XA	NOV0507	5.36	97	<0.1	<0.1	<0.1	0.1
3057-230-XA	NOV0508	4.94	116	0.4	0.6	0.7	3.1
3057-231-XA	NOV0509	5.07	98	<0.1	<0.1	<0.1	<0.1
3057-232-XA	NOV0510	5.03	97	<0.1	<0.1	<0.1	0.1
3057-233-XA	NOV0511	5.15	96	<0.1	<0.1	<0.1	<0.1
3057-234-XA	NOV0512	4.91	88	<0.1	<0.1	<0.1	<0.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 3 Dioxin Furan Data Summary

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg
3057-235-XA	NOV0513	5.12	89	<0.1	<0.1	<0.1	<0.1
3057-236-XA	NOV0514	5.14	87	<0.1	<0.1	<0.1	<0.1
3057-237-XA	NOV0515	4.99	89	<0.1	<0.1	<0.1	<0.1
3057-238-XA	NOV0533	5.15	97	0.4	<0.1	<0.1	<0.1
3057-32/17ft	NOV0534	5.17	90	0.1	<0.1	<0.1	<0.1
3057-239-XA	NOV0608	5.17	101	<0.1	<0.1	<0.1	<0.1
3057-240-XA	NOV0609	5.25	98	<0.1	<0.1	<0.1	<0.1
3057-241-XA	NOV0610	5.29	104	<0.1	0.1	<0.1	0.5
3057-242-XA	NOV0612	5.07	100	<0.1	<0.1	<0.1	<0.1
3057-243-XA	NOV0613	5.10	95	<0.1	<0.1	<0.1	0.2
3057-244-XA	NOV0614	5.18	93	<0.1	<0.1	<0.1	<0.1
3057-245-XA	NOV0615	5.18	92	<0.1	<0.1	<0.1	<0.1
3057-246-XA	NOV0616	4.97	95	<0.1	<0.1	<0.1	<0.1
3057-247-XA	NOV0713	5.03	96	0.5	0.8	2.2	9.9
3057-248-XA	NOV0714	5.17	94	<0.1	<0.1	<0.1	<0.1
3057-249-XA	NOV0715	5.21	107	<0.1	<0.1	<0.1	1.0
3057-250-XA	NOV0716	4.94	97	<0.1	<0.1	<0.1	<0.1
3057-251-XA	NOV0718	4.98	90	<0.1	<0.1	<0.1	<0.1
3057-252-XA	NOV0719	4.96	88	<0.1	<0.1	<0.1	<0.1
3057-253-XA	NOV0720	5.13	99	<0.1	<0.1	<0.1	1.8
3057-254-XA	NOV0721	4.98	101	0.5	1.4	0.9	8.4
3057-255-XA	NOV0722	5.22	98	0.4	0.8	0.6	2.9

notes: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 4 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-152-XA	1.4	1.0	2.8	2.4	2.1	8.0
3057-153-XA	1.4	5.0	28	41	110	36
3057-155-XA	<0.5	<0.5	<0.5	<.5	8.1	3.2
3057-160-XA	3.8	9.6	47	55	150	48
3057-162-XA	<0.5	<0.5	13	12	34	14
3057-163-XA	<0.5	<0.5	<0.5	<.5	3.8	<1
3057-164-XA	1.7	21	120	460	820	640
3057-165-XA	0.9	9.0	34	110	120	110
3057-166R-X	<2 ppt	<2 ppt	<3 ppt	<3 ppt	<6 ppt	<6 ppt
3057-168-XA	3.6	3.0	6.2	5.5	360	37
3057-169-XA	1.4	1.2	2.4	2.1	69	2.1
3057-170-XA	2.6	2.1	4.4	4.0	93	31
	<0.5	<0.5	<0.5	<.5	<1	<1
3057-171-XA	2.2	2.3	140	56	270	30
3057-172D-XA	14	68	420	1100	1100	750
3057-173-XA	11	19	170	140	420	110
3057-174-XA	<0.5	0.7	4.2	8.1	18	6.5
3057-175-XA	1.3	1.3	23	29	72	34
3057-177-XA	71	84	810	310	980	87
3057-178-XA	6.7	20	97	110	190	44
3057-179-XA	13	20	440	150	900	72
3057-180-XA	500	450	2900	1100	3200	290
3057-181-XA	7.1	9.8	49	31	600	17
3057-182-XA	0.9	1.3	8.2	3.7	18	2.4
3057-183-XA	<0.5	<0.5	1.4	0.5	3.0	<1
3057-184-XA	<0.5	<0.5	0.8	<.5	1.9	<1
3057-176-XA	<0.5	<0.5	5.8	5.2	11	4.1
3057-185-XA	<0.5	<0.5	1	<.5	2.5	<1
3057-186-XA	<0.5	<0.5	6.7	0.7	19	3.2
3057-187-XA	<0.5	<0.5	2.5	<.5	7.7	4.0
3057-188-XA	<0.5	<0.5	8.2	1.7	33	6.0
3057-189-XA	1.8	0.8	17	11	83	9.5
3057-190-XA	0.9	1.0	3.9	2.4	12	7.5
3057-192-XA	<0.5	<0.5	<0.5	<.5	6.3	<1
3057-194-XA	26	100	670	1300	1600	1000

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 5 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-195-XA	1.3	3.5	14	26	22	17
3057-198-XA	0.9	2.6	13	20	32	18
3057-199-XA	<0.5	1.3	6.9	9.2	17	8.5
3057-201-XA	<0.5	<0.5	<0.5	0.8	1.7	<1
3057-203-XA	<0.5	<0.5	1.3	0.7	5.0	1.0
3057-205-XA	<0.5	<0.5	1.8	2.0	10	2.6
3057-206-XA	75	320	2100	2800	4600	2300
3057-206-XA	<0.5	<0.5	<0.5	<.5	12	2.9
3057-208-XA	<0.5	<0.5	<0.5	<.5	4.8	1.4
3057-212-XA	<0.5	<0.5	<0.5	<.5	1.0	<1
3057-214-XA	<0.5	<0.5	3.5	2.0	9.1	3.4
3057-215-XA	<0.5	<0.5	2.5	2.5	4.2	13
3057-216-XA	<0.5	<0.5	<0.5	<.5	2.7	<1
3057-217-XA	7.2	38	110	210	160	98
3057-218-XA	8.2	36	230	340	840	320
3057-211-XA	<0.5	<0.5	<0.5	<.5	1.6	<1
3057-213-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-215-XA	<0.5	<0.5	1.6	1.4	2.6	1.8
3057-217-XA	7.2	33	160	270	240	160
3057-218-XA	4.9	25	150	250	510	290
3057-219-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-220-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-221-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-222-XA	<0.5	<0.5	<0.5	<.5	1.8	<1
3057-223-XA	<0.5	<0.5	<0.5	<.5	2.1	<1
3057-224-XA	<0.5	<0.5	1.5	2.6	5.0	2.4
3057-225-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-226-XA	<0.5	<0.5	2.7	4.0	6.4	3.0
3057-227-XA	<0.5	3.7	23	48	73	46
3057-228-XA	7.5	35	180	280	380	300
3057-229-XA	<0.5	<0.5	1.7	1.9	6.3	3.3
3057-230-XA	24	59	270	260	260	260
3057-231-XA	<0.5	<0.5	2.4	3.4	6.6	4.1
3057-232-XA	<0.5	<0.5	1.0	1.2	2.0	1.3
3057-233-XA	<0.5	<0.5	0.8	0.5	1.9	1.5
3057-234-XA	<0.5	<0.5	0.5	<.5	2.9	1.1

note: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

Table 2 page 6 Dioxin Furan Data Summary

SAMPLE ID	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-235-XA	1.1	7.2	46	100	250	130
3057-236-XA	<0.5	<0.5	0.9	0.7	5.2	1.9
3057-237-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-238-XA	<0.5	<0.5	<0.5	<.5	3.0	<1
3057-32/17ft	<0.5	<0.5	<0.5	<.5	1.1	<1
3057-239-XA	<0.5	<0.5	1.1	1.3	3.5	1.7
3057-240-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-241-XA	2.2	9.8	33	53	91	41
3057-242-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-243-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-244-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-245-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-246-XA	<0.5	<0.5	<0.5	<.5	<1	<1
3057-247-XA	17	52	230	110	1200	180
3057-248-XA	<0.5	<0.5	3.2	1.9	8.0	1.1
3057-249-XA	4.7	21	84	140	250	110
3057-250-XA	<0.5	1.9	7.5	13	25	10
3057-251-XA	<0.5	<0.5	<0.5	<.5	1.9	<1
3057-252-XA	<0.5	<0.5	<0.5	<.5	2.7	<1
3057-253-XA	3.8	18	110	180	400	200
3057-254-XA	11	68	130	300	250	150
3057-255-XA	8.4	66	200	580	550	500

notes: The values given for wipe samples (wt = 1.00 grams) are total ng present, not ug/kg.

YORK RESEARCH CONSULTANTS, INC.

Lab No. 85-11-008

Soils for pentachlorophenol analysis

November 12, 1985

Four soil samples were received for the determination of pentachlorophenol on November 7, 1985. The results are shown below:

<u>Sample ID</u>	<u>Pentachlorophenol</u> <u>mg/kg</u>
3057-194	2,400.
3057-194 Dup.	2,700.
3057-205	2.2
3057-230	2,400.
3057-238	ND
Detection limit	1.0

ND = None detected



Environmental Consultants

16 227

December 11, 1985

Mr. Fred Choske
OH Materials
16406 U.S. Route 224 East
Findlay, Ohio 45840

Dear Fred,

Enclosed are the analytical results for samples received on November 22 and November 26. In general, the level of interferences in these samples appeared to be greater than the previous sets. Values greater than 100 ug/kg (500 ppb for OCDD/F) are beyond the range of the method and should be used as estimates only.

Two values are reported for #273. The TA data are the result of a hot (~50°C) toluene extract, and the WA data are the result of a hot (~90°C) water extract. In both cases the spike and internal standards were added to the extract to permit quantification.

If you have any questions, please do not hesitate to call.

Sincerely,


Robert V. Collins
Vice President

RVC/lj
Enclosure

cc: Mr. Paul Sawyer

York Research Consultants
938 Quail Street, Denver, Colorado 80215, Phone (303) 233-1513

INSTRUCTIONS FOR MANUAL SPLIT SPOON SAMPLING

The manual split spoon sampler is used when taking sub-surface samples from surface to 10 feet. The sample compartment of the split spoon may be 12" to 24" in length.

Prior to sampling, sample points and depths should be determined and sampling points staked out. A grid pattern may or may not be used, but in any case, the location of each point must be described in the field sampling log or notes in terms of measured distances from known fixed reference points. When this is done, the sampling may begin.

Using a clean shovel or hand auger, a hole is dug down to the starting depth. Once the desired depth has been reached with the shovel, a clean split spoon is placed on the area to be sampled (Note: If the soil appears loose, a basket screen is placed in the end of the sampler to prevent the soil from falling out of the sample). The split spoon is driven into the soil with a sledge hammer until the shoe reaches the desired depth. It is often convenient and necessary to mark the starting and ending depths on the drive rod.

When the sampler has been driven to the desired depth, it is pulled from the sample point, the spoon removed from the shaft and the split tube opened. At this time, the sampling technician puts on a clean pair of sample gloves. With a new tongue depressor, he removes an appropriate amount of soil from the center of the compartment and places it into the sample container.

The container is sealed with teflon lined cap, wiped off, and the sample labelled immediately. A description of the soil is recorded in the field log. Now that the split spoon is dismantled, its parts are washed with soap and water, rinsed with the appropriate solvents, and dried. The shovel or auger used to prepare the sample point should be washed, rinsed, and dried as well. All disposables should be discarded into a contaminated waste drum.

After the split spoon is cleaned and reassembled, the sample point must be marked. The next sample point then may be sampled.

Materials Required:

Split Spoon Kit, Containing -

- 2 - 12" split tubes
- 2 - regular shoes
- 1 - saw-toothed shoe
- 2 - head assemblies
- 3 - basket screens
- 2 - drive-head assemblies
- 1 - closed auger with rod and handle
- 5 - sections drive rod
- 2 - 18" pipe wrenches
- 2 - wire brushes

- 1 - sledge hammer
- 1 - br. steel wool
- 1 - can WD40
- 1 - stocking list
- 1 - written sampling method
- 1 - aluminum box

- 1 - bucket with soap and water
- 1 - scrub brush
- sample jars with teflon lined caps
- sample labels
- log book or field sheets
- paper towels
- garbage bags
- sample gloves
- tongue depressors
- appropriate solvents
- squeeze bottles

Additional Materials Recommended: 1 - pipe vise, and a pick-up truck to haul all these supplies

Tips:

On driving split spoon in:

1. One man uses sledge-hammer. The other holds the drive rod steady. Personnel must be equipped with hard hats, steel toed shoes, and any other appropriate safety equipment. The two men orient themselves perpendicular to each other.
2. If the holder feels that the spoon has hit something hard (i.e., a rock), the spoon is moved to another location. The first try is recorded as rejected. To continue will only damage the split spoon.
3. All threaded connections must be kept tight. The holder should use the bar inserted into the drive head to maintain clockwise torque on the split spoon as it is being driven in.
4. In ground that is compacted and/or cemented together the saw-toothed shoe should be used. To use this, the holder must rotate the split spoon clockwise between sledgehammer blows.
5. A backhoe is never used to drive a split spoon down.

On Pulling Split Spoon Out:

1. The bar is used in the drive head. The two samplers, each holding an end of the bar, walk clockwise while lifting up.
2. If tip #1 does not work, a sledgehammer is used to rap the underside of the bar handle. Then the first method is retried.

On Disassembling the Sampler:

1. A pipe vise should be used.
2. Threads must be kept clean.
3. If the shoe or head assembly will not loosen up, the position of the pipe wrench on the split tube should be changed.

On Decontaminating the Sampler:

1. The project chemist or technical foreman should always be consulted about the decontamination procedure.
2. The split spoon is first washed with soap and water. It is important to remove all soil and visible contamination.
3. Recommended rinsing regimes:
 - a) for metals and cyanide - 10% nitric acid then deionized or distilled water
 - b) for volatile organics - distilled water with flame drying, acetone rinse or paper towel drying.
 - c) for semi or non-volatile organics - acetone then hexane

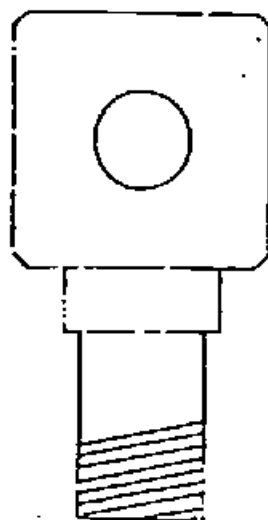
On Removing the Sample from the Spoon:

1. Clean sample gloves and tongue depressor are used.
2. The top and bottom 1/2" of sample are discarded.
3. A quart or 8 oz. jar with a teflon liner are usually used. However, 40 ml Pierce vials with teflon lined septa are used for volatile organics.
4. To split a sample, a clean knife, or sharp, clean spatula is used to cut the core down its length. Then a tongue depressor is used to transfer each half into separate jars.
5. One should never drive the spoon in 12" to get two 6" samples. This will cross-contaminate the lower 6" sample.
6. WHEN IN DOUBT, CALL FINDLAY.

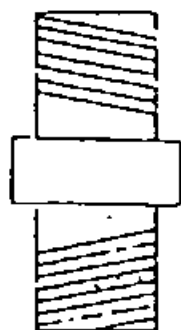
On Maintenance:

1. The split spoon must be kept clean and free of rust. A rusty split spoon cannot be properly decontaminated.
2. The split spoon should be oiled with WD-40 or a similar light oil when it is not in use (i.e., at the end of the day).

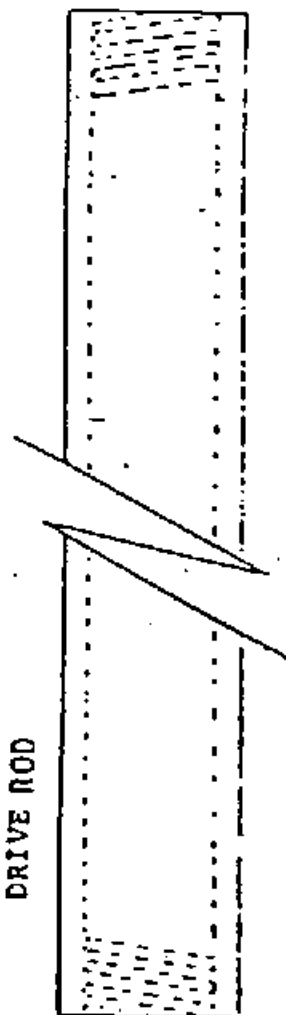
DRIVE HEAD



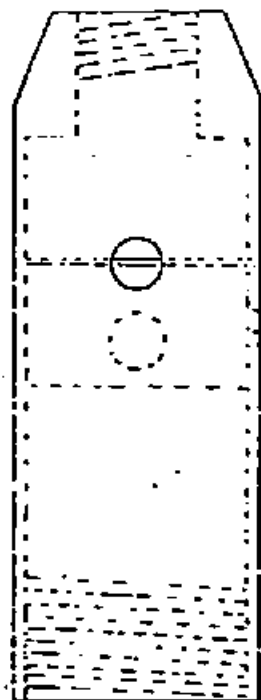
CONNECTOR



DRIVE ROD



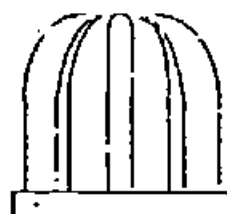
HEAD ASSEMBLY WITH WATER OUTLET
AND CHECK BALL



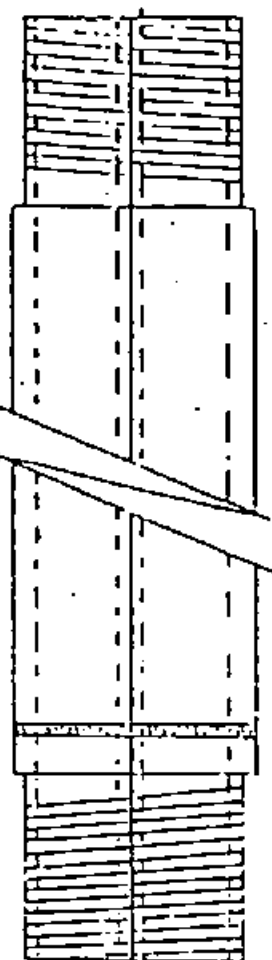
SHOE



BASKET SCREEN



SPLIT TUBE



GRAB SURFACE SOIL SAMPLING**Materials Required:**

- Clean Shovel
- Tongue Depressors
- Sample Bottles with Teflon Lined Caps
- Sample Labels
- Sample Gloves
- Trash Bag
- Materials for Decontamination of Shovel
- Field Log

Procedure:

1. The number and location of desired samples is determined along with the location of duplicate samples.
2. A hole, 3-4", is dug with the clean shovel at the first sample location.
3. The sampler puts on clean sample gloves and scrapes the side of the hole with a tongue depressor to expose a fresh surface. This is done to eliminate the possibility of cross-contamination from material below.
4. The first tongue depressor is discarded and a new one is used to dig material from the top 2" of soil and transfer it into the sample jar. If the soil is too hard for this, the sampler may chip the sample out with a clean screw-driver while holding the open sample jar directly below where he is chipping.
5. After an adequate sample volume is obtained, the jar is sealed, and the sample labeled. Then the pertinent information is recorded in the field log.
6. Used expendables are placed in a trash bag. Any tools used are decontaminated with soap and water and appropriate solvent rinses.
7. Steps 2 - 6 are repeated until all samples have been taken.

NOTES:

1. It is important that one or more background samples be taken in conjunction with any soil sampling program.
2. Samples must be relocatable. That is, the sample locations must be described clearly and accurately, so that someone who reads the descriptions could locate the sample points without prior knowledge of the site. Therefore, it is essential that any descriptions of sample location be coherent with an accurate site map.

SOLIDS PILE SAMPLING WITH THE TRIER

The trier is used to obtain core samples (which are usually then composited) from sludge and waste piles or from any containers which contain solid or semi-solid material which cannot readily be sampled with liquid or sludge samplers.

For purposes of sampling, solid piles are often divided into regions of roughly equal volume. One or more core samples is then taken from each region. These samples are then composited to produce either composites of each region or of the whole pile. The number of samples needed for a good composite depends on the size of the sample and the size and homogeneity of the pile.

