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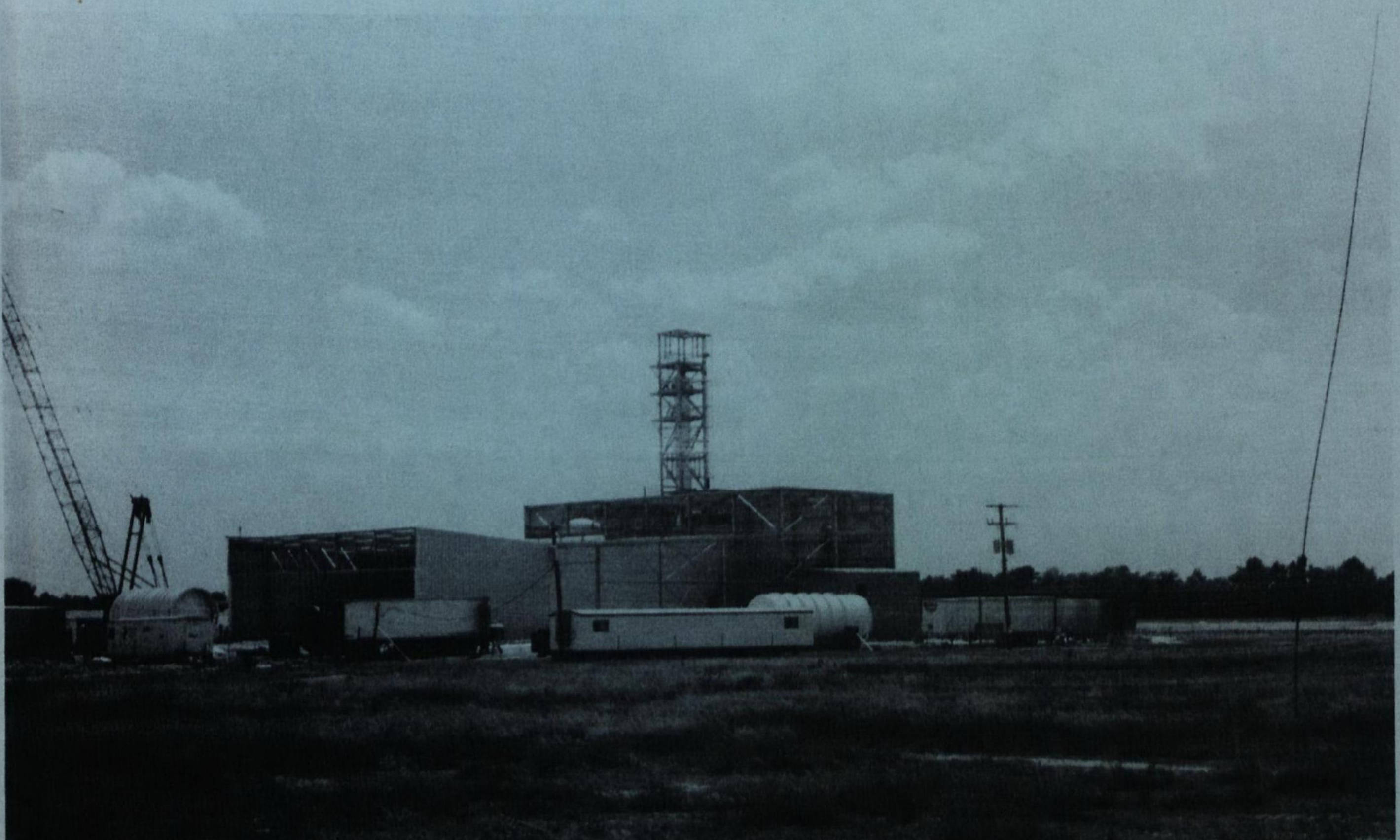
Public Health and Environmental Exposure Assessment

Draft

Unison PCB Separation Facility
Henderson County, Kentucky



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PUBLIC HEALTH AND ENVIRONMENTAL EXPOSURE ASSESSMENT
for
UNISON PCB SEPARATION FACILITY
HENDERSON COUNTY, KENTUCKY

Prepared by
U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia 30365

This Draft Public Health and Environmental Exposure Assessment addresses a proposed Toxic Substances Control Act operating permit for an alternate method of PCB disposal. This permit is to be used by a facility owned by UNISON, Inc. and located in Henderson County, Kentucky. Estimates of the potential exposure to UNISON's activities both in Henderson and around the county are provided. Estimates of how great these exposures are likely to be and their duration are also presented. A characterization of the risk associated with these exposure estimates is then described.