Materials Needed

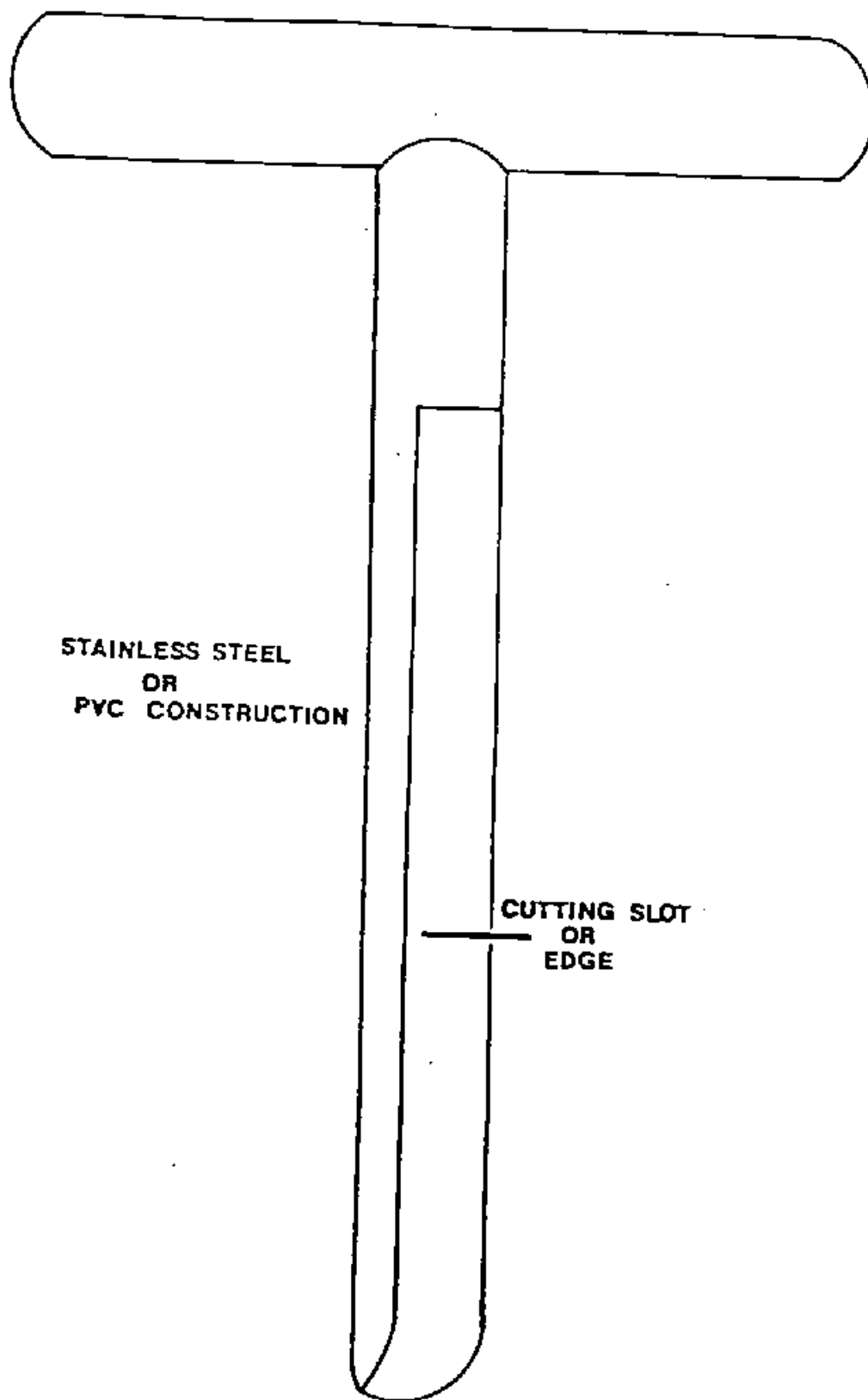
Trier
Sledgehammer
Backhoe and chain (may be needed)
Spatula
Pyrex baking pan or metal bucket
Sample gloves
Sample jars with Teflon lined caps
Sample labels
Wire brush
Scrub brush
Bucket of soap and water
Appropriate rinse solvents
Squeeze bottles
Paper towels
Trash bags
Tongue depressors
Field log

Procedures for Use

1. An appropriate decontamination procedure is used to clean the trier prior to use. A thorough soap and water scrub is always the first step. It is important that visible contamination be removed.
2. The trier is driven into the material to be sampled with a sledgehammer or a backhoe. If a solids pile is being sampled, the trier should go in perpendicular to the surface. However, if its angle is too close to the vertical, the core may fall out.
3. The trier is rotated at least 360 degrees to cut out a core.
4. The slot of the trier is then turned upward and it is slowly withdrawn. It may be necessary to pull it out with a backhoe.

5. The material in the trier is transferred, using clean sample gloves and spatula to a clean container (Pyrex baking pan or metal bucket) for mixing.
6. After the material has been thoroughly mixed, with clean spatula, a quart jar is filled with the material. The jar is then labeled, and the location of the sample recorded.
7. If the next sample will be composited with the one just taken, then decontamination of the trier and spatula is unnecessary. However, they must be thoroughly decontaminated between composites or if the samples are not being composited.
8. Items 1 - 7 are repeated until the pile has been sufficiently sampled.

TRIER SAMPLER



STAINLESS STEEL
OR
PVC CONSTRUCTION

CUTTING SLOT
OR
EDGE



APPENDIX
D

LABORATORIES UTILIZED:

York Research
529 Spirit of St. Louis
(Mobile Lab Site)
Chesterfield, MO 63017
(314)532-9408 (Dioxin Analysis)

York Research
938 Quail Street
Denver, CO 80215 (Bob Collins)
(303)233-1513 (Dioxin Analysis)

Roy F. Weston
7720 Lorraine Drive
Suite 102 (Dennis Jenner)
Stockton, CA 95210 (PCB, Metals, PCP, Pesticides)

Savannah Laboratories
P. O. Box 13842
Savannah, GA 31416-0842 (Janette Davis)
(912)354-7858 (PCB)

California Analytical Laboratories
2544 Industrial Blvd.
W. Sacramento, CA 95691 (Mike Mille)
(916)372-1393 (Dioxin, PCP)

A & L AGRICULTURAL LABORATORIES, INC.

411 N. Third St. • Memphis, TN 38105-2723 • (901) 527-2780

ACCT # 775



REPORT NUMBER

115-016A

Q

April 25, 1985

83
232

Defense Depot
SASG Procurement Division
Memphis, TN 38114

P.O. # 51-0830043

29

LABORATORY NUMBER:

51769

SAMPLE IDENTIFICATION:

Pentachlorophenol Sample collected from
PCP Dip Vat adjacent to new pest control
facility
LTC McLaurin, DLA-WB AV284-6357

ANALYSIS:

X Pentachlorophenol

15.5 X

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A & L AGRICULTURAL LABORATORIES, INC.

Dan Moffett
Dan Moffett, Laboratory Manager

DM/csd

James W. Andrews, Ph.D.

President

Janette M. Davis
Chief Chemist, VP

36 239
**SAVANNAH LABORATORIES
AND ENVIRONMENTAL SERVICES, INC.**

P.O. Box 13842 • Savannah, Ga. 31416-0842
(912) 354-7858



REPORT OF ANALYSIS

TO: Mr. Paul Sawyer
O.H. Materials Co.
90 Almon Road
Covington, GA 30209

REPORT NO. 50905124
DATE RECEIVED 9/5/85
SAMPLED BY client

IDENTIFICATION: Samples submitted to the laboratory for analysis.

METHODS: EPA SW-846 Method 8080

Sample Identification

3057-1 Oil sample, 55 gal drum (4/5 full), taken 9/5 @ 1630	240 mg/kg (Aroclor 1260)
3057-4 Oil sample, transformer, taken 9/5 @ 1700	910 mg/kg (Aroclor 1260)
3057-2 Water sample from oil drum (full - 55 gal), taken 9/5 @ 1635	0.0068 mg/l (Aroclor 1260)
3057-3 Water sample from oil drum (full - 55 gal), taken 9/5 @ 1650	0.0033 mg/l (Aroclor 1260)
3057-5 Soil sample, by drums, composite of 5 samples, taken 9/5 @ 1705	5.1 mg/kg (Aroclor 1260)
3057-6 Soil sample, discrete, taken 9/5 @ 1715	<0.5 mg/kg Total PCB

cc: Fred Choske
O.H. Materials
Roadway Inn
2949 Airways Blvd.
Memphis, TN 38116

Janette M. Davis

Table 1 page 1

Summary of Sample Shipments

SAMPLE ID	SAMPLE TYPE	COCR NO	DATE REC'D	HOLD BASIS
3057-256-11	SOIL	11053	11/22/85	NONE
3057-257-12	SOIL	11053	11/22/85	NONE
3057-258-13	SOIL	11053	11/22/85	NONE
3057-259-14	SOIL	11053	11/22/85	NONE
3057-260-16	SOIL	11053	11/22/85	NONE
3057-261-18	SOIL	11053	11/22/85	NONE
3057-262-19	SOIL	11052	11/22/85	NONE
3057-263-20	SOIL	11052	11/22/85	NONE
3057-264-21	SOIL	11052	11/22/85	NONE
3057-265-22	SOIL	11052	11/22/85	NONE
3057-266-23	SOIL	11052	11/22/85	NONE
3057-267-24	SOIL	11052	11/22/85	NONE
3057-268-25	SOIL	8966	11/22/85	NONE
3057-269	SOIL	8966	11/22/85	NONE
3057-270	SOIL	8966	11/22/85	NONE
3057-271	SOIL	8966	11/22/85	NONE
3057-272	SOIL	8966	11/22/85	NONE
3057-273	CARBON	8966	11/22/85	NONE
3057-274-26	SOIL	8967	11/26/85	NONE
3057-275-27	SOIL	8967	11/26/85	NONE
3057-276-28	SOIL	8967	11/26/85	NONE
3057-277-29	SOIL	8967	11/26/85	NONE
3057-278-30	SOIL	8967	11/26/85	NONE
3057-279-31	SOIL	8967	11/26/85	NONE
3057-280-32	SOIL	8968	11/26/85	NONE
3057-281-33	SOIL	8968	11/26/85	NONE
3057-282-34	SOIL	8968	11/26/85	NONE
3057-283-35	SOIL	8968	11/26/85	NONE
3057-284-36	SOIL	8968	11/26/85	NONE
3057-285-37	SOIL	8968	11/26/85	NONE
3057-286-38	SOIL	8968	11/26/85	NONE
3057-287-39	SOIL	8968	11/26/85	NONE

Table 2 Summary of Results

SAMPLE ID	FILE NO	WT grams	% SUR RECOVERY	TCDD ug/kg	TCDF ug/kg	PCDD ug/kg	PCDF ug/kg	HxCDD ug/kg	HxCDF ug/kg	HpCDD ug/kg	HpCDF ug/kg	OCDD ug/kg	OCDF ug/kg
3057-256-1A	DEC0609	7.10	97.8	5.3	3.0	7.6	35	9.4	120	140	410	1400	520 ✓
3057-257-1A	DEC0610	5.06	118.6	9.5	0.2	8.7	0.4	0.6	47	120	680	2500	2500 ✓
3057-257B-1A	DEC0620	6.16	99.3	1.0	1.7	2.0	4.4	5.2	23	47	79	190	62 ✓
3057-258-1A	DEC0309	6.25	95.2	<0.1	0.7	1.0	2.3	7.3	28	100	180	380	180 ✓
3057-259-1A	DEC0403	5.00	100.4	3.0	5.6	4.2	8.1	17	64	150	230	500	200 ✓
3057-260-1A	DEC0404	5.19	104.7	1.5	3.2	1.1	4.5	12	57	340	980	2800	2500 ✓
3057-261-1A	DEC0405	6.80	111.6	1.4	2.1	0.6	5.2	8.2	22	54	92	120	59 ✓
3057-262-1A	DEC0406	4.84	105.0	1.4	2.9	6.3	5.9	22	130	380	910	1030	880 ✓
3057-263-1A	DEC0410	5.43	123.9	0.8	2.3	1.7	4.3	5.9	18	44	44	150	39 ✓
3057-264-1A	DEC0602	5.90	97.8	3.4	1.0	2.6	8.1	3.5	22	51	300	3300	3000 ✓
3057-265-1A	DEC0409	7.11	84.6	0.6	1.0	1.9	1.4	5.6	23	51	83	180	72 ✓
3057-266-1A	DEC0509	7.37	100.0	3.5	3.1	11	13	29	130	620	1500	3800	3600 ✓
3057-267-1A	DEC0503	6.20	92.5	0.1	0.1	6.5	2.1	62	200	1500	2000	6700	3400 ✓
3057-268-1A	DEC0623	6.08	79.0	0.1	49	19	0.2	21	66	140	180	660	210
3057-269-1A	DEC0631	6.51	101.1	5.4	4.6	10	30	5.3	27	78	87	560	120
3057-270-1A	DEC0625	6.15	103.5	2.0	2.2	21	21	39	210	150	350	520	200
3057-271-1A	DEC0508	8.64	NR-1	16	15	140	41	88	360	1200	1700	4800	2000
3057-272-1A	DEC0507	6.42	96.9	<0.1	0.7	<0.1	<0.1	<0.5	<0.5	1.3	1.3	4.8	1.4
3057-273-1A	DEC1009	4.47	106.8	<0.1	<0.1	<0.1	0.2	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0
3057-273-1A	DEC1010	21.27	110.6	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0
3057-274-1A	DEC0626	5.04	116.3	1.1	2.4	12	12	29	140	470	900	2800	1900 ✓
3057-275-1A	DEC0513	5.12	116.3	2.4	2.7	10	11	23	110	280	590	1600	980 ✓
3057-276-1A	DEC0514	5.24	121.6	2.4	1.9	11	12	21	100	150	330	500	290 ✓
3057-277-1A	DEC0515	5.26	117.5	2.6	2.1	6.2	6.6	12	54	170	320	930	560 ✓
3057-278-1A	DEC0628	4.98	109.9	0.2	2.5	4.6	1.8	11	91	480	2100	NR-2	NR-2 ✓
3057-279-1A	DEC0521	5.30	124.3	2.5	6.4	8.1	11	26	110	410	820	1700	1100 ✓
3057-280-1A	DEC0611	4.98	115.6	0.8	<0.1	5.9	12	30	240	910	2500	5900	5000 ✓
3057-281-1A	DEC0612	4.75	131.9	1.9	13	2.6	2.6	2.0	12	15	17	33	12 ✓
3057-282-1A	DEC0618	5.23	114.3	0.9	3.5	<0.1	0.4	<0.5	1.6	4.0	3.5	9.7	2.0
3057-283-1A	DEC0617	4.84	106.0	1.4	1.3	10	13	26	130	250	710	1300	1000
3057-284-1A	DEC0616	5.42	128.7	1.5	14	3.1	5.8	6.6	20	39	43	220	29 ✓
3057-285-1A	DEC0517	5.32	116.6	1.3	1.8	5.8	6.0	16	74	170	410	530	380 ✓
3057-286-1A	DEC0629	5.28	119.4	NR-1	5.0	1.7	4.7	39	75	330	350	1500	440 ✓
3057-287-1A	DEC0519	5.33	118.7	1.8	3.7	26	7.8	18	60	210	290	630	370 ✓

NR-1 result not reported due to interferences

NR-2 result not reported, value estimated to be > 5 ppm

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INDUSTRIAL HYGIENE AIR SAMPLE DATA

For use of this form see USAEHA TG 141; the proponent is BSEB-10.

Return Address (complete address including Zip Code) 163 Airways Blvd. Memphis, TN 38114-5297		Point of Contact (name/AUTOVON) John Tibbels AV 683-4900	
Samples Collected By John Tibbels		Date Collected 19 Sep-26 Sep	Date Shipped 27 Sep 85
Project Number		Associated Bulk Samples ☐ Yes ☐ No	
Location (BLDG/AREA) Side Shop		Bulk Sample No(s):	
Sampled Installation Defense Depot Memphis		AR LOC	
Description of Operation (details on reverse) Decontamination of PCP dip vat			
Persons Exposed ☐ Hrs/Day		Method of Collection Midget Impinger	
Associated Complaints (be specific) (state NONE if applicable) NONE			
Analysis Desired Pentachlorophenol			

Sampling Data

Sample No.	AS-85-5	AS-85-6	AS-85-7	AS-85-8	AS-85-9	AS-85-10	AS-85-11	AS-85-12
Start Time	9:02	9:14	11:14	11:46	1300	1302	1024	
Stop Time	14:51	14:38	14:58	14:53	15:44	15:45	13:42	
Total Time (min)	349	335	224	187	164	163	198	
Flow Rate (LPM)	1.4	1.4	1.4	1.4	1.4	1.4	1.45	
Volume (Liters)	488.6	469	313.6	262	230	228	287	
Lab No.	15470	15471	15472	15473	15474	15475	15476	15477

Results

Pentachlorophenol	<.004	<.004	<.006	<.008	<.007	<.008	<.006	<.008

Comments to Lab:

Air samples are area samples.

$$TLV = 0.5 \text{ mg/m}^3$$

Lab Use Only

Analyst (Initials) JIM	Reviewed By (Initials) JEL	Date Received 10 Oct	Date Dispatched 25 Oct 85

Form 9, 1 Oct 84

Replaces AEHA Form 9, 1 Oct 80 which is obsolete.



APPENDIX
E

SITE SPECIFIC SAFETY PLAN
DEFENSE INDUSTRIAL PLANT
EQUIPMENT CENTER (DIPEC)
MEMPHIS, TENNESSEE

To facilitate the successful re-packaging and segregation of materials at the Memphis, Tennessee DIPEC facility, OHM and depot personnel shall observe a defined site layout. This is necessary to complete the project in a safe, organized and expeditious manner.

The site will be divided into three zones. These zones shall consist of the "hot" or contaminated zone, the transition zone and the clean zone. Due to the location of many drummed materials at various locations around the facility, and the size of the area, there will be multiple hot zones and transition zones. These hot zones will be marked with yellow tape or rope. Transition zones will have receptacles for disposal of expendable items and wash water for clean-up. Hot zones at this writing consist of the repackaging area in R5203 and R5206, the storage area directly in front of this area, and the drum storage area going further east by the railroad tracks. These are further described in Figure 1.

Air Quality

Air quality on the site is very good. Concern over air quality is centered around drum transfers for which personnel respiratory protection extensively addressed. Hence, on site air monitoring is not currently planned. However, equipment will be available to address air quality concerns should they arise. In planning work activities, fuming materials such as hydrofluoric acid and ammonium hydroxide will be handled on the weekends. Due to minimal depot personnel activities on the weekends, personnel exposure would be essentially eliminated in the event of a spill.

OHM's personnel who will be working within each hot zone will use the following protective equipment and measures as dictated by activity:

1. Manifold breathing air system, full face respirator or half-face respirator. Transferring or pouring organic solvents normally calls for the use of supplied breathing air.

2. Protective chemical suits or paper suits as dictated by activity.
3. Protective neoprene boots or disposable vinyl boots.
4. Protective gloves and hoods.
5. OSHA approved hard hats.
6. Utilization of buddy system at all times.

The protection above constitutes Level "C" when air purifying respirators are used and Level "B" when supplied breathing air is used.

Requirements for respiratory protection area:

1. In all cases, when protective respiratory equipment is used, every respirator type is fit tested to the individual using it. Fit tests are made using irritant smoke. All field personnel are trained in the use of different respirator types and the limitations of those respirators.
2. In work site areas where the respirator wearer may be overcome by toxic vapors, there are several personnel available to initiate a rescue operation. There is also at least one man always within the visual, auditory, or signal communication line of the respirator wearer.
3. Employees using air supplied manifold respirators are always equipped with a five-minute Scott escape pack.
4. Supervisory personnel maintain frequent on-site inspections of respiratory protection gear for cleanliness, function, and repairs (if needed). They also check to be sure that respiratory equipment is properly stored.
5. Supervisors conduct periodic procedural training sessions on site for personnel so they are familiar with the proper use, care, and maintenance of all types of respirators being used.
6. All employees wearing respirators are required to be clean shaven to help ensure proper respirator fit.

OHM demands from its employees safe work practices and daily maintenance of safety equipment. Protective clothing is cleaned at the end of each workday. Each manifold breathing apparatus and respirator is disassembled, cleaned, inspected, and properly stored each day. Supervisory personnel also do periodic inspections of equipment in addition to the daily procedures required of workers.

At the beginning of every workday, a safety meeting is held. The plan for the day is disclosed as clearly as can be determined and the appropriate safety measures related to those activities are explained. All operations are closely supervised for proper safety practices.

Safety equipment such as first-aid kits, emergency eye showers, and emergency oxygen inhalation systems will be placed at strategic locations on the project site so they are quickly accessible for any emergency situation.

Drum Handling

OHM has been supplied a list of materials stored on site. In addition OHM has visually checked containers on the site and identified products and locations. Should concern arise in regards to the handling of any materials on site, OHM will record National Stock Numbers and request a Material Safety Data Sheet from the Post Hygienist, Mr. John Tibbels. This will insure that all applicable safety measures will be applied.

OHM has contingency plans for the following emergencies:

1. Fires

- a. A minimum of three, 20-pound (dry powder and foam) fire extinguishers will be maintained on site.
- b. Radio and/or telephone numbers will be maintained on site for the local fire department.
- c. Access routes for emergency vehicles are maintained throughout the duration of the project.
- d. OHM's supervisory personnel have consulted with Fire Inspector Kelley concerning the event of a fire on site.

2. Medical Emergencies

- a. Supervisory personnel from OHM have first-aid instructor's training; first-aid kits will be

available at the facility along with emergency oxygen inhalation systems and emergency eye showers. Showers and eyewashes in area R5203 and R5206 have been checked and will be utilized if needed.

- b. Safety is stressed. OHM's personnel are trained in safe work procedures; safe work practices are insisted upon by Company supervisory personnel. Work practices of OHM have been inspected and approved by OSHA.

3. Liquid/Solid Waste Spills

- a. Equipment will be maintained on site to clean up spilled materials. Sorbent materials will be maintained on site to absorb the contents of any liquids spilled.
- b. OHM's personnel are highly trained in spill control and prevention methods.
- c. OHM's method of handling materials mechanically minimizes spillage.

4. Emergency Medical Equipment

Essential first-aid equipment, including oxygen, showers, and eye wash fountains, splints, bandages, stretchers, etc., are located at key points within and around the site. Personnel have constant access to first-aid supplies. The communications system is designed to alert local ambulance units immediately in the case of need.

5. Spill Control Equipment

OHM supplies a full complement of spill control equipment to the site. In addition to portable materials such as absorbent pads, personnel are trained to effectively utilize heavy equipment to control spills.

6. Fire Control Equipment

All areas and operations that are identified as flammable hazards are provided with proper type and amount of extinguishing agent. Personnel are trained to use all available site equipment to combat a fire.

7. Preventive Actions

a. Personnel Awareness Program

Safety training is a continual effort at OHM. Employees are trained to recognize safety hazards and alert the

proper site personnel to potential injury situations. Personal and group safety is stressed.

b. Daily Safety Briefings

Prior to commencing any operation, the hazards associated with the day's activities are made clear. Preventive measures are reviewed and emergency procedures established. Routine safety precautions are reviewed.

Personnel and Equipment Decontamination

Hazardous substances are acutely or chronically toxic or otherwise hazardous to man, animals or plants. Decontamination is the process for neutralizing or removing contaminants. To avoid contamination of field inspectors and the subsequent transfer of hazardous substances to clean areas, a thorough decontamination process is required for personnel and equipment involved in field inspections or investigations.

Contamination avoidance is the first and best method for preventing spread of contamination from a hazardous situation. Every effort should be made to prevent direct contact with the contaminant. Careful planning, knowledge of the contaminant, and attention to where one puts his hands and feet are all important. Simple common sense rules of contamination avoidance include not sitting down, not leaning against drums or debris, and not putting equipment on the ground. Although no one should enter a site alone, all tasks should be accomplished with as few team members as possible. In this way exposure is limited to the minimum number of personnel and the decontamination task is greatly simplified.