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AUG 0 1 1986
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EXECUTIVE SUMMARY

PURPOSE OF THE DOCUMENT

The Toxic Substances Control Act (TSCA) is the legislation under which EPA has the authority to issue an operating permit for this project. Regulations promulgated under TSCA require EPA to determine whether the proposed project will present an unreasonable risk of injury to health or the environment. The purpose of this study is to provide a detailed evaluation of the potential risks associated with the proposed UNISON project. The study documents the permit application review and provides the information upon which will be based the determination of whether the proposed project would present unreasonable risks of injury to public health or the environment. The study is also intended to provide an explanation to the public of the permit evaluation process. The document has been issued in draft form to allow public comment before a final decision on permit issuance is made.

DESCRIPTION OF THE PROPOSED PROJECT

The overall process begins with the transport of equipment and a solvent (known as TF-1) from regional warehouses to transformer sites. At the transformer sites, concentrated PCBs are drained from the transformer and drummed for shipment to an EPA approved PCB incinerator. The transformers are then filled with clean TF-1 which acts to leach out PCBs remaining in the transformer cases.

Several month later, UNISON personnel return to the transformer site with additional clean TF-1 and more empty drums. Since the first visit, PCBs which could not be drained from the transformers in the initial visit have gradually dissolved in the TF-1. TF-1 which has been exposed to PCBs in this way is call TF-X. At this second visit, UNISON again drains the transformers and refills them with clean TF-1. The TF-X removed from the transformers is drummed for eventual shipment to Henderson County, Kentucky, for processing.

The draining and refilling operation is repeated every few months until the PCB concentration has been substantially reduced. The last fill of TF-1 is then drained and this TF-X is drummed for shipment to Henderson. The transformer is refilled with a permanent dielectric fluid and recommissioned as a non-PCB transformer.

The UNISON facility in Henderson County, Kentucky, is located in the Henderson County Riverport Authority and Industrial Park at the intersection of Old Geneva Road and Riverport Access Road. It is about 1500 feet south of the Ohio River at River-Mile 808.

Transportation to and from the facility is along Riverport Access Road to Highway 136. Highway 136 connects with Highway 425, the Henderson By-Pass, which terminates at the Pennyrile Parkway. The connection with southern cities is made over the Pennyrile Parkway. The conection with northern cities is over Route 41 to Interstate 64. After completion of Interstate 164, traffic through Evansville will be along it rather than Route 41.

The process to be used at the Henderson facility is physical separation. Physical separations are based on physical chemical properties of substances and not on chemical reactions. The specific nature of the process is protected from disclosure by Federal law.

While the process itself cannot legally be described in this report, the equipment which carries out the process can be described in part. It consists essentially of sealed tanks and pipes. It has been designed according to the engineering standards recommended by the Center for Disease Control, and the

National Institute for Occupational Safety and Health (NIOSH) for the processing of PCBs.

All parts of the plant processing equipment are sealed against the escape of vapors except those few parts where it is unavoidable, such as the brief opening of drums for insertion of the drainage equipment. Vapors drawn off from various parts of the process pass through one of eight vent lines to the roof where they are released to the atmosphere. Before being released to the outside air, vapors must pass through beds of activated carbon at the end of each line. These remove almost all organic vapors. Vapor analyzers guard the vent lines just past the carbon beds to alarm any pass through beyond the trace amounts allowed in the air permit.

ALTERNATIVES

EPA has authority to analyze UNISON's process at their selected site and decide whether it would impose an unreasonable risk to public health or the environment. EPA does not have authority to select a site and make UNISON operate there.

UNISON claims to have selected Henderson in a three step process. Many potential sites were initially considered in the first screening. Sites outside of Kentucky, Indiana, and Tennessee were eliminated because they did not minimize the total mileage, i.e., the economic costs. In the second screening phase, Kentucky was selected because it offered the best flexibility in using the only three permitted incinerators. In the final screening phase, Henderson was selected as offering the best facilities.