The first step in the decontamination process may well take place while the team is still on or just off the hazardous site, but still in the Exclusion Area. This is especially true if there is known heavy ground contamination. In areas of spills or heavy leachate runoff, the protective boots will become heavily contaminated. As the team leaves these areas enroute to the personnel decontamination station (PDS), a boot rinse with a detergent solution (from a prepositioned container) will significantly reduce the spread of contamination along the egress route. These areas will be acknowledged in each hot zone as described earlier.

In general, decontamination at the site will consist of rinsing equipment and personnel with copious amounts of water and washing with a detergent/water solution. If contaminants are known, then a specific detergent and/or solvent can be used to decontaminate.

The decontamination process uses water and rinse solutions for washing down personnel and equipment. The spent solution, brushes, sponges, containers, stands, etc., used in the decontamination process must, until shown otherwise, be considered contaminated and properly disposed.

The decontamination of equipment, material and personnel used or working in the Contamination Reduction Area may be somewhat less complex than "Hot Line" procedures. Exact procedures would depend on the probability of those items being cross-contaminated.

Less extensive procedures for decontamination can be subsequently or initially established when the type and degree of contamination through analysis becomes known or the potential for transfer is judged to be minimal. These procedures generally involve one or two wash downs only, and fewer precautionary measures in doffing equipment. These procedures would not involve additional decontamination of protective clothing removed.

In extreme situations when there may be a question of the efficiency of decontamination to known or strongly suspect substances of a highly toxic nature, protective clothing may have to be discarded after use or tested after decontamination.

Consideration must also be given to the protective equipment worn by those personnel operating the decontamination line. In most cases, chemical protective clothing, boots, and gloves, should suffice. Unless it is suspected and/or confirmed that personnel needing decontamination are highly contaminated, air-purifying respirators with suitable canisters can be work (Level C Protection).

The suggested list of equipment required to set up and operate a typical PDS for Level A Protection is given in the USCG document.

Closure of the PDS

When the PDS is no longer needed, it should be closed down by the PDS operators. All disposable clothing and plastic sheeting used during the operation should be double-bagged and either contained on site or removed to an approved off-site disposal facility. Decon and rinse solution could be discarded on site or removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use. (If gross contamination had occurred additional decontamination of these items may be required). Cloth items should be bagged and removed from the site for final cleaning. All wash tubs, pail containers, etc., should be thoroughly washed, rinsed, and dried prior to removal from the site.

ADDENDUM - SITE SPECIFIC SAFETY PLAN
DEFENSE DEPOT
MEMPHIS, TENNESSEE
OHM PROJECT #3057

A - PCP Dip Tank Building

Due to the discovery of dioxin contaminated wood treating product on site and O.H. Materials' emergency response to this situation, this addendum shall be applied to the Site Specific Safety Plan already developed for this project. Dioxin presents special hazards to personnel handling material thus contaminated and special precautions and procedures must be applied. The following applies to OHM personnel and facility personnel who may work in the building containing the contaminated products.

Contamination in the building must be contained and the spread from the vicinity eliminated. In this light, the work area where personnel will be handling product or contaminated equipment will be covered with visqueen. This material will be disposed as needed and replaced. Contaminated personal gear will be removed and stored in the contaminated or "hot" zone for proper disposal.

Entry and exit to the dip tank area will be carefully controlled through a marked entry and exit zone. This will be clearly marked with yellow hazard tape and will be designated as the "transition" zone. The "hot" or contaminated zone will consist of the building and periphery as marked with yellow hazard tape. The area outside the taped area will be considered the "clean" zone and will demand no special protective gear.

Protective gear to be worn in the building shall consist of the following:

1. Hard hat with face shield
2. Full face respirator w/R53HE or supplied breathing air
3. Paper hood
4. Paper suit under saranex suit
5. Booties
6. Sample gloves and PVC gloves, as needed
7. Tape on all joints

Personnel handling liquids shall use supplied breathing air. Those personnel not handling liquids shall use full-face respirators.

Personnel working in the building will wear paper suits under liquid repelling Saranex suits. This is necessary due to liquids handling and the potential of splashing. The inner paper suit affords a second layer of protection in the event of a tear and subsequent leakage. When personnel exit the work zone, the outer (contaminated) Saranex suit will be disposed and bagged allowing personnel to leave the work area in clean gear. Any additional decontamination of hand tools or other gear will be done wearing this gear in the transition zone.

Odor control will be effected with visqueen by covering excavated soil which may be contaminated. The dip tank will also be covered to effectively reduce volatiles emanating from this vessel.

Due to the uncertainty of the effectiveness of decontaminating rubber or plastic items used in this area, these items will be expended. Stoddard solvent or other equivalent product will be used for wipe-down or pump through of equipment amenable to decontamination (e.g. that which is metallic). All OHM and subcontractor equipment involved in the cleanup will be disposed or properly decontaminated before project completion and demobilization.

Proper OHM and Facility permits will be obtained, if required, for tank cutting operations. Torches are not to be used for cutting the tank or other equipment due to the possibility of volatilizing surficial contamination. However, should procedures be enacted which can remove surficial contamination from the area to be cut prior to cutting, cutting with torches may be considered.

B. MEK Transfer Area

The MEK Transfer Area demands that special precautions be taken due to the volatility and flammability of this product. The close confines of this area dictate that special measures must be taken to ensure safe operations. The following list includes, but is not limited to, precautions which will be implemented by the OHM supervisor of this area:

- o Use of explosion proof barrel pumps
- o Installing generating equipment upwind and at a safe distance from operations
- o Forbidding entry of gas powered vehicles into the work area
- o No smoking or other open flames
- o Grounding equipment as needed

- o Daily inspection of equipment to insure proper working order and integrity
- o Performing operations with cognizance of prevailing wind conditions

Personnel protection shall consist of the following:

- o Hard hat w/face shield. Chemical goggles to be worn when wearing half-face respirator
- o Air purifying respirator w/R53HE cartridges (half or full-face with above applicable)
- o Paper suit
- o Acid jacket or chemical resistant apron
- o Sample gloves and PVC gloves
- o Booties
- o Tape on all joints



EXIT BRIEFING NOTES
DIRECTORATE OF ENVIRONMENTAL QUALITY ENVIRONMENTAL AUDIT
DEFENSE DEPOT MEMPHIS
MEMPHIS, TENNESSEE
8-18 July 1985

1. GENERAL.

a. At the request of DLA, an Environmental Audit was conducted by the U. S. Army Environmental Hygiene Agency at Defense Depot Memphis during the period 8-18 July 1985. An interdisciplinary team of scientists and engineers evaluated air pollution, ground water, hazardous waste, solid waste, and water quality management practices; and determined compliance with all applicable Federal, State and local environmental regulations. In addition, the audit team reviewed aspects concerning the effectiveness of the installation's environmental program. The audit was conducted by the following individuals:

(1) CPT Stephen R. Jenness, Team Leader, Sanitary Engineer, responsible for air pollution.

(2) CPT Michael J. Leggieri, Jr., Environmental Science Officer, responsible for hazardous waste.

(3) Mr. Jerry A. Valcik, P. E., Chemical Engineer, GS-13, responsible for water quality.

(4) Ms. Kim M. Fleischmann, Environmental Scientist, GS-11, responsible for ground water and solid waste.

b. The members of the audit team wish to extend their appreciation to Defense Depot Memphis personnel for their assistance and cooperation extended during the conduct of this audit.

2. FINDINGS. The findings of this environmental audit will be presented in a final report, which will be forwarded to DLA in late October 1985. Major conclusions and recommendations are summarized below.

3. MAJOR CONCLUSIONS

a. Management of the Environmental Program.

At the present time, the responsibilities of establishing an overall environmental program at Defense Depot Memphis is accomplished within the Facilities Engineering Division. Due to the recent depot reorganization, and past policies regarding the implementation of the environmental program, the program appears to be severely fragmented. Although several competent individuals are tasked with performing the day-to-day requirements of depot environmental issues, no one person has total responsibility of the development, implementation, and direction of a sound and thorough environmental program. It has been evident throughout the performance of this environmental audit that an environmental coordinator must be established at the depot to provide a focal point for all environmental issues and concerns. This individual would be responsible for ensuring compliance with all Federal, State and local regulations, as well as establishing a program to identify existing or potential environmental hazards.

b. Air Pollution Audit.

(1) The State of Tennessee requires that owners of certain air contaminant sources must apply for and obtain construction and/or operating permits in accordance with Chapter 1200-3-9 of the Tennessee Air Pollution Control Regulations. Current records indicate the Defense Depot Memphis has not updated the original air pollution operating permits, nor have the proper construction permits been obtained for the incinerator in building 359 and the paint spray booth located in building 1086.

(2) The installation has not sufficiently identified the locations of asbestos at Defense Depot Memphis. In addition the depot has not developed a SOP relevant to asbestos removal and disposal, as well as personal protection during such operations as required by 40 CFR 61 and Chapter 1200-3-11 of the Tennessee Air Pollution Control Regulations.

(3) Current filter replacement procedures at the paint spray booths in buildings 260 and 770 do not make effective use of installed pressure drop manometers.

(4) Current abrasive blasting operations in building 1088, and paint spray operations in building 1087 are in violation with Tennessee Air Pollution Control Regulations regarding visible emissions (Chapter 1200-3-5).

c. Ground-Water Audit

(1) The following areas are potential sources of ground water contamination:

- (a) Dunn Field burial sites
- (b) Pentachlorophenol (PCP) dip vat
- (c) all underground storage tanks (fuel, waste oil, PCP, pesticide rinse water)
- (d) accumulated spills in outdoor storage areas (area east of building 873, DRMO open storage yard, area north of building 873)

(2) The six ground water monitoring wells around the Dunn Field burial sites were installed by a study team from USAEHA during June-July 1982. The wells were sampled once for that study and results indicated that no significant ground water contamination by selected metals or non-metal inorganic parameters (e.g. Cl, SO₄, F) existed. No analyses for organic compounds were performed. No additional samples have been collected and analyzed since the 1982 study.

d. Hazardous Waste Audit

(1) DDMT has neither developed nor implemented a comprehensive hazardous waste management program. (PLAN, COORDINATOR, TDRAC)

(2) Some individuals responsible for managing and/or handling hazardous wastes at DDMT have not received hazardous waste management training as required by the State's regulations for hazardous waste generators.

(3) The inadequate storage of badly deteriorated containers of a hazardous cleaning compound has resulted in soil contamination in an outside storage area adjacent to building 873. The contamination of the soil with this hazardous material constitutes hazardous waste generation and a hazardous waste release under provisions of the State's hazardous waste regulations.

(4) Drums containing potentially hazardous wastes were stored in several locations at DDMT. An effort to identify those wastes in accordance with the State's requirements for hazardous waste generators has not been made.

(5) Hazardous wastes generated from the clean-up of hazardous material spills in various DDMT warehouses were improperly packaged prior to turn in to DRMO for disposal.

(6) DDMT has not complied with all of the State's recordkeeping and training requirements for hazardous waste generators who store hazardous wastes for less than 90 days.

(7) DDMT disposes of potentially recyclable used solvents as hazardous wastes. The generation and disposal of those solvents have not been addressed under the used Solvent Elimination (USE) program.

e. Solid Waste Audit

(1) DDMT stores, collects, and transports all solid waste generated on the depot to various disposal and recycling areas. Approximately 330 functional containers varying in size from 24 gallons to 90 cubic yards are used to handle the waste which is mostly cardboard, scrap metal, scrap wood, and trash. All containers are maintained adequately and are labeled for waste segregation. The containers near the cafeteria areas (Bldgs 144, 210, and 558) are steam-cleaned once a week. No odor or vector problems were identified.

(2) There is no solid waste management program or SOP. No regular collection route or specific collection frequency is followed in the warehouse and industrial operations areas. The 24 and 30 gallon containers which are scattered throughout DDMT are emptied every Monday and Friday. The 2-cubic yard containers in the housing area are emptied once a week. There appears to be no problem with this system. The refuse collection staff will respond to a phone call if a warehouse container becomes full. Daily volume records are kept by the collectors and compiled into a monthly report.

(3) All cardboard is hauled by DDMT to the Memphis Paper Company for recycling under a contract managed by DRMO. Scrap metal, high grade paper, computer paper, and computer cards are transported to DRMO for subsequent sale. Scrap wood, mostly pallets, is dumped in an area outside Gate 9 for subsequent public use. All other trash is hauled to Holmes Landfill, a state-permitted facility operated by the city of Memphis.

f. Water Quality Audit

(1) Potable/Recreational Waters.

(a) DDMT purchases potable water from the Memphis Light, Gas and Water Division, a publicly-owned utility of the City of Memphis. Water furnished to DDMT is in compliance with the State of Tennessee drinking water regulations. Tennessee has primacy for implementation and enforcement of the National Interim Primary Drinking Water Regulations.

(b) The Health Clinic conducts an adequate drinking water bacteriological surveillance program.

(c) The OIS Operations and Maintenance Branch conducts commendable activities related to cross connection control, disinfection of repaired mains and distribution system flushing. Some improvements are desirable in the first two areas.

(d) Swimming pool operational and water quality maintenance/surveillance practices are superb.

(2) Wastewater

a. Sanitary and industrial wastewater discharges to the DDMT sewer system are conveyed to the City of Memphis system for secondary treatment. Most discharges are sanitary in nature. Industrial discharges are limited and include effluents from oil and grease separators at Buildings 253 and 770. Discharges to the City's system are in accordance with the current Sewer Use Agreement (Permit No. S-NN3-013 dated 20 Dec 84) covering the period 1 Jan 85 - 1 Jan 1990.

b. A current NPDES permit (No. TN 0022322 effective 12 Mar 82 through 11 Mar 87) covers surface water discharges at eight sites. A&L Environmental Services is under contract to conduct required sampling/analysis during FY 85. NPDES reports are being filed with the TN regulatory authority as required.

(3) Spill Prevention Control and Compliance

a. Strong emphasis is placed upon spill prevention and control. A comprehensive spill prevention control and counter measures plan (SPCCP) (dated May 83) exists; it includes an installation spill contingency plan (ISCP) (dated Nov 82).

b. The SPCCP requires updating and revision. The basis includes new key personnel (OSC's in OIS and Directorate of Distribution) and deletion of old/addition of new potential spill sites.

c. Underground tanks have not as yet been properly tested for leakage.

d. Annual spill drills are conducted. Adequate training of personnel appears to be provided.

e. Some activities associated with spill prevention were lacking. Examples are non-maintenance of weekly inspection records at Distribution hazardous/flammable material sites, drainage assemblies at all concrete bermed sites not being secured, and some safety (e.g., eye-wash) equipment being non-functional.

f. Spill situations warranting particular attention are as follows:

- (1) Some spillage from 80-100 waste oil drums at the DPDO OS area (site 1) exists.
- (2) A substantial MOGAS leak was found in the unloading valve pit at the Building 253 renovated MOGAS station (a site 4 location); immediate corrective action was taken.
- (3) Concrete containment structure for the 72,000 gallon diesel fuel tank at Building 720 may require an impervious bottom.
- (4) Many instances of leaking POL containers in Building S 873 (Hazardous Materials Storage Shed) were noted; poor "housekeeping" was evident. It is understood that corrective actions have been initiated.
- (5) Improvement in spill containment at the recoup area in Building S873 (via sandbags and catchment pans) to prevent spillage to nearby storm drains is needed.

(6) Severe leakage from many of 360-5 gallon containers of a carbon removing compound in OS area near Building 873 was noted. Recoupment is in progress.

(7) About 10 per cent of the estimated 1,000 lub oil drums in the OS area near Building 8873 are leaking.

(8) In X-13 (a site 6 area), approximately 4 percent of about 1,200 POL drums in seven groupings, each group having about 150-200 drums stacked "3 high" in double rows, apparently in accordance with DoD criteria, are experiencing leaks. Access for many leakers, particularly on bottom row, requires movement of numerous drums include in SPCCP. Promptly identify leakers. Take corrective action ASAP. Improvement alternatives that may be considered are single height storage, obtaining DLA approval to store upright with caps, use of special pallets for easy access, and pave/curb project perhaps with O/W separator. Substantial expanded storage may be planned for this area.

g. Two important improvement projects are underway.

(1) Hazardous material warehouse, in the approximate 40 percent design stage.

(2) Recoupment facility, about 10 percent design completed.

4. RECOMMENDATIONS

a. Management of the Environmental Program

Establish as a minimum a depot environmental coordinator whose sole responsibilities deal with the establishment and implementation of a consolidated depot environmental program.

b. Air Pollution Audit

(1) Coordinate with the Memphis and Shelby County Health Department and obtain and/or update installation air pollution permits. Ensure that proper air contaminant source construction permits are obtained prior to the installation of future air pollution sources.

(2) Identify the location of asbestos insulation located at the installation, and establish a SOP relevant to asbestos removal, disposal, and personnel protection in accordance with 40 CFR 61 and Chapter 1200-3-11 of the Tennessee Air Pollution Control Regulations.

(3) Utilize the pressure drop manometers installed on the paint spray booths in buildings 260 and 770 to develop a logical schedule of filter replacement.

(4) Operate all abrasive blasting and paint spray operations within the confines of Buildings 1088 and 1087, and ensure that such operations are conducted with the outside doors closed.

c. Ground Water Audit

- (1) Sample the six monitoring wells at the Dunn Field area at least once for selected metals, non-metal inorganics, and the organic priority pollutant compounds.
- (2) Identify any leaking underground storage tanks and determine if the ground water quality has been affected.

d. Hazardous Waste Audit

- (1) Develop and implement a comprehensive hazardous waste management program. The program should include a written hazardous waste management plan and the development of a hazardous waste management board.
- (2) Ensure that all individuals responsible for managing and/or handling hazardous wastes receive adequate hazardous waste management training.
- (3) Recontainerize the drums of hazardous cleaning compound stored in the area adjacent to Building 873. Excavate and containerize all contaminated soil and dispose of it through DRMO as hazardous waste.
- (4) Collect and analyze samples from all drums containing potentially hazardous wastes. Dispose of those wastes in accordance with the State's hazardous waste management regulations.
- (5) Properly package all hazardous material spill residues prior to turn in to DRMO for disposal as hazardous waste.
- (6) Comply with all of the State's recordkeeping and training requirements for hazardous waste generators who store hazardous wastes for less than 90 days.
- (7) Develop and implement a program to identify all used solvent generators at DDMT and to recycle those solvents. Investigate the possibility of replacing non-recycleable solvent's with recyclable solvents.

e. Solid Waste Audit

- (1) Establish responsibility for the solid waste management program under an Environmental Coordinator who would provide SOPs and guidance to the refuse collection staff.
- (2) Develop a solid waste management plan, and document procedures for inspection, cleaning, collection, and disposal in a SOP.
- (3) Continue recycling those wastes which are recycleable.

f. Water Quality Audit

- (1) Formalize a cross connection control program.
- (2) Follow proper disinfection of mains procedures.
- (3) Update/revise SPCCP.
- (4) Perform proper leak testing of underground tanks.
- (5) Correct spill prevention deficiencies (paragraph 3 f (3) (e)).
- (6) Take appropriate action to eliminate spillages (see paragraphs 3 f (3)(f)(1), - (5), - (7), and - (8)).
- (7) Pursue hazardous material warehouse and recoup facility projects ASAP.

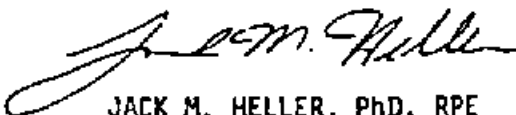
MEMO FOR THE RECORD:

The factors at the recoupment area of DDMT that required the immediate initiation of an emergency recoupment/cleanup contract are as follows:

(1) Environmental - While at the site, numerous active spills/leaks were observed. These spills were not responded to by Depot personnel but were allowed to continue contaminating the soil and potentially ground and/or surface water in the area. Many of these items become hazardous waste when spilled on the ground and constitute a violation of the Resource Conservation and Recovery Act of 1976. This act covers improper disposal if not responded to in the proper manner (i.e., immediate cleanup and packaging for disposal). There is also potential for runoff from the site and/or release of toxic vapors to the surrounding community which is only 450 feet from the recoupment area.

(2) Health and Safety - Many of the hazardous items stored for recoupment were in leaking and deteriorating containers and were releasing toxic and flammable vapors to the environment which present an eminent threat to personnel working in or near the area. Additionally, many of the items stored in close proximity to each other were chemically incompatible and capable, if allowed to come in contact, of producing toxic vapors, fires, or explosive situations. Reactions of this type present an immediate danger to life, property, and the environment in the area both the Depot and civilian community.

Many of the problems cited above are continuing to occur on the Depot since much of the hazardous material that is in unsafe or leaking containers that should be sent to recoupment are still in Depot stock. These situations present a Depot wide threat to the environment and to the health and safety of personnel on the Depot.



JACK M. HELLER, PhD, RPE
Environmental Scientist
U.S. Army Environmental Hygiene Agency

06 263



DEFENSE LOGISTICS AGENCY
DEFENSE INDUSTRIAL PLANT EQUIPMENT CENTER
MEMPHIS, TENNESSEE 38114-6297

IN REPLY
REFER TO

DIPEC-PR (Ms. Terri Kerby/901-775-6353)

SUBJECT: Intent to Award Contract Number DLA002-85-C-0030

This is the intent to award Contract Number DLA002-85-C-0030 to provide necessary labor and materials as follows:

Identify and recoup materials in DOT specified containers and label as required.
Dispose of all empty containers properly after recoupment.
Soil and product testing and analysis as needed.
Clarify and neutralize decontaminate (Calcium Hypochlorite and Chromatid Lime)
Identify, remove, and dispose of contaminated soil.
Contain and remedy on-going spills as necessary.
Determine compatibility of chemicals and handle accordingly.
Analysis samples of PCP solution for PCP percentage and for specified dioxin isomers.

A formal contract will be executed no later than 10 September 1985.

This is your formal authorization to prepare to commence work under the above stated contract at the Defense Depot, Memphis, Tennessee. The Contracting Officer's Representatives have been designated as Jack M. Heller and Dale R. Bowlus, U.S. Army Environmental Hygiene Agency.