UNISON also described several site characteristics which they say played a major part in their selection process. These included a site ten to fifteen acres in size, a flat site which was out of any floodplain, good highway access near the interstate system, and a site far enough away from the nearest community so that it would not result in unreasonable risks and yet close enough to a good sized labor pool which could supply about thirty employees, some of whom had to be skilled or technically trained.

There are four methods currently allowed by law for the disposal of PCBs:

- o High temperature incineration;
- o High efficiency boilers (for oils contamined with low concentrations of PCBs)
- o Landfills (for low concentration solids and drained transformer carcasses); and
- o Alternate methods permitted under 40 CFR 761.60(e).

Alternative methods of PCB destruction include methods which actually destroy PCB molecules and those which only separate the PCBs from whatever material they are contaminating. The proposed UNISON facility plans to use a physical separation process. Physical separation processes include:

- o Centrifugation;
- o Filtration;
- o Reverse osmosis;
- o Distillation;
- o Electrophoresis; and
- o Solvent extraction.

EPA has three options under TSCA in responding to a permit application. The request can be approved, it can be approved with certain specified conditions, or approval may not be given.

PUBLIC HEALTH AND ENVIRONMENTAL EXPOSURE ASSESSMENT AND RISK EVALUATION

The discussion is divided into two broad areas. These are ordinary operations and accidents. The accident discussion is further divided into on-site events and accidents during materials transportation. The Summary Table in Appendix 11 summarizes the accident evaluation.

Total air emissions will be less than 400 pounds per year. These emissions will be almost entirely TF-1 vapors (99.99+%), and they are expected to contain less than 0.0001% PCBs (less than one part per million).

The highest average annual concentrations found were at the Riverport Warehouse and Docks where there are typically twelve employees. The concentration of organic vapor was predicted to average 82.7 nanograms per cubic meter (parts per trillion) at this location. This is less than one twelfth the concentration of PCBs at which EPA and NIOSH have found workers could be exposed 40 hours per week without risk of injury. The projected exposures of TF-1 are also expected to cause no unreasonble risk.

No surface or groundwater releases are expected to occur during normal operations.

The accident analysis is divided into two parts. First, potential on-site accidents were evaluated. This evaluation included the following:

1. Fire and Explosion Related Releases - PCBs, TF-1 and TF-2 are inherently incapable of behaving like fuels. Technically they can be burned in high-temperature, high-oxygen environments of special incinerators, but they have no potential for burning outside of such environments. A number of scenarios were analyzed where runaway heating could occur, but they all involved a number of peculiar and unlikely events happening simultaneously. The chance of this happening was determined to be so remote that it did not warrant further analysis.

2. Potential Releases Due to Pollution Control Equipment Failure - In the unlikely event that UNISON's pollution control equipment fails, and that several employees are severely negligent within the same time frame, it was estimated that large releases of TF-1 containing 0.002% PCB's could continue for a duration of one week. Based on the assumption that such an event could occur once a year for 20 years, and that the same people would be downwind of the facility for the duration of all twenty such incidents, EPA evaluated the exposures to people downwind of the facility. The expected lifetime exposures and risks would be several orders of magnitude lower than those which the Agency has previously found do not pose an unreasonable risk.

3. Airplane crash involving the facility - The UNISON plant is located approximately one mile east of the Henderson/Henderson County Airport.

The probability of an airplane accident at the facility of sufficient magnitude to cause damage greater than minor leaks and spills is very small. Even though there is a low probability of occurence, the Agency did look at the exposures and risks which could result from such a crash. Worst-case PCB exposure estimates at all phases of the plane crash would result in no significant lifetime cancer risk.

EPA also evaluated the comparative exposures to incomplete combustion products from a fuel fire cased by a plane crash. The lifetime doses resulting from exposure to incomplete combustion products from such a fuel fire would be several orders of magnitude lower than those estimated for both short-term and long-term on-site exposures to incomplete combustion products in the soot resulting from a PCB transformer fire.