For additional information contact Mr. Sherman Waller at 901/775-6967 or Ms. Terri Kerby at 901/775-6353, DIPEC Contracting Department.

Sherman W. Waller

Sherman W. Waller
Contracting Officer

8/30/85
Date

Jim Shepard

Jim Shepard
O.R. Materials Co.

8/30/85
Date

*Inter-Office Memorandum*APPLY
REFER TO

DDMT-W

SUBJECT: Justification For Other Than Full and Open Competition

TO: DIPEC-P

1. Under a standing agreement between the Defense Logistics Agency and the U.S. Army Environmental Hygiene Agency, a USAEHA team arrived on the installation on 26 August 1985 to conduct testing of the DDMT Hazardous Spill Response Team. While surveying the installation, it was discovered that DDMT had a very serious situation in and around Building 873 constituting possible violations of the Clean Air Act, Clean Water Act and Toxic Substances Control Act. USAEHA, having the technical expertise in hazardous and solid waste spill response and ground water protection, advised the DDMT Commander and staff that there are numerous chemicals of tremendous volumes, some of which are unknown (containers unlabeled), many of which are leaking on the ground due to expansion of containers, broken seals, rusted seams, incompatibly stored in inadequate storage facilities which are not equipped for storage of hazardous materials. The necessary walls and berms to ensure separation of incompatible materials, the enclosures and properly equipped ventilating systems to insure control of hazardous vapors as well as sufficient covered storage space to keep volatile chemicals sheltered from temperature extremes generated by the sun are not available. Due primarily to the volume and variety of chemicals and compounds, there exists an immediate threat of violent chemical reactions, producing both toxic vapors and/or fires or explosions. USAEHA further advised that the large number of leaking containers of hazardous materials posed a danger to the residential community surrounding the installation (with some portions of the community within 100 yards of the site). Further the situation poses a danger to large quantities of very valuable Government property in the event of fire, explosion or reactions (for example, when fire destroyed one section of a warehouse last year, \$9 million dollars worth of Government property was destroyed). These considerations demand high priority action and decisions. Based on the qualifications of the USAEHA team composed of J. A. Valcik, P.E. Chemical Engineer, Jack Heller, Environmental Scientist, and Rick Bowlus, Environmental Scientist, and their assessment and determination that there was a grave danger currently existing to human life, Government property and the environment, decision was made by the DDMT Commander, Staff and the DLA Environmental Protection Specialist that there exists an unusual and compelling urgency to acquire the services of a professional team with proven qualifications to plan, assess, recoup, restack, determine and relocate non-compatible chemicals in order to safeguard human life, protect the environment and Government property. The contract services will be restricted to those entities beyond the capability of DDMT personnel and those situations posing imminent danger to human life, Government property and the environment. Therefore, under FAR 8.302-2, 10 U.S.C.2304(CX)(2), I request you to immediately locate and authorize a qualified, licensed contractor with the expertise and capability to rapidly, efficiently and safely, with the highest possible standards of workmanship, to repackage these chemicals. The contractor must be capable of assessing the hazards, through chemical testing of unknown containers as well as the ground upon which they have been stored.

DDMT-W PAGE 2
SUBJECT: Justification for Other Than Pull and Open Competition

2. Due to the extreme heat, humidity and rainfall of the last two months and the consequent acceleration of packaging deterioration, the rate of recoupment demands exceeds local capability to the extent that the urgency of this requirement takes on the highest priority of reaction and correction. This requirement is of such urgency that the normal time frames allowed for contract award and preparation are deemed to be excessive and would unreasonably delay acquisition of the required services.

SCOPE OF WORK

Identify and recoup materials in DOT specified containers and label as required.

Conduct soil and product testing and analysis as needed.

Repackage in a 55 gallon drum decontaminate (Calcium Hypochlorite and Chromatid Lime)

Identify, remove and package for disposal of contaminated soil.

Contain and remedy on-going spills as necessary caused by the contractor during the performance of this contract.

Determine compatibility of chemicals and handle accordingly.

Analyze samples of PCP solution for PCP percentage and for specified dioxin isomers.

STATEMENT OF WORK

The Contractor shall provide all labor and materials necessary for the protection from imminent danger of life and Government property due to damage and deterioration of containers of hazardous materials for the recoupment, package for disposal and clean-up of all waste listed in the schedule in accordance with: all local, state and federal EPA solid and hazardous waste laws regulations and all the terms and conditions of the contract. These services shall include all necessary personnel, labor, packaging, detailed analysis (if required for disposal, including manifesting or completing waste profile sheets) equipment and reports. Government supplies will be used until such time as Government assets are exhausted and cannot be replenished in a timely manner.

**** CERTIFICATE ****

I Certify that the above description of the facts is accurate and complete to the best of my knowledge.


JOHN W. KROSNES
Lt Col, USAF
Director, Installation Services

PUBLIC EXIGENCY STATEMENT

28 August 1985

On 27 August 1985, the United States Army Environmental Hygiene Agency, in surveying the installation, identified leaking containers of hazardous items which pose an immediate threat to the environment and health of some employees.

Pursuant to the advice of the United States Army Environmental Agency, I have directed my staff to initiate the necessary procurement instruments for high priority recoupment/disposition services as required by Environmental Protection Agency laws. These requirements are described on the accompanying documents.

This is a priority matter of public exigency with no need to eliminate competition between firms having the capability to respond, except those who cannot meet immediate performance requirements.


COREY J. TROYER
Colonel, USAF
Commander

MEMORANDUM FOR RECORD

6 Sep 85

SUBJECT: Hazardous Material Handling at Bldg 873, DDMT

1. Following discussion with Col C. J. Troyer, CDR, DDMT, and Mr. Jan Reitman, DLA-WS, the undersigned was directed to contact appropriate state and local environmental authorities concerning subject work being performed by contract. Noted below are results of this notification and coordination.
2. A call to Shelby County was made from the office of Lt Col J. Kroenes, at 1550 this date. A speaker phone was used to ensure all interested parties would be involved and informed in and of the conversation. In attendance from DDMT were the following:
 - Lt Col John Kroenes, Director, Installation Services, DDMT-W
 - Mr. Hyases Truitt, Deputy Director, Installation Services, DDMT-W
 - MAJ D. Lamothe, Chief, Facilities Engineering Division, DDMT-WI
 - LTC J. Corthell, Chief, Warehousing Division II, DDMT-TW
 - Mr. Dale R. Bowlin, Environmental Scientist, USAERA
 - Mr. Paul Sawyer, Environmental Specialist, O. H. Materials Company
 - Mr. Norman C. LaChapelle, Director of Environmental Health Services, Memphis-Shelby County Health Department, was contacted at phone number 578-7890. The entire local situation was explained to Mr. LaChapelle. Emphasized was the fact that no ground water contamination, no air pollution, and no run-off had been experienced, and that service of the Contractor, O. H. Materials from Findlay, Ohio, had been obtained to take care of a hazardous material problem before it became out of control. At the conclusion of the conversation, Mr. LaChapelle indicated that DDMT appeared to have the situation under control. He indicated his office would contact State of Tennessee officials and that he would visit the site on Monday, 9 Sep 85.
3. Attempt was then made to contact Mr. Paul Patterson, Local Environmental Office, State of Tennessee, at phone number 529-8695. The phone call was answered by a receptionist who indicated Mr. Patterson, as well as all assistants, had departed the offices for the day. Request was made for Mr. Patterson to return the call to Lt Col Kroenes on 9 Sep 85.
4. At approximately 1815 Mr. LaChapelle called Lt Col Kroenes to indicate he would like to visit the subject site on 8 Sep 85. Arrangements were made to have his entourage met at Gate No. 1, DDMT, and guided to the site.
5. Shelby County officials arrived at Building 873 at approximately 1915 on 8 Sep 85. The following officials were in this group:

DDMT-W

Page 3

9 Sep 85

SUBJECT: Hazardous Material Handling at Bldg 873, DDMT

Mr. Norman C. LaChapelle, Director, Environmental Health Services, Memphis-Shelby County Health Department (MSCHD)

Mr. Thomas Gibbs, Manager of Air Pollution Control, MSCHD

Ms. Cheryl Poirier, Chemist, MSCHD

A site tour was conducted by Mr. Dale R. Bowlin, USAEHA. All individuals noted in paragraph 2 above, representing DDMT, were also in attendance. Questions posed by the visiting officials were answered. Mr. LaChapelle indicated that DDMT appeared to have the situation well in control. He again indicated that he would discuss the situation with Mr. Paul Patterson on 9 Sep 85. Also, he planned to revisit the site with State of Tennessee officials on 9 Sep 85.

6. Discussion with respect to notification of EPA Region Number Five and the Office of the Federal Facilities Coordinator resulted in a local decision to wait until State of Tennessee officials had visited and commented on the DDMT program and actions. It was the consensus of all present that no reportable spills or Federal violations had occurred at DDMT. MSCHD officials departed DDMT at approximately 1800. Clean-up/recoupe activities were to be continued as scheduled.



DOUGLAS R. LAMOTTE
MAJ, ER, USA
Facilities Engineer

cc:

Mr. Dale R. Bowlin, USABRA
Lt Col John W. Kroenes, DDMT-W

Inter-Office Memorandum

DPMT-W

14 Sep 85

SUBJECT: Request for Disposal of Hazardous Dioxin Contaminated
Pentachlorophenol (PCP)

TO: DIPEC-P

1. The U.S. Army Environmental Hygiene Agency (USAEHA) visitors have brought to our attention yet another serious problem which requires immediate action. Our wood treatment and preservation dip vat at Building 753 contains a high concentration of dioxins. Preliminary test results reveal that the level of concentration is in the high range of parts per billion, a range which may be extremely hazardous and which demands immediate disposal. We are, as yet, unaware of the exact concentration because the laboratory conducting the tests, assuming a routine contamination level in the low parts-per-billion range, tested an undiluted sample and exceeded the calibration standards of their instruments. They immediately informed us so that we could take measures to cover and isolate the vats. In the meantime, the laboratory is reanalyzing the sample. We expect exact results by Tuesday, 17 September.

2. This is a new development for us. Preservation of wood pallets was a routine procedure here for years. However, at a point where it became more economical to purchase pre-treated pallets, we ceased assembly-line-style wood preservation operations but retained the wood preservative for occasional future use. The high dioxin concentration is a normal by-product of earlier PCP manufacturing processes, practiced during a time when we were unaware of the dangers of dioxin. Because we no longer have any use for wood preservation, I attempted to turn the product over to DRMO for resale this spring but, under the advice of the DLA pest management staff, decided not to do so until the solution was sampled for contaminants. One sample was taken which only determined percent of PCP concentration, so the USAEHA sampled the vats for dioxin. We now have the preliminary results and are faced with the need to immediately take the following steps:

- a. Sample the surrounding area for contamination.
- b. Sample the contents of the underground supply tank and the surrounding soil for contamination.
- c. Recover all contaminated materials and prepare for long-term bulk storage; (there is no known way to safely dispose of dioxin).
- d. Depending upon test findings and concurrence of state authorities, remove underground storage tanks and surrounding contaminated soil.

DDMT-W

PAGE 2

SUBJECT: Request for Disposal of Hazardous Dioxin Contaminated
Pentachlorophenol (PCP)

14 Sep 85

3. Now that we are fully aware of the surprisingly high level of dioxin concentration, we have no choice but to proceed with as much speed as possible to protect our people and the environment. This is a public exigency which must be pursued until the danger to ourselves and the ground water is contained. Therefore, I recommend that correction of this situation be included in the emergency contract with which we are presently involved.


JOHN W. KROSNES
Lt Col, USAF
Director, Installation Services

14 SEP 1985

07

Inter-Office Memorandum

DDMT-W

16 Sep 85

SUBJECT: Review of the Emergency Recoup of Hazardous Chemicals,
Contract No. DLA002-85-C-030

TO: DIPEC-PR

1. The following comments justify continuing the present Contract No. DLA002-85-C-030 beyond the scope originally agreed upon in our initial justification.

2. The state of emergency which originally precipitated the current effort still exists. For instance, on 11 September the contractor recouped highly volatile petroleum ether, and on 12 September they encountered over-age ethyl ether which, due to its age and probable change in chemical properties, could have the explosive potential and sensitivity comparable to a vial of nitroglycerin. In spite of its potential danger, the substance had been placed on the shelf in Bldg. 873 for recoupment. We disposed of the ether on 13 September with a controlled detonation. We are currently in the process of cleaning up a spill of PCB-contaminated transformer oil and have also just recieved a report of an alarmingly high concentration of dioxins in our wood treatment vats. These problems require immediate attention.

3. These and several other observations of our current effort have revealed factors which add to the gravity of the situation and increase the urgency for us to continue the contract and somewhat expand its scope.

a. Our physical facilities are woefully inadequate, especially with respect to the volume of suspect materials which must be inspected, segregated and repackaged. The absence of walls, berms, catch basins, etc. in the holding areas renders our efforts to segregate incompatible materials almost futile. Under such conditions, should a rupture of weakened containers occur, a liquid can flow to a nearby incompatible chemical, generating, at best, noxious fumes and at worst, a fire or explosion. Even the recent weather conditions have worked against us, the deterioration of storage drums and packages having been greatly accelerated by humidity, heat and sunlight. In the morning, when the temperature rises most rapidly, one can see and hear the drum heads distending as the heat expands their contents. Metal fatigue, cracked coatings and popped seals all create vulnerabilities which accelerate corrosion and deterioration. Under the current limitations, the most obvious solution to the recoupment storage problem is to totally eliminate recoupment storage so that there are no incompatible chemicals stored side by side. This means that not only must we eliminate the backlog, but we must also find a way to keep it eliminated.

b. Even though our physical facilities restrict our ability to safely manage hazardous chemicals, a well trained, sophisticated warehouse work force could partially compensate by using enlightened storage procedures. Unfortunately, this situation has demonstrated some limitations of our warehouse crews. Even though subjected to hazardous substance training, they have needlessly exposed themselves and the environment to hazards. Our people need additional training before we can be confident that the current situation will not recur.

DDMT-W

PAGE 2

16 Sep 85

SUBJECT: Review of the Emergency Recoup of Hazardous Chemicals,
Contract No. DLA002-85-C-030

c. A similar problem exists with our recoup team. During the short duration of this contract, our team has suffered several spills. A recoup team is in the business of preventing and cleaning up spills, not initiating them. For this reason, the team has been placed in a remedial training status and two new people have been added. The team's rate of recoupment has been dramatically decreased and will remain at its slow pace until levels of proficiency have been significantly increased. In the meantime, with respect to the volume of work yet to be accomplished, our organic recoup capability is now minimal.

d. Even as we work, the volume of chemicals being processed through the depot generates new requirements. As you have seen, receipt, storage and shipment of chemicals generates storage requirements by the acre. The storage environment is very dynamic and, again, is supported by storage facilities inadequate to the task. The sheer volume of inventory and transactions works against us.

e. These four factors, the limited capabilities of our warehousemen, the restricted abilities of our recoup team, the lack of suitable facilities and the high volume of business that we transact, convince me that we are not safe until the backlog of chemicals requiring recoupment is virtually eliminated.

4. For these reasons, I can no longer agree with any suggestion that we will shortly reach a point where public exigency ceases; I cannot agree until the backlog is eliminated. At that point, we should be in a position to use our own teams to control locally generated deficiencies until the next poorly packed chemical shipment arrives at the depot. In the meantime, all of the chemicals in our inventory that require repacking constitute an environmental hazard and all of those, even the most innocuous, can pose safety hazards if a warehouseman makes the wrong decision regarding storage compatibility.

5. Therefore, I must conclude that in view of what we have learned since the onset of this situation, the magnitude of the current emergency has not diminished. The emergency still exists and its continued control is nearly totally dependent upon the efforts of the on-scene contractor.


JOHN W. KROSNES
Lt Col, USAF
Director, Installation Services

NEWS RELEASE • Defense Logistics Agency

DEFENSE DEPOT MEMPHIS

2163 Airways Blvd.

Memphis, Tenn. 38114

Curt Guenther

Public Affairs Officer

(901) 775-6753 7:30 to 4:00

(901) 324-0567 After Hours



September 19, 1985

Operations are underway at the Defense Depot Memphis to remove a vat of wood preservative found to be tainted with chemical compounds commonly called dioxins.

The dioxins were discovered during an analysis performed during a routine environmental inspection of the depot by environmental consultants on September 13.

The preservative is pentachlorophenol (commonly called PCP), a substance used for years to treat wood. Dioxins could occur as a side-product during the production of PCP and other chlorinated materials in methods formerly used by manufacturers.

About 75 different isomers (chemical arrangements) of dioxins can occur. The most dangerous of the isomers is not present at the depot. Further lab tests are being conducted to determine the concentration of the isomers found at the depot.

Officials of the Tennessee Department of Health and Environment and the Memphis and Shelby County Health Department have been notified of the discovery and have visited the site to monitor removal activities.

Regular operation of the vat was discontinued in July, 1971. Since the discovery of the chemicals, the vat area has been secured against access by depot employees.

No evidence of contamination has been found outside the immediate area of the building containing the vat. Environmental scientists are continuing to conduct tests to determine if any contamination exists, and appropriate precautionary medical examinations will be conducted for depot employees most closely associated with the vat operation.

-more-

Note: Pages 1 & 2 given to press; page 1 only to depot employees

Corlyn J. Troyer, Colonel
Defense Depot Memphis
Page two

Representatives from the Defense Logistics Agency - Memphis, however, did request consideration for approval of an alternate remedial plan. Lt. Colonel John Krosnes and Major Doug Lamothe suggested the placement of 6-8" of compacted gravel in those areas which exhibited levels below the EPA action level. This action would be more suitable in the event the Defense Logistics Agency wishes to concrete the area for future storage capacity. In consideration of the pathways for exposure (dermal and/or inhalation) their request was approved with the following conditions:

1. The graveled area must be placed "off limits" to any and all vehicular traffic.
2. The area must be indicated as a "non-use" area on the facility development plat.
3. Future plans for utilization of the area must be approved by the Department.
4. Prior to placement of gravel, the entire area should be sprayed with water to prevent dusting.

Therefore, please accept this letter as written approval to implement the previously referenced remedial actions. If you have any questions concerning this letter or if I may be of further assistance, please do not hesitate to contact me at (901) 529-6695.

Sincerely,



Paul Patterson
Division of Solid Waste Management

The Commercial Appeal, Memphis, Tennessee, Saturday, September 21, 1985

Depot detoxifies dipping vat

By CLAY BAILEY

Defense Depot Memphis is cleaning up a dipping vat that once contained pentachlorophenol (PCP) — a toxic wood preservative used primarily for treating wood pallets.

Yesterday, workers dressed in white protective suits worked near the vat as part of the clean-up operation. Those not working in the cleanup were kept a considerable distance from the brown metal building.

Depot officials yesterday received preliminary results of soil tests around that building, which revealed a small amount of a toxic chemical. Dr. Jack M. Heller, an environmental scientist with the U.S. Army Environmental Hygiene Agency, emphasized the amount found in the soil near the building is below the Environmental Protection Agency clean-up level.

At a press conference announcing the clean-up proce-

dures, officials said the dioxins found in the vat and near the building posed no danger to residents of neighborhoods surrounding the depot or employees who worked near the building on the west central part of the one-square-mile area.

The removal began after an expanded routine inspection by the environmental and hygiene agency last summer. The depot received the test results showing the dioxins in the vat solution on Sept. 13.

"We do not have the extremely toxic or cancer-producing dioxin," Dr. Heller said. "Still, it is at levels that will warrant cleanup, pumping out of the vat and some cleanup of the soil."

Further lab tests will determine the level of chemicals found at the depot, officials said.

The vat has been used sparingly since 1971 after about 19 years

of regular operation. Lt. Col. John Krosnes, depot director of installation services, said prior to 1971, the depot bought the pallets untreated and treated them in the 224-cubic-meter vat. The solution was kept in a 12,000-gallon underground tank next to the building. That tank was drained some time ago.

Section B (Metro), page 4 (page with the obituaries)

Television coverage included about 90 seconds of film/tape on the NBC affiliate, including scenes from the press briefing and shots of the vat site while work was going on; and about 60 seconds of film/tape only of work at the vat site, with a narrator's voiceover, on the ABC affiliate.

Local coverage was fair, accurate, and non-sensational.

The local Associated Press office received a press release from the DDMT PAO; the local reporter called for some details, but I have not seen any results of his work yet.



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

September 26, 1985

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Troyer:

I am writing this letter in response to a request by Rick Bowlus, US Army Environmental Hygiene Agency, on behalf of the Defense Logistics Agency (DLA) - Memphis, for approval of temporary storage of hazardous waste in Building 783. An inspection of the building was conducted on September 25, 1985 by Dale Ozier, Environmental Engineer, Division of Solid Waste Management, Memphis Field Office and myself. That inspection indicated the facility to be suitable for storage of the waste materials generated from the clean up of the wood treatment area provided the following stipulations are met:

1. The drain openings at the front portion of Building 783 must be sealed to eliminate the potential for surface discharge from seepage or any unplanned sudden release.
2. All materials presently located within this building must be removed prior to the storage of any hazardous waste.
3. All cracked or deteriorated walls and ceiling surfaces should be repaired prior to storage of any hazardous waste.
4. In the event it becomes necessary to contain any liquids resulting from seepage or condensation, the material must be managed as hazardous waste unless otherwise specified. Once a hazardous waste determination has been performed on the liquid, appropriate disposal alternatives can then be addressed.

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Page two

The above items address those measures which this office feels is necessary to prepare and maintain Building 783 as an area which temporarily stores hazardous waste. In addition to the above criteria it will be necessary that the facility comply with the appropriate regulations for temporary storage of hazardous waste as defined in Rule 1200-1-11-.03(4)(e). I have enclosed a copy of the Rules Governing Hazardous Waste Management in Tennessee for your information. Compliance inspections will be conducted of this area in conjunction with those of the Defense Property Disposal Office.

In closing I would like to re-emphasize that this area is only approved for temporary storage of hazardous waste for 90 days or less. Rule 1200-1-11-.03(4)(e)2 provides for the issuance of a 30 day extension to the 90 day period. In the event of an unforeseen, temporary or uncontrollable circumstance prohibits DLA from moving the waste within the time limit, notification should be forwarded to this office describing the circumstances surrounding the issue.

If you have any questions regarding this letter, or if I may be of further assistance, please do not hesitate to contact me at (901) 592-6695.

Sincerely,

Paul Patterson

Paul Patterson
Division of Solid Waste Management

cc: SWM Nashville
Rick Bowlus
Dr. Sherman Kahn, MSCHD

ENCLOSURE

PP/lar



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT

Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

September 26, 1985

Corilyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, TN 38114

Dear Colonel Troyer:

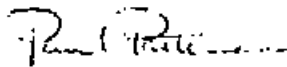
This letter is written in regard to the remedial action underway at the Defense Logistics Agency. Specifically, this letter shall address those areas as determined by the US Army Environmental Hygiene Agency to be contaminated with 2,3,7,8 tetrachlorodibenzo-dioxin (hereafter referred to as dioxin). While the levels detected thus far do not warrant immediate removal of soil, the Department feels that some action should be initiated to reduce human exposure as well as off-site migration through siltation. Therefore, it has been determined the following steps will be necessary in order to mitigate any potential problems at the confirmed sites:

1. Immediately analyze the six (6) composite soil samples collected September 22, 1985 from the quadrant north of the dip vat area between railroad tracks 40 and 38.
2. Provided the results of these analyses are below the EPA action level (5-6 ppb) immediate steps must be taken to reduce exposure and potential off-site migration. As discussed with Rick Bowlus, US Army Environmental Hygiene Agency and Dr. Jack Heller, US Army Environmental Hygiene Agency, a six (6) inch buffer of soil, seeded with grass shall be placed over those areas where dioxin-contaminated residues were detected.
3. In the event the six (6) composite samples are above the EPA action level, appropriate steps must be taken to identify the extent of contamination along with a remedial action plan to address the areas.

Corlyn J. Troyer, Colonel
Commander, Defense Logistics Agency
Page two

The response and dedication the Defense Logistics Agency has demonstrated in addressing this matter as been commendable. The courtesy and cooperation shown during our visits is appreciated. If you have any questions concerning this letter or if I may be of further assistance, please contact me at (901) 529-6695.

Sincerely,



Paul Patterson
Division of Solid Waste Management

cc: SWM Nashville
Dr. Sherman Kahn, MSCHD
Rick Bowlus

PP/lar

HIGHLIGHT
OFFICE OF INSTALLATION SERVICES & ENVIRONMENTAL PROTECTION
27 Sep 85

Environmental Support Provided to Defense Depot Memphis, TN
DDMT. Serious environmental conditions were identified at the Defense Depot Memphis, TN (DDMT) hazardous material recoupment area during an internal environmental inspection conducted the week of 26 Aug 85. Dioxin contamination was subsequently identified at a dip tank used for applying wood preservative. DLA-W made arrangements to provide funding for a cleanup contract which DDMT let under a public exigency basis. Arrangements were also made for a team of environmental scientists and technicians from the U.S. Army Environmental Hygiene Agency (USAEHA) to remain at DDMT for technical support. In response to a DDMT request, USAEHA personnel served as technical advisor to the Contracting Officer's Representative (COR) and have been on-site to provide continuous advice and direction for cleanup operations. USAEHA geologist and pesticide monitoring personnel monitored excavation operations and took soil samples for analysis. DLA-W personnel were also on-site to monitor cleanup activities and coordination with regulatory authorities. Contractor cleanup operations are expected to be complete the week of 30 Sep 85.

(Mr. Reitman/46967/DLA-W)

There are no current items recommended for SecDef Highlights.

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OCT 85 RR RR UUUU

NO

DDMT MEMPHIS TN//DDMT-TW

DGSC RICHMOND VA//DGSC-

INFO: DLA CAMERON STATION VA//DLA-

UNCLAS

SUBJ:

REF:

This depot is experiencing recurring problems with the one gallon containers of hydrofluoric acid (NSN 6810-00-43-4012). The phenolic tops supplied by the manufacturer have a tendency to become brittle and break, and the secondary tape seals cannot contain acid leakage. This problem is occurring with both lots supplied by Chemical Commodities & Inland Packaging.

2. Acid was leaking out of Chemical Commodities containers to such an extent that the acid ate up the packaging, label, and top. Each bottle had to be repackaged, relabeled and recapped. The containers had to be washed down with sodium bicarbonate to neutralize the residue of acid left on each bottle. We are already discovering failure in some of these repoured containers. We are beginning to rework the lot from Inland Packaging in the same manner since they appear to have the same problem.

4. Request you review the container specifications to determine compliance with established specifications and if necessary upgrade these specifications to preclude

J.L.CORTHELL,LTC,USA,Chief,Warehousing Div II
DDMT-TW/AV 683-6232

M.J.AUGENSTEIN,Dir, Directorate of
Distribution, DDMT-T/6681

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OCT 85 RR RR UUUU

NO

premature leakage. Container specifications must take into account great temperature fluctuations that result from lack of controlled temperature storage.

5. This recurring, premature failure of these containers strains our limited recoup capability and creates a hazard to depot personnel and the surrounding environment.

6. POC this depot is Mr. Harry Hartwig, AV 683-6005.

UNCLASSIFIED

MSHB-ES-H

2 October 1985

MEMORANDUM FOR RECORD

SUBJECT: Recoupment Area and Dioxin Cleanup, Defense Depot
Memphis, Tennessee

1. Background. While conducting a routine spill training exercise at Defense Depot Memphis, Tennessee (DDMT) (26-30 August 85), several areas of the installation were found to have serious health and safety problems relating to hazardous materials handling and storage. The recoupment and flammable storage area, in particular, had numerous active spills and leaks of toxic and flammable material that were not responded to in a timely and/or correct manner. Additionally in the recoupment area there were serious storage incomparabilities that could have resulted in fire, explosion, or the release of toxic vapors. These situations were deemed serious enough to warrant the initiation of an emergency contract to correct them. Also while at DDMT samples were taken from a pentachlorophenol (PCP) dipping vat previously used for treating wood pallets. Samples were also taken of soil in the area and from a 12,000 gallon underground storage tank that supplied PCP to the vat. Analysis was conducted for PCP content and possible dioxin contamination to comply with the new "Final Dioxin Rule" recently published in the Federal Register (14 Jan 85).

2. Progress of PCP Vat Study. Results of analysis on the contents of the PCP dipping vat showed the material to be contaminated with a number of different dioxin and dibenzofuran isomer in the 50-100 ppm range. The soil in the area was either not contaminated with dioxin or it was present at a level not requiring remedial action. Additional samples collected from nearby gravel/soil storage area showed only one 3.5 acre area to be contaminated with 2.9 ppb 2,3,7,8-TCDD and 2.6 ppb other dioxin isomers.

3. Remedial actions. Since discovery of the dioxin contamination on 13 September 1985 the following cleanup actions have been taken by O. H. Materials, the cleanup contractor, under the direction of Agency personnel (Dr. Heller and/or Mr. Bowlus).

a. Removed liquid, sludge, and process piping from PCP vat and containerized.

HSHB-ES-H

SUBJECT: Recoupment Area and Dioxin Cleanup, Defense Depot
Memphis, Tennessee

2 October 1985

- b. Removed underground storage tank and stockpiled soil to await dioxin test results.
- c. Decontaminating (sandblasting) PCP vat, process line, and necessary area of the building.
- d. Decontaminating underground storage tank.
- e. Doing additional soil tests on contaminated storage area to better define dioxin contamination. The following cleanup actions must still be completed:
 - (1) Move drums of dioxin material to new storage area (ammunition bunker).
 - (2) Complete decontamination of tank, building, vat and process line and test to confirm cleanup effectiveness.
 - (3) Containerize decontamination grit and move to storage area.
 - (4) Fill in tank hole if "clean" or remove soil if contaminated, then fill in.
 - (5) Cap contaminated storage area if no "high" (i.e., above 6 ppb) 2,3,7,8-TCDD level are detected. If high levels are found, remove contamination then cap area.
- 4. Recoupment and flammable storage area cleanup. The following actions have been taken by O. H. Materials under the direction of Agency personnel at the recoupment and flammable storage areas:
 - a. Comparably stored all hazardous chemicals.
 - b. Contained all leaking chemicals and recontainerized.
 - c. Tested soil in recoupment area to ascertain need for remedial action (awaiting results).
 - d. Recontainerized and/or recap all damaged and leaking containers.
 - e. Sampled all unknown containers of material.

MSHB-ES-H

2 October 1985

SUBJECT: Recoupment Area and Dioxin Cleanup, Defense Depot
Memphis, Tennessee

f. Decontaminated empty containers of hazardous material prior to disposal.

g. Neutralized caustics and acids.

Work at the recoupment and flammable storage areas has been completed as of 25 September 1985, although more damaged material has already started to stockpile in the recoupment area again.

5. Completion of Dioxin Cleanup. If all incoming test results from the dioxin contaminated area are within acceptable limits the cleanup of this area should be completed by 30 September 1985, with the exception of the capping of the 3.5 acre storage site. If high levels of dioxin are found at the storage area, the underground tank hole, or in the vat building the completion schedule will be drastically effected.

6. New Dioxin Data. Additional data on levels of dioxin from the tank hole, contaminated storage area, and process building was received on 29 September 1985. This new data showed high levels (62 ppb - 2 ppm) of dioxins and dibenzofurans in all three areas. The dioxin and dibenzofuran isomer detected in high concentration were the hepta and octa groups containing 7 and 8 chlorine atoms respectively per molecule. These isomers are much less toxic and have a much lower cancer inducing potential than the tetra, penta, and hexa isomers which contain 4, 5, and 6 chlorine atoms respectively per molecule. It will, therefore, be necessary to negotiate the level of cleanup and remedial actions required with EPA Region IV and the State of Tennessee. This is because there are no established cleanup levels for dioxin isomers other than the very toxic 2,3,7,8-TCDD, with a cleanup criteria of 1 ppb in residential settings. This current situation will obviously effect the scheduled completion date for dioxin cleanup.

7. Chronology of Events

a. 26-30 August 1985 - Scheduled Spill Training Exercise and Sampling of PCP Vat.

b. 4 September 1985 - Start of Emergency Cleanup Contract at Recoupment/Flammable Storage Area.

c. 13 September 1985 - Discovery of Dioxin in PCP Vat.

HSMB-ES-H

SUBJECT: Recoupment Area and Dioxin Cleanup, Defense Depot
Memphis, Tennessee

2 October 1985

- d. 16 September 1985 - Start of Dioxin Cleanup.
- e. 25 September 1985 - Completion of Cleanup at Recoupment/Flamable Storage Area.
- f. 30 September 1985 - Scheduled Completion of Dioxin Cleanup.

for Paul D. C. Hyman
JACK M. HELLER, PhD, R.P.E.
Environmental Scientist
Waste Disposal Engineering Division



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

October 16, 1985

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Troyer:

This letter shall document the meeting held on October 1, 1985 at the Defense Logistics Agency - Memphis. The subject of that meeting was to discuss the dioxin contaminated areas on the Defense Logistics Agency - Memphis property as referenced in my September 26, 1985 letter along with a review of the proposed remedial action plan for the contaminated sites. Those in attendance were:

Jack Heller - US Army Environmental Hygiene Agency
James E. Fleming - Tennessee Department of Health
and Environment
Paul Patterson - Tennessee Department of Health
and Environment
Ulysses Truitt - Defense Logistics Agency
Lt. Colonel John Krosnes - Defense Logistics Agency
Curt Gionther - Defense Logistics Agency
Terri Kirby - Defense Logistics Agency
Rick Bowlus - US Army Environmental Hygiene Agency
Doug Lamothe - Defense Logistics Agency
Cheryl Poirier - Memphis Shelby County Health
Department
Bob Cibulskis - US Environmental Protection Agency -
ERT
Jane Rogers - US Environmental Protection Agency -
Region IV

The remedial action as planned for the areas exhibiting levels of 2,3,7,8 tetrachlorodibenzo-dioxin (TCDD) below the EPA action level (5-6 ppb) consisted of covering the areas with 6-8" of soil and stabilization. This proposal was discussed in detail and evaluated based upon the levels of TCDD present and the potential for harm to the public health and environment. Basically the group agreed that the plan was more than sufficient to eliminate any potential problems from the site.



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

October 18, 1985

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Troyer:

I am writing this letter in regard to my visit to the Defense Logistics Agency - Memphis on October 17, 1985. The purpose of my visit was to inspect the graveled area north of the dip vat area between railroad tracks 38 and 48.

Based upon my visual inspection the work appeared to be satisfactory and fulfills the stipulations of the remedial action plan. If you have any questions or if I may be of further assistance, please do not hesitate to contact me at (901) 529-6695.

Sincerely,

A handwritten signature in cursive script that reads "Paul Patterson".

Paul Patterson
Division of Solid Waste Management

DDMT-W (Mr. Trull/AV663-6394/cb)

18 October 1985

SUBJECT: Hazardous Waste Cleanup, DLA-002-85-C-0030

TO: DLA-W8
ATTN: Mr. Reitman

1. Due to new developments under performance of subject contract, an additional \$260,000 is required to ensure compliance in totality to Local, State and Federal EPA Laws with regard to disposition of Pentachlorophenol (F027) waste.
2. In the ongoing cleanup process, it was discovered that the feeder line from the holding tank to the dipping vat had been leaking for a long period of time, contaminating numerous cubic yards of soil. This has prompted the necessity for removal of the vat, its concrete support system and part or all of the affected building and contaminated soil. Due to recent regulatory changes banning disposal of F027 waste in landfills, the residue of this cleanup will require containerization and special accommodations.

3. If further information is required, please contact the Office of Installation Services, AV663-6394.

FOR THE COMMANDER:

JOHN W. KROSNES
Lt Col, USAF
Director, Installation Services

cc:
DDMT-C
DIPEC-P (Mrs. Kerby) ✓
PSAEMA (Mr. Bowlus)

18 OCT 20 12 00
DIPEC-P
RECEIVED



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Centers for Disease Control

Memorandum

Date - October 24, 1985

From Public Health Advisor
ATSDR-EPA Liaison

Subject Memphis Army Depot;
Memphis, Tennessee

To Jan Rogers
OSC
EPA, WMD, ERRB

On October 3, 1985, I discussed the above facility with Dr. Frank Mitchell and Kent Gray of the ATSDR.

The basis for this discussion was your request for our assistance in addressing U.S. Army and EPA concerns regarding the Depot's desire to construct a heavy equipment and storage area on the 3½ acre ex-wood pallet treating operation and to take corrective actions to eliminate any potential human health or environmental threats from the furans and dioxins which were identified and resulted from operations that took place until 1971. For our discussion, I used the analytical data you shared with me as well as notes taken from our discussions regarding the visit by you and Bob Cibulskis to inspect the area of concern and to meet with U.S. Army personnel.

We basically concur with the U.S. Army's proposal for future use of the property. However, we do have some suggestions to offer. These suggestions are:

- o Consider covering the open, unpaved areas of concern with heavy gauge plastic sheeting and placing gravel on top. The plan to compact the gravel to a uniform 6 in. depth seems adequate. The proposal for concreting the property for heavy equipment & storage uses should also effectively and securely eliminate any potential for residual environmental threats or human health concerns. The plastic sheeting will be punctured in some areas by the gravel. However, using dual coverings should significantly reduce the potential for offsite migration or leaching.
- o All workers who will apply the plastic sheeting and/or gravel should wear adequate personal protection. Since the main worker exposure routes are dermal and possibly inhalation, a low level "C" that includes tyvek-type coveralls, disposable boot covers and gloves should be adequate. If it is anticipated that dust will be generated during these actions, wetting of the areas before any work commences or wearing respirators with dust cannisters are recommended.

page 2

- o According to the information and analytical data you provided to us, this parcel of property has been inactive since 1971. Hence, the last potential human exposure to the contaminants at this site occurred 14 years ago. As a result, it is Dr. Mitchell's impression that there is no justification to initiate any efforts to locate, notify or attempt to provide any medical follow-up to civilian or military staff who worked at this wood pallet treating operation.

Please let me know if we can be of additional assistance to you regarding this facility.

Chuck Pietrosewicz

Chuck Pietrosewicz

cc: ATSDR



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

November 4, 1985

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Troyer:

This letter is written in regard to my recent conversations with members of your staff and representatives of the US Army Environmental Hygiene Agency concerning continued storage of the hazardous wastes generated from current remedial action activities on the Defense Logistics Agency's property.

During my last on-site inspection, there appears to be an increasing need to secure additional on-site storage for the hazardous waste resulting from the clean-up operation. In an attempt to address this issue I have been asked to consider the approval for transporting some of the waste to an off-site facility, specifically the Milan Army Ammunition Plant. After careful consideration of this proposal I feel such an alternative is unacceptable for the following reasons:

1. The Milan Army Ammunition Plant does not have authority from the Tennessee Department of Health and Environment or EPA to accept off-site shipments of hazardous waste.
2. Arrangements and/or agreements for storage of this waste have been made with consideration given to on-site storage as opposed to off-site storage. I cannot justify shipping the waste off-site to an unauthorized facility when there appears to be additional storage capacity on-site.

In closing I would like to address the application of permit standards to the storage facilities to be utilized for storage of the clean-up waste. As you know the Defense Logistics Agency - Memphis does not have authority to store hazardous waste for periods exceeding 90 days. There is a provision to grant 30 day extension to the 90 day time limit resulting in storage up to 120 days. The Department recognizes that the Defense Logistics Agency has acted in a responsible manner in addressing the

Colonel Troyer
Memphis Defense Depot
Page two

unexpected problem as discovered by the US Army Environmental Hygiene Agency. Nevertheless, we must acknowledge the fact the waste will likely remain on the Defense Logistics Agency property past the 120 day time limit.

On October 31, 1985, I discussed this matter with Tom Tiesler, Director, Division of Solid Waste Management. Based upon our discussion, it is felt that if the Defense Logistics Agency takes immediate steps to permit the storage areas for the clean-up wastes enforcement discretion can be justified. Please feel free to contact this office regarding the specifics of the permitting process.

If you have any questions concerning this letter or if I may be of further assistance, please do not hesitate to contact me.

Sincerely,



Paul Patterson
Division of Solid Waste Management

cc: SWM Nashville
Rick Bowlus
Dr. Sherman Kahn, MSCHD

PP/lar



TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
Room 1101, State Office Building
170 North Mid America Mall
Memphis, Tennessee 38103

November 15, 1985

Corlyn J. Troyer, Colonel
United States Air Force
Commander, Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Troyer:

On November 8, 1985, a meeting was held in this office regarding bulk temporary storage of the hazardous waste resulting from the remedial action presently underway at the Defense Logistics Agency - Memphis. Specifically, contaminated soil and demolition materials from the wood treatment building were the subject of our discussion. Those in attendance were Fred Choske - OH Materials, Rick Bowlus - US Army Environmental Hygiene Agency, Terri Kerby - Defense Logistics Agency, Dale Ozier - Tennessee Department of Health and Environment and myself.

Based upon information supplied by Mr. Bowlus the bulk storage proposal involved placement of contaminated soil in 20 cubic yard "roll offs" covered with a tarpaulin. The containers are to be sealed to prevent any leakage that may result from condensation or precipitation. Additional comments surrounded the location of the containers on a gravel surface as opposed to concrete. The concept of temporary storage in 20 cubic yard "roll-offs" is acceptable. Additionally, temporary storage on gravel will be acceptable as an interim measure. However, once the facility submits an application for hazardous waste storage, more stringent requirements may be imposed or required for secondary containment.

The hazardous waste storage areas (building 783 and the 20 cubic yard roll-offs) must be inspected as referenced in my letter of September 26, 1985. These inspections should be in force at the time of this letter. Records should be on file documenting each inspection, findings, and corrective action taken if applicable.

Corlyn J. Troyer, Colonel
Defense Depot Memphis
Page two

Also discussed were acceptable clean-up levels for contaminated soil in the wood treatment area. As indicated by Mr. Bowlus, ten foot excavations will generally reduce the levels of contamination by 85-95%. However, in the immediate area of the dip vat it appears that 260-380 ppb hepta and 840 ppb octa would remain as result of a ten foot excavation. In an attempt to determine the feasibility or necessity to further excavate, a telephone call was made to Bob Cibulski, Environmental Protection Agency, Emergency Response Team. Mr. Cibulski stated that hepta and octa isomers of dioxin demonstrate very low toxicity and consequently further removal would not be practical. Mr. Cibulski supported his opinion with the following points:

1. Groundwater supplies not impacted by this situation
2. Compounds not mobile in soil
3. Contamination is confined to low levels of the less toxic isomers
4. Additional soil removal will increase exposure to workers

Those present in our meeting discussed this matter and considered Mr. Cibulski's comments. Subsequently all agreed that a uniform excavation of ten feet would be sufficient. The trench shall be backfilled with a high clay content soil to reduce surface infiltration.

In closing I will appreciate you having a copy of OH Materials' work summary forwarded to me once remedial action is complete. Also, I have requested a copy of the US Environmental Hygiene Agency's report upon its completion. If you have any questions, please do not hesitate to contact me.

Sincerely,



Paul Patterson
Division of Solid Waste Management

cc: Rick Bowlus - US Army Environmental Hygiene Agency
SWM Nashville

PP/lar

SELECTION OF COVER FOR DIOXIN CONTAMINATED AREA

The choice of a cover material for the dioxin contaminated quadrant was based on the following considerations:

1. Environmental, health and safety considerations
2. Cost
3. Future use of the area

The first consideration was protection of the environment and the safety of potentially exposed workers. Fortunately, this factor could be addressed while still taking into account the cost effectiveness of the situation and still considering potential future use of the area.

The choices available were:

1. Clay, soil, grass seed and mulch - \$35,000
2. Gravel Cap - \$38,000
3. Concrete cap - \$250,000
4. Removal and disposal of contaminated soil/gravel restoration of the site.

After evaluation, it was determined that a six inch gravel cap most effectively addressed all the pertinent issues for the following reasons:

1. Removal of contaminated soil/gravel from the site (minimum of 8 inches) would address all the issues of concern in a satisfactory manner, however, the cost would be prohibitive and locating a disposal/treatment site at this time would be virtually impossible. This would entail the long term storage of large amounts of contaminated soil/gravel on the depot until a disposal/treatment facility could be located. The depot currently has no facilities suitable for this function that would be large enough to hold all the material that would require storage. The cost of construction and maintaining such a facility would be extremely expensive and there would be the additional problem of obtaining the approval for this approach from the State of Tennessee.