4. Earthquake - Various methods of estimating the chances of a major earthquake in the Henderson area could be utilized. One study indicated a 10% chance of a major earthquake in this area in the next 50 years. EPA concluded that the chances were sufficient enough to warrant an analysis of what the impact of a major earthquake would be. The three major potential consequences of an earthquake were evaluated: shaking, liquefaction and subsidence. Of all three earthquake effects, liquefaction appears to have the greatest potential for affecting the UNISON site. However, the character of underlying soils at the facility suggest that liquefaction effects, if they occur at all, would be very minimal. It has been concluded that some contamination of soils in the immediate area could potentially occur but significant contamination of the Ohio River from PCB's or TF-1 would not occur from a reasonably forseeable worst case earthquake.

Other types of potential on-site accidents including flooding and tornadoes were found to be much less likely to occur. The site is located above the 500 year flood level. A flood of this magnitude would put much of Evansville under water before the UNISON facility was endangered. An evaluation of the potential effects of tornadoes indicated that there is no unreasonable risk related to potential releases.

Transportation related releases are a possibility each time a truck load of materials travels on our nations highways. The potential for releases is estimated from both local and national perspectives. The national analysis estimated the total number of additional miles which will be generated by this facility. Average rates of accidents and releases were then used to estimate one releasing incident involving tankers carrying PCB residue or TF-2 every 18 years. There is a 50% chance that this release would involve PCBs. EPA took this analysis one step further to analyze what the result would be if these releases involved "worst case" accidents in the project area. Accidents occuring in two sensitive locations, the Ohio River Bridge and in a high density residential area, were evaluated.

The site for the bridge accident is the Route 41 bridge which crosses the Ohio River between Henderson Kentucky, and Evansville, Indiana. It was assumed that an entire 23 ton load of PCB residues would be released to the River. Due to the wide range of release and river flow characteristics, a variety of related possible bridge accidents were evaluated rather than one "worst case" incident. Because of this range of possibilities, it is difficult to accurately estimate the potential exposures and risks associated with transportation related spills into water supplies. Given the tendency of PCBs to bind to sediment it is expected that should a large spill occur only a small percentage of PCB's spilled will actually be carried in the water. Further, any dissolved PCB's would tend to be dispersed by the flow of the river, so that individual ingestion exposure to PCB's (either through contaminated fish or through drinking water) would be mitigated. The scenario of most concern would be a release to the River above the Evansville water supply intake during high flow conditions. Evansville does, however, have suitable technology available for effective treatment. As long as emergency notification procedures are properly implemented, no PCBs should pass into the finished drinking water supply.

EPA also evaluated several scenarios involving a spill along Highway 41 in Evansville. The worst of these cases assumed the largest possible amount of residues spilled on hot pavement in a residential area. Exposure to initial concentrations of PCBs and any vapors would be limited to a maximum one hour response time (time to cover the spill area in order to mitigate inhalation exposure). In such a case, emergency response personnel would be subject to the greatest potential exposure. Assuming that emergency response personnel do not wear respirators, the resulting exposures would be less, by one or two orders of magnitude, than those found not to pose an unreasonable risk to workers in manufacturing facilities which inadvertently generate PCBs.

Available studies indicate that the levels of organic vapors within one hundred meters of a large spill from a PCB residue or TF-2 tanker truck could result in eye and respiratory irritation. Direct contact with the spill material could result in skin irritation (dermatitis). Such effects from a a predicted worst case spill are believed to be reversible with no long term adverse health consequences.

PROPOSED EPA ACTION

Based upon a review of UNISON's permit application and the material presented in this document EPA has made a preliminary determination that operation of the proposed facility at the UNISON site in Henderson will not pose an unreasonable risk of injury to human health or the environment. This determination is conditional upon the Draft Conditions of Authorization which are listed in Chapter 9.

EPA has also authorized the initiation of the test demonstration in late August. This test will determine whether the process operations achieve adequate separation of PCB residues and meet restrictions on emission levels. EPA's final decision on authorization of plant operation will be based on the results of the test demonstration as well as the comments received on this Draft Public Health and Environmental Exposure Assessment.

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1.0 INTRODUCTION

This report summarizes the results of a Public Health and Environmental Exposure Assessment conducted by EPA Region IV on the proposed UNISON* PCB separation facility to be operated in Henderson County, Kentucky. The report is intended primarily as a public information document which describes those aspects of EPA's study which can be revealed without compromising UNISON trade secrets. The report summarizes information and analyses required by EPA to evaluate a request by UNISON to operate an alternate method of PCB disposal under the Toxic Substances Control Act (TSCA).