2. While addressing the cost, environmental, health, and safety issues a grass cover severely limits the future uses of the area. Before the area could be utilized for storage or construction purpose, the soil cap would have to be removed and tested to determine the extent of dioxin contamination present at that time. Disposal or use of the soil would be determined by the test results.

3. A concrete cap, like soil and grass also fulfills the environmental, health, and safety requirements of the situation and in addition would allow for future use of the area for storage. However, the cost of concrete (\$250,000) can not be justified in this situation when cheaper alternatives will accomplish the same function and still allow for future use of the area if needed.

4. Capping of the contaminated area with six inches of compacted gravel was the alternative chosen for use in this situation. It addressed all the pertinent issues in the most effective manner and was approved ~~by~~ by the State of Tennessee Department of Health and the US Environmental Protection Agency (Region IV). The cost of this alternative was in line with the most inexpensive method, soil and grass cover. In addition, this type of base will allow for future use of the area for storage (following concrete capping) with little or no removal of the gravel cap.

RICHARD C. HACKETT
MAYOR

CITY of MEMPHIS

November 20, 1985



DIVISION OF PUBLIC WORKS

ADMINISTRATOR,
ENVIRONMENTAL ENGINEERING
Room 603
901-528-2720

John W. Krosnes
Lt Col, USAF
Director, Installation Services
Defense Logistics Agency
Defense Depot Memphis
2163 Airways Boulevard
Memphis, Tennessee 38114

Dear Colonel Krosnes:

The City of Memphis has received your November 15 letter requesting permission to discharge 7,000 gallons of carbon filtered water into the City sanitary sewer system.

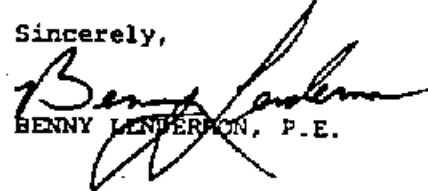
The City understands this water is a resultant of a pesticide and dioxin cleanup operations at the Memphis Defense Depot. We also understand that the analytic results performed on these water samples have shown very, very low contamination.

Based upon this information and my previous site investigation, the City of Memphis approves discharge of this water into our sanitary sewer system.

This water should be discharged through your existing on site sanitary sewer connections. You should inform this office of the amount of water discharged at the completion of this operation, and you will be billed 58.68 cents per thousand gallons by the City of Memphis Sewer Fee Accounting Office.

If you require any additional information concerning this matter, please do not hesitate to call.

Sincerely,


BENNY LENDERON, P.E.

BL:nh

cc: John Leonard
Rodney Thomas



DDMT-W

3 December 1985

Mr. Benny Lendermon, P.E.
125 North Mid America Mall
Room 519, City Hall
Memphis, Tennessee 38103

Dear Mr. Lendermon:

As requested in your letter of 20 November, we wish to advise that 8,000 gallons of carbon-filtered water were discharged into the City sanitary sewer system by Defense Depot Memphis.

Thank you for your help in this matter.

Sincerely,

JOHN W. KROSNES
Lt Col, USAF
Director, Installation Services

Depot discovery
September 19

6 300

Depot employees have been informed of the discovery.

Removal operations are being handled by O.H. Materials Company of Findlay, Ohio.

Defense Depot Memphis is a major field installation of the Defense Logistics Agency, the arm of the Defense Department responsible for supplying the military services with support materiel. The 40-year-old installation stores and distributes more than 360,000 items to military activities throughout the southeastern and midwestern United States.

-END-

DDMT-D

6 December 1985

Mr. Paul Patterson
Tennessee Department of Health
and Environment
Room 1101, State Office Building
170 North Mid-America Mall
Memphis, Tennessee 38103

Dear Mr. Patterson:

This letter is to request a 30-day extension (from 17 December 1985) for temporary storage of FO27 hazardous waste currently being stored at Defense Depot Memphis, Memphis, Tennessee (DDMT). The waste is at two areas of the Depot, Building 873 (740 thirty-gallon and 62 fifty-five-gallon drums) and the open area northwest of Building 737 (39 roll-off containers [24-30 cubic yards]).

This extension is requested because at the present time no commercial disposal or treatment facilities are available for FO27 waste material.

Questions regarding this matter should be directed to Lt Col John W. Krosnes, Director, Installation Services, DDMT, Telephone No. 775-6394.

Sincerely,


CORLYN J. TROYER
Colonel, USAF
Commander

USAEHA (Mc. Bowlus)





The Environmental Services Company

P.O. Box 551
Findlay, Ohio 45839-0551
Phone (419) 423-3526

CHAIN-OF-CUSTODY RECORD

Sawyer, Paul
Whitely and Shipyard Road
Swanton, OH 43416

PROJECT NUMBER
11205

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN		762-359-7838 Dr. Jim Andrews		901-775-6985 305		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-1	1-40 ML	Oil sample, 55 gal drum (4/5 full), taken 7/5 @ 1630, P5/AB	✓	7/5		
2	3057-2	1-QT.	Water sample from oil drum (full-55 gal), taken 9/5 @ 1635	✓			
3	3057-3	1-QT	Water sample from oil drum (full-55 gal), taken 9/5 @ 1650	✓			
4	3057-4	1-40 ml	Oil sample, transformer, taken 7/5 @ 1700	✓			
5	3057-5	1-8 oz.	Soil sample, by drums, composite of 5 samples, taken 7/5 @ 1705	✓			
6	3057-6	1-8 oz	Soil sample, discrete, taken 7/5 @ 1715 (field blank)	✓			
Att: Sample # 1-6 from facility Eng. Storage Area							
PAUL SAWYER		ATTENTION		TRANSFERS RELINQUISHED BY		ACCEPTED BY	
DATE		TIME		DATE		TIME	
7/5				7/5			
Purpose of analysis (use back of front sheet if necessary) PCB analysis; allow water to settle before analysis; request results by 9/11 p.m. Paul Sawyer							



The Environmental Services Company

P.O. Box 551
Findlay, Ohio 45839-0551
Phone (419) 423-3520

CHAIN-OF-CUSTODY RECORD

Lab. Analytical
Sacramento, CA 95691
Mike Mills P 916-312-1393

No. 11206

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN				JOB → 901-775-6985		3057	
				OHM Atlanta office: 404-787-3934			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK			
1	3057-7	1-40 ML	Oil sample from PCP dip tank #1, taken by J. Hill 8/30/85	1	✓		
				2			
				3			
				4			
				5			
				6			

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	1	Mike Mills	FED-Y	7/5	1730
2					
3					
4					
5					
6					

PAUL SAWYER
Attention: OH MARTIN 9/5/85
Time: 1730
Purpose of analysis (use back of front sheet if necessary)
Analysis for chlorine, ammonia, chrysene, fluorene, and penta-chlorinated. Price quoted: \$1000 for chlorine and dibenzofuran. \$200 for PCP plus Mike Mills. Two weeks turnaround. Contact Paul Sawyer or turn around. Contact 901-775-1000

Samples 8-44 held by facility for disposal purposes

J.H. Miller & Co.

P.O. Box 551

Findlay, Oh 45840

419-423-3528

CHAIN-OF-CUSTODY RECORD

No 8973

PROJECT LOCATION

Memphis, Tenn.

NAME OF CLIENT

DLA

PROJECT TELEPHONE NO

901-775-6752

PROJECT NUMBER

3057

ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINER	DESCRIPTION	TRANSFER NUMBER & CHECK
1	3057-45	1 - 52oz Glass Jar	soil sample grad A-1 7/14/83 12000 FMC	1 2 3 4
2	3057-46	"	soil sample grad A-2 7/14/83 14000 FMC	
3	3057-47	"	soil sample grad A-3 7/14/83 1700 FMC	
4	3057-48	"	soil sample grad A-4, B-1 7/13/83 1300 FMC	
5	3057-49	"	soil sample grad B-1 7/14/83 1700 FMC	
6	3057-50	"	soil sample grad B-2 7/13/83 1130 FMC	
7	3057-51	"	soil sample grad B-3 7/14/83 1140 FMC	
8	3057-52	"	" " " " 7/14/83 1150 FMC	
9	3057-53	"	soil sample grad C-1 7/14/83 1150 FMC	
10	3057-54	" " " " " " " "	soil sample grad C-2 7/14/83 1150 FMC	

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	1-9	John A. Miller	Ed. J. Miller	7/14/83	1920
2					
3					
4					
5					
6					

Person Responsible for Sample

E. J. Miller

O.H. Miller

Purpose of analysis (use back of front sheet if necessary)

Eptox Melting

Pesticides

PCB

Please Report Results to

O.H. Miller

@ 901-775-6752

C...NO. CUC...DY...CO...

No 8976

NAME OF CLIENT		PROJECT TELEPHONE NO.		PROJECT NUMBER	
P...d		701-275-6152		8976	
TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	1-8	Shed Gleson	FRD Lx	11/15/55	0930
2					
3					
4					
5					
6					

NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK
1 - 100 lb. bags	soil sample - C1, D-4	582 11/15/55 1200
1 - 100 lb. bag	soil sample - D1	1-15 10/1/55
1 - 100 lb. bag	soil sample - D2	1-15 01/30/56
1 - 100 lb. bag	soil sample - D3	31-173 11/20/55 10/1/55
1 - 100 lb. bag	soil sample - E1	11/1/55 1400 10/1/55
1 - 100 lb. bag	soil sample - E2	11/1/55 1500 10/1/55
1 - 100 lb. bag	soil sample - C3	11/1/55 0800 11/1/55

CHAIN-OF-CUSTODY RECORD

No 8974

Memphis, Tenn.
P.O. Box 551
Findlay, Oh 45840
419-423-3526

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, Tenn.		DLA.		701-775-6152		8974	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-62	1- 30cc glass jar	Composite of soil - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			
2	3057-63	"	Soil - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			
3	3057-64	"	Soil - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			
4	3057-65	"	Soil - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			
5	3057-66	"	Soil - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			
6	3057-67	1- 30cc glass jar	Water - 100 ft. to 120 ft. depth 8/20 1110 0000	✓			

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	1-1	DLA 100 ft. to 120 ft. depth	8/20 1110 0000	8/20	1110 0000
2					
3					
4					
5					
6					

Person Responsible for sample: F. Chosko
Allocation: OHM
Date: 8/27 1730
Purpose of analysis (use back of front sheet if necessary):
Determine if sample is contaminated with lead.
Appropriate request for test results.
701-775-6152

CHAIN-OF-CUSTODY RECORD

No 8975

Materials Inc.
P.O. Box 551
Findlay, Oh 45840
419-423-3526

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, Tenn.		DLA		601-775-6151		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK			
				1	2	3	4
1	3057-63	1 - 32 oz Jar	Fin. white - bag cut, 34% w/ 100% cotton	✓			
2	3057-64	1 - 32 oz Jar	Spec. white - bag cut, 34% w/ 100% cotton	✓			
3	3057-70	1 - 32 oz Jar	Fin. white - bag cut, 34% w/ 100% cotton	✓			
4	3057-71	1 - 32 oz Jar	Picking cut bag cut, 34% w/ 100% cotton	✓			
5	3057-72	1 - 32 oz Jar	Difficult white - bag cut, 34% w/ 100% cotton	✓			
6	3057-73	1 - 32 oz Jar	Spec. white - bag cut, 34% w/ 100% cotton	✓			
7	3057-74	1 - 32 oz Jar	Fin. white - bag cut, 34% w/ 100% cotton	✓			
Person Responsible for sample		Attestation	Date	Transfers Relinquished By	Accepted By	Date	Time
F. Checke		DLA (initials)	4/1/85	Steve A. Hines	Steve A. Hines	4/1/85	10:50
Purpose of analysis (use back of front sheet if necessary)							
Duplication - 5 samples - 1 - 32 oz jar - 1 - 32 oz jar Repeat - 1 - 32 oz jar - 1 - 32 oz jar - 1 - 32 oz jar 601-775-6151							

Samples 75-102 are drum samples
held for disposal purposes by facility

CHAIN-OF-CUSTODY RECORD

NO 8977

P.O. Box 551
Findlay, Oh 45840
419-423-3526

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER			
Municipal Center		DLA		601-775-6757		3057			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK					
				1	2	3	4	5	6
1	3057-114	1 - 8oz Jar	Segment #1 0-4" Freshwater, 112/ps, 11/20, 1100 - 1102						
2	3057-115	1 - 8oz Jar	Segment #2 0-4" 2nd from West, 112/ps, 11/20, 1100 - 1102						
3	3057-116	1 - 8oz Jar	Segment #3 0-4" 3rd from West, 112/ps, 11/20, 1100 - 1102						
4	3057-117	1 - 8oz Jar	Segment #4 0-4" 4th from West, 112/ps, 11/20, 1100 - 1102						
5	3057-118	1 - 8oz Jar	Segment #5 0-4" 2nd from East, 112/ps, 11/20, 1100 - 1102						
6	3057-119	1 - 8oz Jar	Segment #6 0-4" 3rd from East, 112/ps, 11/20, 1100 - 1102						
7	3057-120	1 - 8oz Jar	Segment #1 0-4" 1st from West, 112/ps, 11/20, 1100 - 1102						
8	3057-121	1 - 8oz Jar	Segment #2 0-4" 2nd from West, 112/ps, 11/20, 1100 - 1102						
9	3057-122	1 - 8oz Jar	Segment #3 0-4" 3rd from West, 112/ps, 11/20, 1100 - 1102						
10	3057-123	1 - 8oz Jar	Segment #4 0-4" 4th from West, 112/ps, 11/20, 1100 - 1102						

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	1-10	Steve H. H. H.	For 1-10	4/2/85	11:00
2					
3					
4					
5					
6					

Person Responsible for sample: F. Choske
 Affiliation: O.H.M. Trials
 Date: 4/2/85
 Time: 11:00
 Purpose of analysis (use back of front sheet if necessary):
 Division 15 minutes - 11/20/85
 all samples
 Please report results to:
 O.H. H. H. H.
 @ 401-775-6757

CHAIN-OF-CUSTODY RECORD

P.O. Box 551
Findlay, Oh 45840
419-423-3528

NO 8978

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER				
Memphis, Tenn.		DLA		701-775-6752		3057				
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK						
1	3057-124	1-8oz Jar	Segment #5, 4-8" Jun from East, 11/21/85, FC/JSK, 1426 - 5012	1	2	3	4	5	6	
2	3057-125	1-8oz Jar	Segment #6, 4-8" Furthest East, 11/21/85, FC/JSK, 1440 - 5012							
3	3057-126	1-8oz Jar	Soil From Wall - 1 ST From Top, 11/22/85, FC/JSK, 1440							
4	3057-127	1-8oz Jar	Soil From Wall - Halfway Down, 11/22/85, FC/JSK, 1445							
5	3057-128	1-8oz Jar	Soil From Bottom of Tank Area, 11/22/85, FC/JSK, 1450							
6	3057-129	1-8oz Jar	Soil from outside of Tank, 11/22/85, FC/JSK, 1508							
F. Choske			O.H. Materials		Date		Time			
Purpose of analysis (use back of front sheet if necessary)			11/21/85		11/21/85		11/21/85			
Dietin isomers and furans on all samples										
3057-126) - (3057-129) needs POP run on them										
Please Report results to										
OH Materials										
At 001. 975-1742										

Materials Co.
P.O. Box 551
Findlay, Oh 45840
419-423-3526

CHAIN-OF-CUSTODY RECORD

89 8979

PROJECT LOCATION			NAME OF CLIENT		PROJECT TELEPHONE NO.		PROJECT NUMBER	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	ACCEPTED BY	DATE	TOTAL	
1	3047 -134	1 - 1/2" dia.	1 - 1/2" dia. x 1/2" thick	1				
2	3047 -134	11	11 - 1/2" dia. x 1/2" thick	2				
3	3047 -132	11	11 - 1/2" dia. x 1/2" thick	3				
				4				
				5				
				6				

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TOTAL
1	1				
2					
3					
4					
5					
6					

Person Responsible for Sample: *John Doe*

Purpose of analysis (use back of front sheet if necessary): *For analysis of sample for 1-13-89*

CHAIN-OF-CUSTODY RECORD

W. M. Tals
P.O. Box 651
Findlay, Oh 45840
419-423-3526

APR 8980

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER				
Memphis, TN		DLA		(201) 793-6133		3057				
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK						
				1	2	3	4	5	6	7
1	3057-133	1-Box Jar	Southwest corner of 1st house 1740-1745, 1940-1945	✓						
2	3057-134	"	North wall 4" deep 1740-1745, 1940-1945	✓						
3	3057-135	"	East wall 11" deep 1740-1745, 1940-1945	✓						
4	3057-136	"	West wall 11" deep 1740-1745, 1940-1945	✓						
5	3057-137	"	North wall 11" deep 1740-1745, 1940-1945	✓						

Person Responsible for sample	Signature	Date	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
R. Christie	OK/M	1/2	1850	1	1-5	R. Christie	R. Christie	10/1	
				2					
				3					
				4					
				5					
				6					

Purpose of analysis (use back of front sheet if necessary)

Diagnose mineral and chemical samples

Please report results to W. M. Tals

W 201 793-6752

3868 017

**P.O. Box 551
Findlay, Oh 45840
419-423-3526**

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER			
Memphis TN		DLA		(901) 775-6752		3057			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1	3057-135	1- 8oz glass jar	grid location C2-8" 10/3/85 15.00 Fc/PT	1	1-13	Fc/PT	Fc/PT	10/3/85	1400
2	3057-137	"	grid location C2-5" 10/3/85 15.35 Fc/PT	2					
3	3057-140	"	grid location E1-5" 10/3/85 15.45 Fc/PT	3					
4	3057-141	"	grid location D3-8" 10/3/85 15.50 Fc/PT	4					
5	3057-142	"	grid location F1-4" 10/3/85 16.00 Fc/PT	5					
6	3057-143	"	grid location F2-4" 10/3/85 16.10 Fc/PT	6					
7	3057-144	"	grid location F3-4" 10/3/85 16.15 Fc/PT	7					
8	3057-145	"	grid location F4-4" 10/3/85 16.20 Fc/PT	8					
9	3057-146	"	grid location A2-8" 10/3/85 16.30 Fc/PT	9					
10	3057-147	"	grid location B4-8" 10/3/85 16.35 Fc/PT	10					
Person Responsible for Sample		Affiliation		Date		Time			
F. Choske		OHM		10/3		1645			
Purpose of analysis (use back of front sheet if necessary)									
Pesticide screen									
DDT, DDD, DDE, etc.									
/									

CANNON-CLOUD RECORD

P.O. Box 551
Findlay, Oh 45840
419-423-3526

No 8984

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis TN		PLD		775-6752 (901) 67		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-148	1-8oz clear jar	Wipe of ceiling above that 17/18 1/2 in dia	✓			
2	3057-149	"	Sail composite south-west of stangebook 17/18 1/2 in dia	✓			
3	3057-150	"	Sail composite west end of stangebook 17/18 1/2 in dia	✓			
4	3057-151	"	Sail composite east end of stangebook 17/18 1/2 in dia	✓			
Person Responsible for sample				Transfers Relinquished By		Accepted By	
F. Choske				F. Choske		Federal Express 10/15/70	
Date				Item Number		Transfer Number	
10/15/70				1-4		1	
Purpose of analysis (use back of form sheet if necessary)							
Dioxin 15 samples & Furans							
on all 5 samples							

W. M. Jale
P.O. Box 551
Findlay, Oh 45840
419-423-3526

CHAIN-OF-CUSTODY RECORD

89 8987

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER		
Memphis TN		DLA		(901) 745-6444		3057		
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & PAGE				
1	3057-152	1-8oz jar	Wipe sample of Radio 194/1/2 1940 FC	1	2	3	4	
2	3057-153	"	Soil sample mobile lab. 1 cont of pit 104-1, FC 194/1/3 1940 FC	1	2	3	4	
3	3057-155	"	Concrete from slab at bottom of hole 194/1/3 1940 FC	1	2	3	4	
Prison Responsible for sample F. Canale Attention DLA Date 10/1/89 Time 1330				TRANSFERS RELINQUISHED BY F. Canale		ACCEPTED BY F. Canale	DATE 10/1/89	PAGE 1
Purpose of analysis (use back of front sheet if necessary) Dioxin 150 mg/kg & F. in 1940 FC								

Samples 156-159,161 given to Chemical Waste Mgt.
for disposal assessment

T.N. Tenn. P.O. Box 551
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419-423-3526

CHAIN-OF-CUSTODY RECORD

No 8986

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER			
Memphis TN		DLA		(901) 775-6752		3057			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK					
				1	2	3	4	5	6
1	3057-160	1-8oz jar	Soil Composite from middle to east end On top of concrete slab 10/10/85-10/10/85 MF/FC	✓					
2	3057-162	"	Composite of Soil Gravelly - sand to m shingle	✓					
3	3057-163	"	Bank specimen f RCP Building 10/10/85-10/10/85	✓					
4	3057-164	"	SE Corner of Pit Edge of Base 10/10/85-10/10/85	✓					
5	3057-165	"	NE Corner of Pit Edge of Base 10/10/85-10/10/85	✓					
			Composite of Base of Pit 10/10/85-10/10/85	✓					

Person responsible for sample	Initials	Date	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
Echoate	DMH	10/10/85	11:50	1	1-5	DLA	DLA	10/10/85	
				2					
				3					
				4					
				5					
				6					

Purpose of analysis (use back of front sheet if necessary)
 For 10/10/85 and 10/10/85

419-423-3526

8868 047

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO.		PROJECT NUMBER	
Memphis, TN		DLA		(901)		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER	DATE	INITIALS	
1	3057-166	1 - 1 liter glass jar	1 liter sample stored in jar under N ₂ 10/15/85 12:30 P.M.	1	10/15/85		
2	3057-167	" "	SAME AS ABOVE SAMPLE - Run only one of the samples unless you need two because of unknowns -	2			
				3			
				4			
				5			
				6			

Person Responsible for Sample: F. Chosko

Purpose of analysis (use back of front sheet if necessary): Diastereomers and furan isomers

CHAIN-OF-CUSTODY RECORD

P.O. Box 551
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419-423-3526

MP 8989

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER					
Memphis, TN		DLA		(901) 979-7122		3057					
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	1	2	3	4	5	6	
1	3057-168	1-8oz glass jar	Wipe - End of Pencil from 1713-1714/1715	0							
2	3057-169	"	Wipe - inside building 1721-1722/1723	1							
3	3057-170	"	Wipe - metal from inside building 1723-1724/1725	0							
Person Responsible for sample		Attestation		Transfers Relinquished By		Accepted By		DATE		TIME	
F.C. No 360		O.H.M.		1-3		Paul D. Evans		1/24		11:00	
Purpose of analysis (use back of front sheet if necessary)											
Dioxin 131411											
Furan 151411											

Dr. W. W. Balk-

P.O. Box 551

Findlay, Oh 45840

419-423-3526

CHAIN-UP—CUSTODY RECORD

5868

PROJECT LOCATION			NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN			DLA		(706) 295-1452		3137	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER	DATE	TIME	ANALYST	REMARKS
1	3057-171	1-8oz glass jar	inside storage tank (rooming) 10/10/50 - 1000 02/10/50	1	10/10/50	11:00	CHM	
2	3057-172	"	1 ft below bottom of dip tank 10/10/50 - 1000 02/10/50	2	10/10/50	11:00	CHM	
3	3057-173	"	2 ft below bottom of dip tank 10/10/50 - 1000 02/10/50	3	10/10/50	11:00	CHM	
4	3057-174	"	4 ft below bottom of dip tank 10/10/50 - 1000 02/10/50	4	10/10/50	11:00	CHM	
5	3057-175	"	Bottom of storage tank composite 10/10/50 - 1000 02/10/50	5	10/10/50	11:00	CHM	

Purpose of analysis (use back of front sheet if necessary)

Dioxin 150miers

furan 150miers

Purpose of analysis (use back of front sheet if necessary)

Don't know

from 1500 to 1500

64. Memphis

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419-423-3526

CUM-N-C-CUS-300) ACCORD

York info

NY 8990

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN		ELA		41-775-4762		2057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	TOX
1	3057-177	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
2	3057-178	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
3	3057-179	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
4	3057-180	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
5	3057-181	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
6	3057-182	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
7	3057-183	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			
8	3057-184	1-50g	from west end of lot near 1st & 2nd streets 4/15/80 3/10/83	✓			

Person Responsible for sample	Utilization	Date	Time
Paul Sullivan	ANAL	4/15/80	2:00

Purpose of analysis (use back of front sheet if necessary)

From 1st & 2nd streets

From 1st & 2nd streets

U.S. Materials Co.
P.O. Box 551
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419-423-3526

CHAIN-OF-CUSTODY RECORD

419 8991

6 325

PROJECT LOCATION			NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
MARIETTA, TN			DUN		(419) 771-0874		8991	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	INITIAL	TIME
1	3057-185	1 8oz glass jar	Wood from bridge on bridge (100 ft) 10/10/88	1				
2	3057-186	"	Old wooden sample (100 ft) 10/10/88	2				
3	3057-187	"	TRUCK (100 ft) 10/10/88	3				
4	3057-188	"	U.S. (100 ft) 10/10/88	4				
5	3057-176	"	TRUCK (100 ft) 10/10/88	5				
6	3057-189	"	U.S. (100 ft) 10/10/88	6				

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS DELIVERED BY	ACCEPTED BY	DATE	TIME
1	1				
4					
5					
6					

Person Responsible for sample: *[Signature]* Title: *[Title]*

Purpose of analysis (use back of front sheet if necessary):

O.H. Malen Co.
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119-423-3526

CHAIN-OF-CUSTODY RECORD

No 8992

PROJECT LOCATION			NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER			
Memphis, TN			DLA		(901) 775-1752		3057			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK						
1	3057-190	1 Bag - Jars	Soil Hole #1 - 10 ft deep - 10/20/75 - 11/20/75	1	2	3	4	5	6	
2	3057-192	"	Soil Hole #2 - 10 ft deep - 11/20/75 - 12/20/75							
3	3057-194	"	Soil Hole #3 - 5 ft deep - 11/20/75 - 12/20/75							
4	3057-195	"	Soil Hole #3 - 10 ft deep - 10/20/75 - 12/20/75							
5	3057-196	"	Soil Hole #4 - 5 ft deep - 11/20/75 - 12/20/75							
6	3057-197	"	Soil Hole #5 - 5 ft deep - 11/20/75 - 12/20/75							
7	3057-191	"	Soil Hole #1 - 12 ft deep - 11/20/75 - 12/20/75							
8	3057-193	"	Soil Hole #2 - 13 ft deep - 10/20/75 - 11/20/75							
9	3057-196	"	Soil Hole #3 - 14 ft deep - 10/20/75 - 12/20/75							
10	3057-197	"	Soil Hole #3 - 15 ft deep - 11/20/75 - 12/20/75							
11	3057-200	"	Soil Hole #5 - 16 ft deep - 10/20/75 - 12/20/75							
			Run the first six samples of the robot station in greater than 100ppb then run the next sample that corresponds to that hole.							
			→							
Person Responsible for sample			Attachment	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
F. Choske			OIM	11/30	1	1-B	E. Choske	Earl Expend	11/30	1500
Purpose of analysis (use back of front sheet if necessary)										
Dioxin Isomers										
Furan Isomers										

O.H. Materials Co.
P.O. Box 551
Findlay, Oh 45840
419-423-3526

CHAIN-OF-CUSTODY RECORD

No 8994

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN		DLA		901 975-6752		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-205	1-8 oz glass jar	Soil Hole #6 5ft deep - 10/31/85 - 13.0 Fggs	✓			
2	3057-201	"	Soil Hole #6 10ft deep - 10/31/85 - 14.0 Fggs	✓			
3	3057-203	"	Soil Hole #7 12ft deep 10/31/85 - 15.0 Fggs	✓			
4	3057-202	"	Soil Hole #6 12ft deep 10/31/85 - 14.0 Fggs	✓			
5	3057-204	"	Soil Hole #7 15ft deep 10/31/85 - 15.0 Fggs	✓			
Run items 1-3 first. If the total Dioxin is greater than 100ppb then run the next corresponding sample							
Person Responsible for sample		Allotment		ACCEPTED BY		DATE	
F. Chaske				F. Chaske		10/31 1830	
Purpose of analysis (use back of front sheet if necessary)							
Dioxin isomers							
Furan isomers							

O.H. Mate
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419-423-3526

CHAIN-OF-CUSTODY RECORD

NO 8993

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis		DLA		(901) 715-6752		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK			
1	3057-206	1-8oz. plastic	Hole 8 - 5 ft deep w/ 1/2" x 1/2" - 0700	1	2	3	4
2	3057-208	"	Hole 9 - 10 ft deep w/ 1/2" x 1/2" - 0700	5	6	7	8
3	3057-210	"	Hole 10 - 10 ft deep w/ 1/2" x 1/2" - 0700	9	10	11	12
4	3057-212	"	Hole 11 - 11 ft deep w/ 1/2" x 1/2" - 0700	13	14	15	16
5	3057-214	"	Hole 12 - 5 ft deep w/ 1/2" x 1/2" - 1000	17	18	19	20
6	3057-215	"	Hole 13 - 10 ft deep w/ 1/2" x 1/2" - 1200	21	22	23	24
7	3057-217	"	Hole 14 - 10 ft deep w/ 1/2" x 1/2" - 1400	25	26	27	28
8	3057-219	"	Hole 15 - 17 ft deep w/ 1/2" x 1/2" - 1500	29	30	31	32
9	3057-218	"	Hole 16 - 17 ft deep w/ 1/2" x 1/2" - 1500	33	34	35	36
Person Responsible for sample		Attestation	Date	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY
F. Choske		04/17	11/1	12:00	1-13	1-13	F. Choske
Purpose of analysis (use back of front sheet if necessary)							
Dioxin - 1000000							
Furan - 1000000							

U.M. Materials Co.
P.O. Box 551
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419-423-3526

CHAIN-OF-CUSTODY RECORD

NO. 8995

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER											
Aluminum		DLA		(111) 777-0950		8995											
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK													
1	3057-207	1 x 1/2 x 1/4	Aluminum - 1/2 x 1/2 x 1/4	1	2	3	4	5	6	7							
2	3057-208	"	Aluminum - 1/2 x 1/2 x 1/4	1	2	3	4	5	6	7							
3	3057-211	"	Aluminum - 1/2 x 1/2 x 1/4	1	2	3	4	5	6	7							
4	3057-212	"	Aluminum - 1/2 x 1/2 x 1/4	1	2	3	4	5	6	7							
				These are for the use of the first person who gets the items except for the sample and the rest of the items													
Person Responsible for sample		Date		Time		TRANSFER NUMBER		ITEM NUMBER		TRANSFERS RELINQUISHED BY		ACCEPTED BY		DATE		TIME	
F. J. J. J.		8/1/77		11:00		1		1-4		J. J. J.		J. J. J.		8/1/77		11:00	
Purpose of analysis (use back of front sheet if necessary)																	
To determine the composition of the material																	
To determine the composition of the material																	

O.H. Mater. Co.
P.O. Box 551
Findlay, Oh 45840
419-423-3526

CHAIN-OF-CUSTODY RECORD

IN: 8981

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN		DLA		(901) 775-6152		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-219	1-802 glass jar	Soil - Hole #15 - 15 ft deep 11/2/85 - 0800 - FCPTS	1 2 3 4 5 6 7			
2	3057-220		Soil - Hole #16 - 5 ft deep 11/2/85 - 0800 - FCPTS				
3	3057-221		Soil - Hole #17 - 10 ft deep 11/2/85 - 0855 - FCPTS				
4	3057-223		Soil - Hole #18 - 10 ft deep 11/2/85 - 1000 - FCPTS				
5	3057-224		Soil - Hole #19 - 5 ft deep 11/2/85 - 1100 - FCPTS				
6	3057-225		Soil Hole #20 - 5 ft deep 11/2/85 - 1200 - FCPTS				
7	3057-226		Soil Hole #21 - 5 ft deep 11/2/85 - 1300 - FCPTS				
8	3057-227		Soil Hole #22 - 5 ft deep 11/2/85 - 1400 - FCPTS				
9	3057-222		Soil - Hole #17 - 8 ft deep 11/2/85 - 0915 - FCPTS				
			RUN 3057-222 if sample 3057-221 has failed diam greater than 100ppb				
Person Responsible for sample		Analysis	Time	DATE	TIME		
F. Chosko		OHM	4/2	4/2	11:00		
Purpose of analysis (use back of front sheet if necessary)							
Dioxin 150 mg							
Furan 150 mg							

U.S. Materials Co.
P.O. Box 551
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419-423-3526

CHAIN-OF-CUSTODY RECORD

NO 8982

6 331

PROJECT LOCATION			NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN			DIA		1111 1111 1111		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	ACCEPTED BY	TIME
1	3057-229	1-3/4 1/2 1/2 1/2	1/2 1/2 1/2 1/2	1	1-1	11:11		
2	3057-229	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	2	1-1	11:11		
3	3057-230	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	3	1-1	11:11		
4	3057-231	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	4	1-1	11:11		
5	3057-232	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	5	1-1	11:11		
6	3057-233	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	6	1-1	11:11		
7	3057-234	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	7	1-1	11:11		
8	3057-235	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	8	1-1	11:11		
9	3057-236	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	9	1-1	11:11		
10	3057-237	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	10	1-1	11:11		
11	3057-238	1/2 1/2 1/2 1/2	1/2 1/2 1/2 1/2	11	1-1	11:11		

Person Responsible for sample: *F. Ch...*
 Date: *11/11/11*
 Purpose of analysis (use back of form sheet if necessary):
...
...



The Environmental Services Company

OHM
P.O. Box 551
Findlay, Ohio 45839-0551
Phone (419) 423-3526

CHAIN-OF-CUSTODY RECORD

11054

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER				
Memphis, TN		DLA		(901) 715-6752		3057				
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK						
				1	2	3	4	5	6	7
1	3057-239	1-8 oz glass jar	Hole 34 10ft JS/KD 11/3/85 - 0700	✓						
2	3057-241	"	Hole 35 5ft JS/KD 11/3/85 - 0700	✓						
3	3057-242	"	Hole 36 4ft KD/PC 11/3/85 - 1000	✓						
4	3057-243	"	Hole 37 5ft JS/KD 11/3/85 - 1300	✓						
5	3057-244	"	Hole 38 5ft JS/PC 11/3/85 - 1400	✓						
6	3057-245	"	Hole 39 27ft KD/JS 11/3/85 - 1530	✓						
7	3057-246	"	Hole 40 27ft KD/JS 11/3/85 - 1700	✓						
8	3057-240	"	Hole 34 13ft JS/KD 11/5/85 - 0715 To be run if item 1 has a total Dioxin greater than 100ppb	✓						

Person Responsible for sample	Attestation	Date	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
F. Chosko	OHM	11/5	1800	1	1-8	F. Chosko	F. J. Eppers	11/5	1900
Purpose of analysis (use back of front sheet if necessary)									
Dioxin isomers									
Furan isomers									



OHM
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Phone (419) 423-3528

The Environmental Services Company

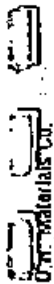
CHAIN-OF-CUSTODY RECORD

11050

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO.		PROJECT NUMBER			
Memphis, TN		DLA		(901) 775-6752		3057			
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK					
				1	2	3	4	5	6
1	3057-247	1-8oz glass jar	Compound from field soil/soil per drilling 7/20-11/2/85-1300	✓					
2	3057-248	"	Hole 41 - 5ft deep - 8/9/85 - 11/4/85 - 0700	✓					
3	3057-249	"	Hole 42 - 5ft deep - 8/9/85 - 11/4/85 - 0800	✓					
4	3057-250	"	Hole 43 - 5ft deep - 8/9/85 - 11/4/85 - 0900	✓					
5	3057-251	"	Hole 44 - 10ft deep - 8/9/85 - 11/4/85 - 1030	✓					
6	3057-253	"	Storage TANK NE corner - 11/4/85 - 1530 - 1545	✓					
7	3057-254	"	Storage TANK NE corner - 11/4/85 - 1545	✓					
8	3057-255	"	Storage TANK NE corner - 11/4/85 - 1545	✓					
9	3057-252	"	Hole 44 - 14ft deep - 8/9/85 - 11/4/85 - 1045 To be run if item 5 (3057-251) has a total depth greater than 1000ft	✓					
Person Responsible for sample: F. Chaske				Date: 11/4/85		Time: 1715			
Purpose of analysis (use back of front sheet if necessary): Digging samples From 1300000				Transfers Relinquished By: F. Chaske		Accepted By: F. Chaske		Date: 11/4/85	



The Environmental Services Company



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CHAIN-OF-CUSTODY RECORD

11053

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER				
Memphis, TN		DTH		1901/ 775-6752		3057				
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK						
1	3057-257-11	1 qt	Composit. Soil 11-13-85 1400 TW/PR	1	2	3	4	5	6	
2	3057-257-12	1 qt	Composit. Soil 11-14-85 1000 TW/PR							
3	3057-258-13	1 qt	Composit. Soil 11-14-85 1030 TW/PR							
4	3057-259-14	1 qt	Composit. Soil 11-14-85 1100 TW/PR							
5	3057-260-16	1 qt	Composit. Soil 11-14-85 1210 TW/PR							
6	3057-261-18	1 qt	Composit. Soil 11-16-85 0900 TW/PR							
Person Responsible for Sample			Aliquot	Time	TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
Randy Bennett			OHM	4/1	1	1-6	R Bennett	Tested Express	4/1/85	11:00
Purpose of analysis (use back of front sheet if necessary)										
Dioxin Isomers & Furans										



The Environmental Services Company

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Phone (419) 423-3528

CHAIN-OF-CUSTODY RECORD

11052

6 335

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Mentor, OH		DEH		(419) 775-6752		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	
1	3057-262-19	1 qt	Composite, Soil 11-16-85 1000 TW/RB	✓			
2	3057-263-20	1 qt	Composite, Soil 11-16-85 1100 TW/RB	✓			
3	3057-264-21	1 qt	Composite, Soil 11-16-85 1330 TW/RB	✓			
4	3057-265-22	1 qt	Composite, Soil 11-18-85 1430 TW/RB	✓			
5	3057-266-23	1 qt	Composite, Soil 11-18-85 1430 TW/RB	✓			
6	3057-267-24	1 qt	Composite, Soil 11-19-85 0830 TW/RB	✓			
Person Responsible for sample				ACCEPTED BY			
Randy Bennett				R. Bennett		11/21/85 1600	
Date 11/21							
Purpose of analysis (use back of front sheet if necessary)							
DIONID. ISOMERS & FURANS							

OHM

318 Co.

P.O. Box 501

Findlay, Oh 45840

419-423-3526

CHAIN-OF-CUSTODY RECORD

No 8966

6 336

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, TN		DLH		(401) 775-6752		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK	DATE	TIME	ACCEPTED BY
1	3057-268-25	1-803	Compass 20 Soil 11-19-55, 0130 W/AB	✓			
2	3057-269	1-803	Soil 35' N-6" EAST WALL 11-20-55 1918 1914	✓			
3	3057-270	1-803	Soil 4' N-6" EAST WALL 11-20-55 1920 1914	✓			
4	3057-271	1-803	Soil 20' N-5" EAST WALL 11-20-55 1925 1914	✓			
5	3057-272	1-803	Soil 20' N-5" EAST WALL 11-20-55 1925 1914	✓			
6	3057-273	1-803	Compass 20 Soil 11-19-55, 0130 W/AB	✓			
Purpose of analysis (use back of front sheet if necessary) Dioxin I Somers & Farnham				TRANSFERS RELINQUISHED BY Randy Beckett			
Signature for sample Randy Beckett				ACCEPTED BY Richard E. Farnham			
Date 11/21				DATE 11/21			
Time 11:11				TIME 11:00			

O.H. Materials Co.

P.O. Box 551

Findlay, Oh 45840

419-423-3526

CHAIN-OF-CUSTODY RECORD

INVO 8967

6 337

PROJECT LOCATION		NAME OF CLIENT		PROJECT TELEPHONE NO		PROJECT NUMBER	
Memphis, In		DLA		(901) 775-6752		3057	
ITEM NUMBER	SAMPLE NUMBER	NUMBER & SIZE OF CONTAINERS	DESCRIPTION	TRANSFER NUMBER & CHECK			
1	3057-274-26	1-Q4	Soil Composite 11-21-85 1515 TW/PA	1	2	3	4
2	3057-275-27	1-Q4	Soil Composite 11-21-85 1550 PA/TW	✓			
3	3057-276-28	1-Q4	Soil Composite 11-21-85 1620 PA/TW	✓			
4	3057-277-29	1-Q4	Soil Composite 11-22-85 0830 PA/TW	✓			
5	3057-278-30	1-Q4	Soil Composite 11-22-85 0930 PA/TW	✓			
6	3057-279-31	1-Q4	Soil Composite 11-22-85 1015 PA/TW	✓			
Person Responsible for Sample				ACCEPTED BY		DATE	
Randy Beckwith				R. Beckwith		11/25 1600	
Date				TRANSFERS RELINQUISHED BY		TIME	
11/25 1600				R. Beckwith		11/25 1600	
Purpose of analysis (use back of front sheet if necessary)							
DIORIN ISOMERS & FURANS							



...us carry
unravelling their
increasingly important

Dioxin: Is Everyone Contaminated?

By JANET RALOFF

Dioxin: Most people know it as the extremely toxic contaminant in Agent Orange, or the pollutant that transformed Times Beach, Mo., into a virtual ghost town. The Environmental Protection Agency has called it "one of the most perplexing and potentially dangerous chemicals ever to pollute the environment." What most people don't realize is that, according to recent studies, a body burden of dioxin and its chemical cousins has become a price humanity pays for its industrial culture.

"In the United States we've found that everyone's got dioxin in them," says Arnold Schecter, a professor of preventive medicine at State University of New York in Binghamton. Because the same appears to be true of Canadians and Europeans, dioxin researchers are now coming to the conclusion that these industrial pollutants, along with furans and PCBs, contaminate the bodies of all individuals living in developed countries — and potentially in many lesser-developed countries as well.

Says Schecter, "This is powerful, new data that is just overwhelming in what it suggests." At a minimum, he says, the finding calls into question the validity of all published and ongoing epidemiology investigating the human health effects of these toxic chemicals. "The American numbers suggest very strongly," he says,

"that current epidemiologic studies are very seriously flawed because they're probably not comparing exposed with nonexposed populations — as they originally thought they were." And any good epidemiologic study, he says, must be able to distinguish between those exposed and those not.

One implication of all this, he says, is that many of the cancer incidence figures now treated as normal for the general population may be due in part to society's low-dose exposure to these toxic chemicals. In other words, these pollutants may be exerting a subtle but deleterious effect on the health of the world's most industrialized societies.

Right now the extent of that effect is not known for certain. Schecter acknowledges. However, the best-known and most toxic of dioxin's 75 different species — 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) — has been shown to cause cancer in animals, has been linked with an increased incidence of certain rare cancers in humans and can cause a disfiguring human skin disease, chloracne. Moreover, TCDD exposures in animals have been linked with weight loss, liver disorders, gastric ulcers, birth defects, reproductive failure and immune system abnormalities. Knowing this, and knowing the extent to which the industrial world is contaminated, scientists should put increased

emphasis on identifying precisely how toxic to humans this family of chemicals really is, Schecter believes.

Together with John J. Ryan of Health and Welfare Canada, in Ottawa, Schecter presented several papers in May at the national meeting of the American Chemical Society (ACS) in Miami, detailing human dioxin levels in both North American and Vietnamese populations. At an ACS meeting two years ago, Ryan had reported finding TCDD in a small sample of Canadians (SN: 9/3/83, p. 156). This year, he and Schecter described results of a follow-up analysis of tissues from more than 100 presumably unexposed individuals in Canada and the United States. Within these people, the researchers again found a general low, or "background," level of contamination with dioxins and furans — related toxic chemicals often found in association with one another. Although all the tissues they examined contained the chemicals, Ryan says, "we found the highest levels of dioxins and furans in fat." Moreover, the levels found in any tissue tended to reflect its relative amount of fat.

In this group of Canadians and Americans, TCDD was measured at background levels of between 5 and 10 parts per trillion (ppt) in fat. Furans that similarly contained four chlorine atoms per molecule were found in somewhat smaller concen-

trations. The more highly chlorinated dioxin and furan species — which are less toxic but not necessarily benign — were measured at concentrations of up to 1,000 ppt in fat.