Section 2.0 of the report provides a description of the background of the study, including the project history, study objectives, applicable regulatory framework, and background information on the chemistry of PCB's. Section 3.0 provides a description of the proposed project, including both on-site and off-site activities and processes. Section 4.0 summarizes the various site and process alternatives available to the TSCA permit applicant (UNISON) as well as options available to EPA regarding permitting of the facility. Section 5.0 is an assessment of the potential exposures of the public and the environment which could result from operation of the facility, including those resulting from both on-site and off-site activities and processes. Section 6.0 describes the socioeconomic effects of construction and operation of the facility. Section 7.0 summarizes the applicant's efforts to mitigate health and environmental effects and discusses additional mitigation available to minimize risks associated with facility operation. Section 8.0 summarizes public participation related to the project, and section 9.0 presents EPA's proposed decision on the application.

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*"Unison Transformer Services, Inc., a wholly owned subsidiary of Union Carbide Corporation" is abbreviated throughout this document simply as "UNISON".

2.0 BACKGROUND

This section describes the history of EPA's involvement in the UNISON project and the purpose of this document. An overview of Toxic Substances Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA) regulations as they relate to the proposed facility is also given. Finally, some background on PCB chemistry is provided.

2.1 HISTORY OF THE PROJECT

Early in 1984, UNISON entered into discussions with EPA's Office of Pesticides and Toxic Substances (OPTS) regarding the possibilities of decontaminating PCB transformers using an alternative disposal method. OPTS has jurisdiction over alternative methods which are mobile or may be operated in more than one region. Regional EPA offices have jurisdiction over alternative methods to be operated solely within each region (See 40 CFR 761.60(e) in Appendix 1). In September 1984, UNISON submitted an application for its process to be operated at a site in Chicago. Before action could be taken, the site was purchased by a competitor.

In September 1985, UNISON updated its application to specify Henderson County, Kentucky as its preferred operating site and jurisdiction over its application was transferred to EPA's Region IV offices in Atlanta. Region IV is processing the application with technical and policy assistance from OPTS.

At about that time, EPA began receiving letters from concerned citizens in the area requesting a detailed study of the project and a public meeting. EPA then determined that there were several issues which should be investigated in detail and presented to the public before action was taken on the permit application. This document presents the results of that investigation.

Before the Scope of Work for this document was finalized, a public meeting was held in the project area to gather additional input from the public. This meeting was held in Henderson, Kentucky, on December 2, 1985. Eight hours of testimony from concerned citizens were gathered at the meeting. A summary of major issues raised at the meeting is presented in Section 8.0.

Early in 1986, UNISON submitted its completed permit application for the proposed facility to Region IV. The Scope of Work for the Public Health and Environmental Exposure Assessment was then finalized and work on review of the application was initiated.

2.2 PURPOSE OF THIS DOCUMENT

The Toxic Substances Control Act gives EPA authority to issue an operating permit for this project. TSCA and regulations promulgated under TSCA require EPA to determine whether the project will present an unreasonable risk of injury to health or the environment. The purpose of this study is to provide a detailed evaluation of potential risks associated with UNISON's proposed project. The study documents the permit application review and provides information concerning EPA's determination regarding potential unreasonable risks of injury to public health or the environment. This study is also intended to provide an explanation of the permit evaluation process. EPA has prepared this public information document as part of its on-going effort to be responsive to public concerns. EPA believes that a valuable public purpose is served by the open discussion of the issues involved. The document has therefore been issued in draft form to allow public comment before a final decision on permit issuance is made. EPA's proposed decision is described in Section 9.0.

2.3 REGULATION UNDER THE TOXIC SUBSTANCES CONTROL ACT

EPA is given authority to regulate PCBs in the Toxic Substances Control Act (TSCA) of 1976. Section 6(e) of TSCA (see Appendix 1) generally prohibits manufacture and use of PCBs as of January 1, 1978. However, exceptions were made for uses which are "totally enclosed" or which EPA determines "will not present an unreasonable risk of injury to health or the environment." Regulations promulgated under TSCA Section 6(e) are codified in 40 CFR 761 (See Appendix 1). Among other things, these regulations require disposal of PCBs in special facilities and allow and encourage the decontamination of existing transformers.