As a rule, dioxin concentrations were somewhat higher than furan concentrations. There also seemed to be an unwritten rule that as one progressed from 8-chlorinated molecules to 7-chlorinated, and on down successively to 4-chlorinated ones like TCDD, the concentrations of each particular species of dioxin or furan decreased.

Schechter and Ryan point out that the levels they measured in these members of the general population "are two or three orders of magnitude lower than those known to cause acute effects in humans, although the [chronic] long-term effects of these residues are not clear."

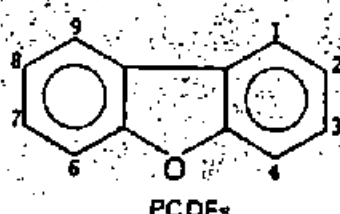
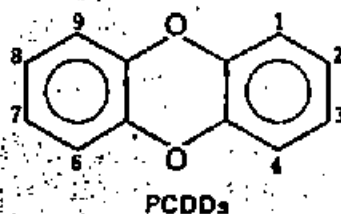
Fish, they suggest, could be one dietary source of 2,3,7,8-TCDD, which enters the environment as an industrial contaminant in the antiseptic hexachlorophene and in the bactericide 2,4,5-trichlorophenol. (Products made from the latter include 2,4,5-T, a popular herbicide that was a component of Agent Orange.) Bodily residues of the more highly chlorinated dioxins, say Schechter and Ryan, could come from exposure to pentachlorophenol, a chemical extensively used as a wood preservative, general bactericide and fungicide.

Scientists last year reported similar TCDD levels among the controls of a preliminary study investigating the likelihood of finding dioxin residues in the tissues of Vietnam veterans. Writing in *ENVIRONMENTAL RESEARCH* (Vol. 33, p. 261), Michael Gross and his colleagues from the University of Nebraska in Lincoln and two Environmental Protection Agency laboratories reported that it appeared that here too were signs of a "baseline accumulation of TCDD in some members of the general U.S. population."

In a second paper, Schechter and Ryan reported on the first measurements of dioxins and furans in the adipose tissues (fat) of Vietnamese. The researchers see northern Vietnam, where Agent Orange was not used, as a control for the population in southern Vietnam, onto which the U.S. military dropped some 19 million gallons of TCDD-contaminated herbicides, mainly Agent Orange. For this study, Schechter obtained the fat samples of patients in hospitals awaiting surgery from autopsies while he was visiting the country last year as a guest lecturer. Vietnamese physicians and scientists studying Agent Orange and dioxin asked him to take the fat samples back for analysis in the West, where techniques are available to measure minute quantities of toxic chemicals.

Five patients and two autopsies from Schechter from Hanoi's Viet Duc Hospital are from what was formerly North

Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs)



Of the 210 chemicals that make up the dioxin/furan family, 75 are dioxins. The long strings of numbers used to identify individual species, or isomers, within this family refer to the positions of their chlorine atoms. In 2,3,7,8- varieties, chlorines bond to the outermost left and right positions. Tetra-chlorinated isomers contain a total of 4 chlorines, pentas have 5, hexas 6, heptas 7 and octas a full complement of 8. Though the tetras are believed most toxic, many of the more prevalent, higher-chlorinated forms are not considered benign. And among higher-chlorinated isomers, those with chlorines at the 2, 3, 7 and 8 positions are considered most toxic, Schechter says. Fat biopsies indicate that most of the higher-chlorinated species found in humans contain such "2,3,7,8-substituted" dioxins and furans.

Vietnam. Able to detect dioxin levels as low as 2 ppt, Ryan's analysis of their fat showed no discernible TCDD, and little or no evidence of other dioxins and furans. According to Schechter, this makes them, with regard to these chemicals, "the cleanest tissues seen in the world anywhere to date."

By contrast, tissues from 13 people hospitalized in Ho Chi Minh City (formerly Saigon), to the south, "showed the same types of dioxins and furans as are found in North Americans." Moreover, the levels of dioxins and furans identified in them were similar to those in North Americans except for TCDD — where "the mean, on a net weight basis, was 22.1 ppt, or about three times the value we were getting in the United States," Schechter says.

Based on the pattern of more highly chlorinated contaminants — those having between five and eight chlorine atoms in each molecule — Schechter and Ryan see what looks to be the same pentachlorophenol "fingerprint" of dioxin and furan contamination in the people from southern Vietnam that exists in North Americans. And that's not surprising, they say, since pentachlorophenol has been widely used in South Vietnam, probably from the days when the French ruled. However, since TCDD is not among the many dioxins that contaminate pentachlorophenol, the researchers suspect that the high TCDD levels they detected in the fat from 10 of the 13 southern Vietnamese most likely represent a residual contamination from the heavy use of Agent Orange there during the war.

In light of these findings, Schechter and Ryan suggest that Vietnam would be the ideal place to conduct a major epidemiologic study of dioxin's health effects. "We're talking about a potential sample population of exposed and controls here of 60

million people," Schechter says.

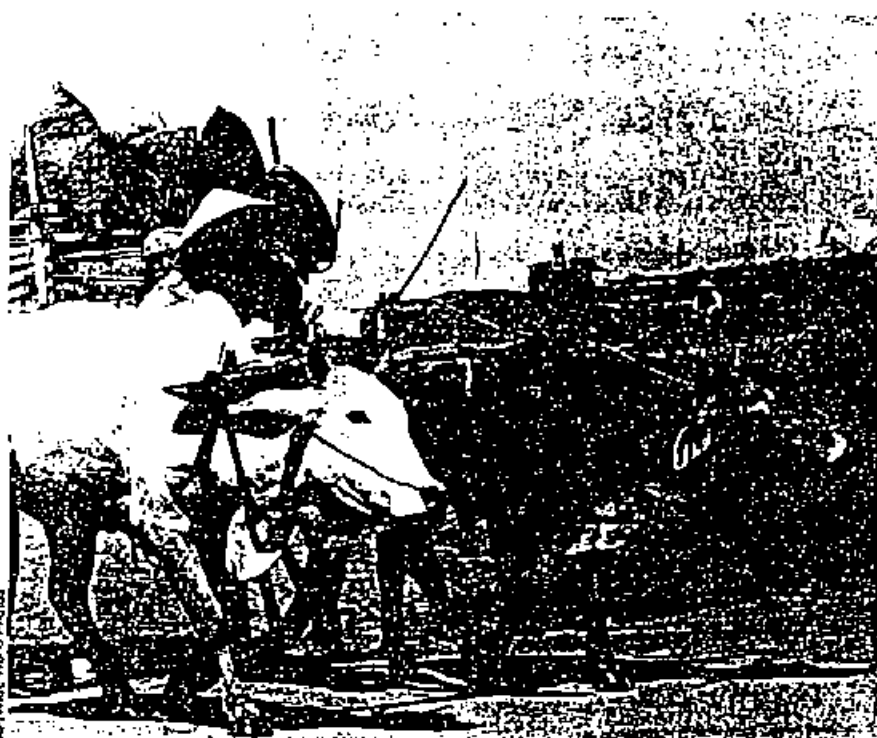
Schechter also points out that the longer researchers wait to conduct a Vietnamese study, the weaker its potential results would be. Unless replenished, body burdens of dioxins can slowly dissipate. If the high levels of TCDD found in some of the southern Vietnamese are due to high wartime and postwar exposures to Agent Orange, eventually their body burdens may fall back to background levels, whatever those might be.

That appears to have happened to Swedish forestry and agricultural workers exposed to chlorophenols and TCDD-contaminated herbicides during the 1950s and 1960s. In a paper given at the same meeting, Lennart Hardell reported on fat biopsies taken from seven such workers who had presumably received brief (two-week to 10-month) but substantial exposures to 2,4,5-T between 20 and 30 years ago, and who now have sarcomas. Three have soft-tissue sarcomas, the cancer type now most suspected of being caused by dioxin. All the workers' biopsies showed background levels of dioxin and furan contamination that were virtually identical to those in the 18 controls.

Hardell, a cancer epidemiologist with University Hospital in Umeå, Sweden, decided to look at adipose tissue from these herbicide sprayers because their work history and illness fit the profile of a potential dioxin-induced cancer — a profile he has helped elucidate over the past 10 years.

In one of his earlier studies, he found a fivefold increased risk of soft-tissue sarcoma associated with TCDD-contaminated herbicides and a sixfold increased risk of this cancer associated with chlorophenols.

From these and other data Hardell cal-



Peasant transports rice harvest in southern Vietnam, where Agent Orange residues may still be contaminating river sediments and soil.

culated a crude latency period for the onset of the cancer: 15 to 20 years for exposure to the herbicides, and 21 to 25 years for exposure to chlorophenols. He says that for Vietnam veterans, if these cancers are going to develop, "they should begin appearing in the 1980s and continue on through the end of the decade." However, his research also suggests that by the time such a cancer is diagnosed, it will probably be long after any fingerprint of Agent Orange exposure is visible in the form of elevated levels of dioxins and furans in their fat.

Hardell and Schecter see in this an important lesson for dioxin epidemiologists: that they risk losing validation of potential dose-effect evidence if fat biopsies of American Vietnam veterans and southern Vietnamese residents are not collected as soon as possible and correlated with what is known about these individuals' estimated exposure to dioxins and furans. In fact, Schecter believes the Vietnamese population offers to yield the stronger data. Because residues of the defoliating herbicides that rained over South Vietnam may still be present in river sediments and soil, contaminating fish and other foods, southern Vietnamese exposures to these chemicals may be more recent, if not higher, than those experienced by American servicemen, he notes.

That's one reason Schecter has decided to go back to Vietnam, probably within the next two months, for a small follow-up survey of adipose tissue. Not only does he want to see if an additional 100 samples show the same striking north/south differential in exposures to TCDD, but he also

plans to collect fish and breast milk as possible sources of TCDD contamination in the diet.

Alvin Young, formerly a dioxin researcher and now a policy analyst with the President's Office of Science and Technology Policy, is less sanguine about the value of such surveys. Citing confounding variables such as poor nutrition, infectious disease and drugs, he says it "would be impossible to try and control for all these in Vietnam." Moreover, he says, "Although [Schecter] says you have a very pure population of those exposed to dioxin, you also have two populations who experienced totally different war situations." Among other differences, he notes, the South was heavily bombed. In fact, Young believes any major federally funded dioxin study involving fat biopsies would be premature until results come in from a new Veterans Administration study of 500 human fat tissues collected between 1970 and 1980; many of the tissues come from Vietnam veterans.

"Frankly, we [in the Reagan administration] are concerned about continuing to call wolf," he says. "There are so many important health issues in this country that we're very concerned that we now begin to put our dollars in places where there are actual data of significance on people dying of cancer. In the case of dioxins, we don't have records of a single person dying from a dose of TCDD."

However, Hardell and Schecter say there is a growing body of data linking dioxins to cancer. In addition to his soft-tissue sarcoma studies, Hardell notes a

Danish study, soon to be published in the British *JOURNAL OF CANCER*, showing an increased risk of those cancers linked with exposure to TCDD-contaminated herbicides. He also cites studies by himself and others linking nasal cancers to chlorophenols and reporting a two- to threefold increased risk of liver cancer in Vietnamese exposed to Agent Orange.

Most U.S. attention on the consequences of human dioxin exposure has focused on health risks to Vietnam veterans. But the finding that civilians have also sustained inadvertent dioxin exposures brings the importance of dioxin toxicology results much closer to home.

Where do the civilian exposures come from? At the Miami meeting, David Firtstone and colleagues from three Food and Drug Administration (FDA) laboratories described their analyses of dioxin residues in fish and other foods. Though the found trace residues in the edible portion of fish from certain regions in the Great Lakes and elsewhere, they said, "the presence of 2,3,7,8-TCDD in fish does not appear to be widespread, but rather is localized in areas near 2,4,5-TCP and 2,4,5-T production sites." FDA analyses since 1971 for more highly chlorinated dioxins have turned up hepta- and octa-chlorinated species in eggs, bacon, chicken, pork chops and beef liver—contamination that the researchers say appears to be related to agricultural use of pentachlorophenol.

Christoffer Rappe and co-workers from the University of Umeå reported in a series of papers on another source of dioxin and furan contamination of the diet: air pollution from municipal, industrial and hazardous-waste incinerators. Dioxins and furans can be generated during the combustion of organic chemicals, polyvinyl chloride and some chlorinated solvents. In fact, in Scandinavia, these incinerators are the best-known source of dioxins. Rappe, an organic chemist whose work has focused on dioxins for many years, has more than a passing interest in the subject. Living only 100 yards from such an incinerator in Umeå, he decided "I had to do a risk calculation on whether to sell my house."

For these calculations, Rappe's team measured dioxins and furans in the air pollution plume downwind of the Umeå incinerator. Measured quantities of the furans and dioxins were then converted based on what is known about the relative acute toxicity of each, into TCDD equivalents. The result was a finding of 55 femtograms of TCDD equivalent per cubic meter of air. (A femtogram is 10^{-15} gram.) Assuming his 50-kilogram wife inhaled 20 cubic meters of air daily, he calculated a daily dose for her of 0.02 picogram (a picogram is 10^{-12} gram) per kg of body weight per day—well below the 1 to 5 pg/kg body weight that he says is being discussed by some scientists as a possible

"allowable daily intake" value for TCDD. He decided not to sell his house.

However, Rappe's research shows, inhalation is probably not the primary route by which these incineration pollutants enter the body. Milk from dairy cows grazing under the incinerator's plume exhibits 10-fold higher dioxin and furan contamination than milk from cows grazing elsewhere, his data show. More important, he says, "We found the cows pick up only the most-toxic 2,3,7,8-substituted dioxins and furans." The Umeå researchers have also measured levels of these chlorinated chemicals in Baltic seals, salmon and human breast milk (see chart).

Rappe says that based on his data, Sweden's EPA decided to enact a moratorium on all new incinerators beginning last February, during which time his group will begin monitoring for trends in dioxin levels in the diet — particularly in breast milk, because of its potential relationship to child health. His research already suggests that nursing infants can get very high doses (measured in TCDD equivalents) — 20 to 100 times the amount being discussed as an allowable daily intake value.

Ironically, Rappe's group has found, incinerators needn't be potent polluters. When one incinerator that they had monitored emitting 80 nanograms of TCDD equivalent per cubic meter of exhaust gases was inspected six months later — after it had been "tightened up" to limit air

DIOXIN, DIBENZO-P-DIOXIN AND FURAN SOURCES (TCDD EQUIVALENTS)	
Inhalation of air (contaminated with 55 femtograms of TCDD equiv./meter ³)	0.02
Baltic salmon (roughly 100 grams)	20
*Though a wide range of dioxins and furans have been measured in these sources, the values given portray the sum — based on estimates of their relative toxicity — calculated in TCDD equivalents.	
Although an allowable daily intake (ADI) value being discussed within the dioxin-research community is only 1 to 5 picograms of TCDD equivalent per day, work in Rappe's lab suggests a bioaccumulation of these pollutants can lead to human dietary exposures well in excess of the proposed ADI.	

leakage — it emitted a mere 6 ng/m³. Combustion turbulence, which can vary dramatically depending on how well the combustion chamber is sealed, seems to be the most important factor in determining dioxin/furan emissions, explains Rappe.

While analytical techniques resolve in ever-clearer detail the extent to which dioxins and furans contaminate our environment and ourselves, there is one vital

piece of the dioxin picture that remains fuzzy — the human toxicity of each of the chemicals that make up this large family. Though few people would suggest that these chemicals are harmless, what data exist on them currently defy any solid quantification of their risks. And that is what makes deciding how to respond to the newfound low-level population exposures such a dilemma for environmental policymakers today.



Understanding DNA and Gene Cloning: A Guide for the Curious

By Karl Drlica

A step-by-step guide to the understanding of life at its most fundamental level that requires little knowledge of chemistry. Layer-by-layer, Drlica peels away the mystery of gene cloning and exposes the elegance and simplicity of this new technology. Tells how genetic science has already revolutionized waste disposal, drug synthesis, cancer treatment and plant breeding. According to Drlica, man's ability to biologically program the next generation is near and everyone will eventually be faced with important personal and societal choices that will require informed decisions.

John Wiley & Sons, 1984, 205 pages,
9 "x 6", paperback, \$11.95

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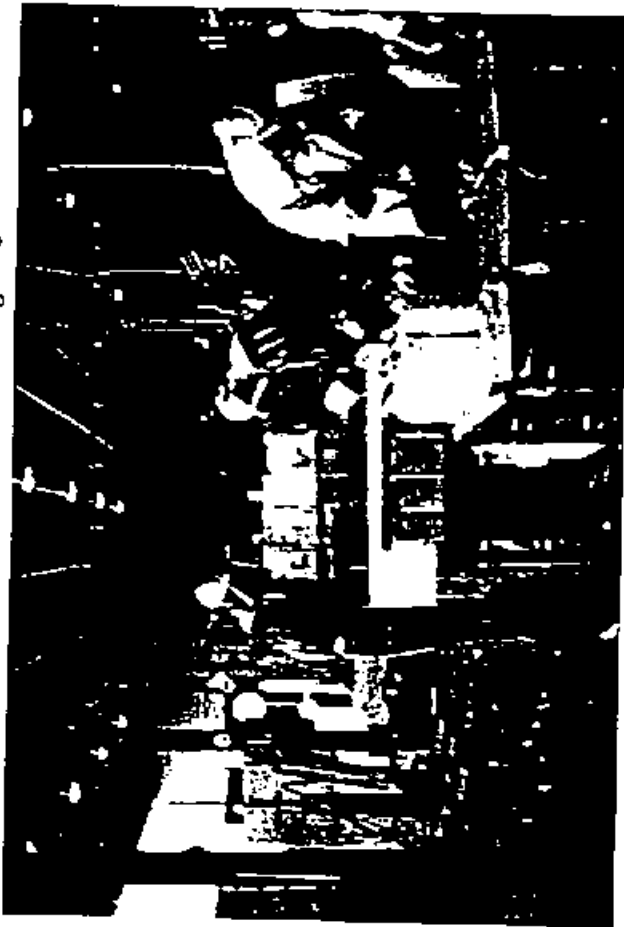
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RS 397

Drums in "Flammables Storage Area"



Recoup Activities in Building 873



Drum Transfer with Explosion-Proof Pump



Sampling and Excavation of PCP Storage Tank



Removal of PCP Storage Tank



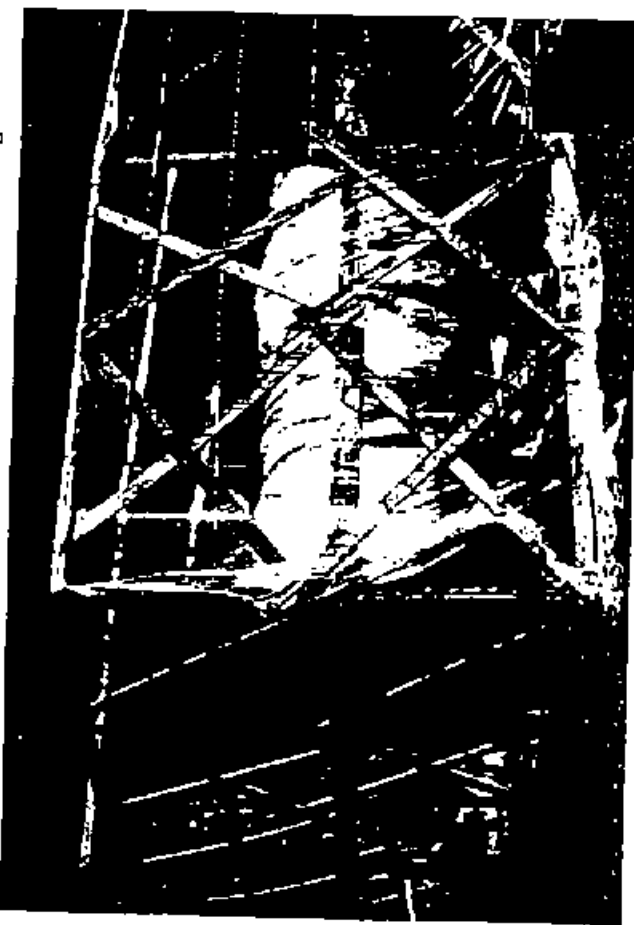
Demolition of Building 737



Excavation of Contaminated Soils in Building 737



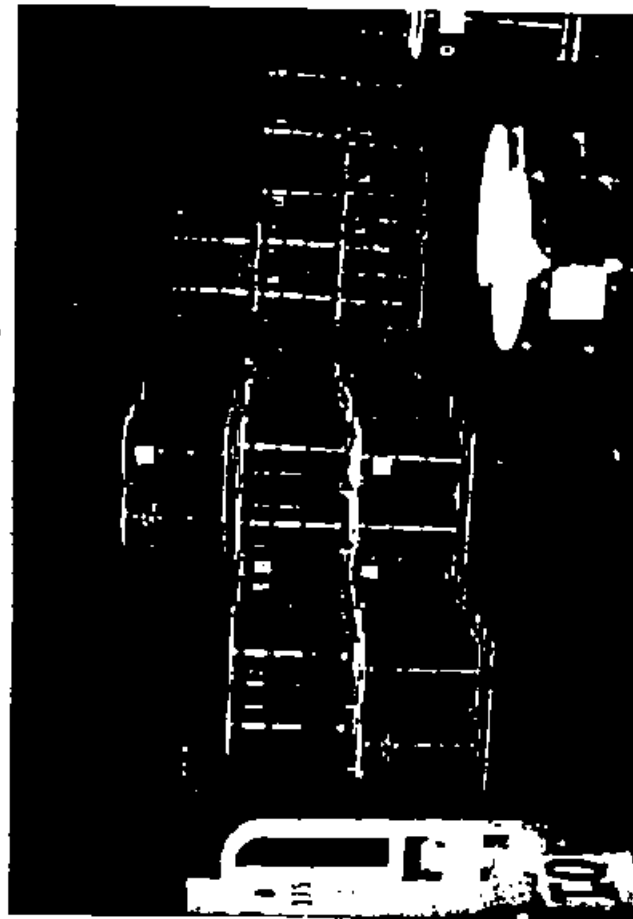
Las Vegas Co. is building for RCP storage tank



Water Treatment System



Storage in Bunker 783



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