When these regulations were promulgated, PCBs like the ones UNISON proposes to treat were only allowed to be destroyed in high temperature incinerators. At that time, incineration was the only proven method. New methods which might be developed were intended to be covered by Section 761.60(e). This section allows EPA to approve "an alternative method of destroying PCBs" if "this alternative method can achieve a level of performance equivalent to ...incinerators". EPA policy is to treat physical separation of PCBs as a new method under the same framework as chemical or thermal destruction of PCBs. UNISON, therefore, has submitted an application for a permit under the alternative disposal method rules. A copy of UNISON's application, free of confidential business information, is available in Henderson and Evansville libraries. The alternative disposal rules and EPA policy statements covering these rules are provided in Appendix 1.

Under TSCA regulations, industrial processes are regulated rather than construction of a facility. A "process" would include off-site activities (e.g., transportation and materials handling) and on-site facility-specific details such as valve specifications, instrument brands, emergency procedures and content of training programs. EPA's authority is limited to determining whether the process at a proposed site might present an unreasonable risk to human health or the environment. EPA can impose conditions on the process to eliminate or minimize risks which might be considered unreasonable, or EPA can refuse to approve the process altogether if unreasonable risks cannot be avoided.

Any company wishing to receive an approval for the operation of an alternative PCB disposal method must first submit an application to EPA. Since UNISON's proposed separation facility is to be operated in Region IV, the request for approval will be acted upon by the Region. (Regarding juridiction over applications, see 40 CFR 761.60(e) in Appendix 1). Applications for approval to operate alternative methods require the following (EPA April 1985):

1. A description of the project organization including persons responsible for obtaining permits, the project manager, facility manager, and safety officer.

2. A description of waste intended to be treated in the unit, including the type of waste to be destroyed (liquid or solid), the proposed total waste and PCB feed rates, and the matrix* and composition of the waste, including major and minor constituents and PCB content.

3. A process engineering description including process flow diagram, narrative description of the system, description of the theoretical basis for the destruction process, layout diagrams, descriptions of the plant or mobile unit, detailed engineering drawings, intended location of the facility and intended location when in storage.

4. A narrative description of the waste feed system, description of waste preparation, and estimate of waste volume.

5. A description of the automatic waste feed cutoff system when process conditions exceed normal bounds, and a description of the procedures to shut off the waste feed line or the whole process in the event of an equipment malfunction.

6. A narrative description of the destruction** system (e.g., descriptio of chemical reactions, stoichiometry, reagents, catalysts, process design capacity), and a list of products and by-products and their concentrations.

7. A description of the pollution control system for process effluents (air emissions, liquid effluents, sludge, solid waste, etc.), design parameters, and important operating parameters of the pollution control system and how they will be monitored.

8. A summary of process operating parameters which lists target values as well as upper and lower boundaries for all measured operating parameters, instrument settings and control equipment parameters.

9. A sampling and monitoring program to monitor process operation and to verify PCB destruction.

10. Sampling procedures including an explanation of the apparatus, calibration procedures, and maintenance procedures.

11. Analytical procedures (e.g., methods, instruments, etc.).

12. Monitoring procedures (methods, instruments, etc.).

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*The matrix is the set of chemical compounds in which the PCBs are dissolved or on which the PCBs are adsorbed. In this project, the matrix is TF-1, a proprietary solvent used to extract PCBs from transformers.

**"Destruction" refers to the elimination of PCBs from the matrix and hence includes separation as is the case here.

13. A spill prevention control and countermeasure plan.

14. A safety plan.

15. A training plan.

16. A demonstration test plan.

17. Test data or engineering performance calculations.

18. Copies of other required permits/approvals.

19. Schedule for operation.

20. A quality assurance plan.

21. A copy of the plant or facility operational plan.

22. A closure plan for the facility.

Once a complete application has been submitted, EPA performs its review. The review involves both a review of the application and a demonstration test. If the technical information in an application indicates that the process cannot achieve safe and effective PCB disposal, approval will not be given. If the demonstration test does not show the process to be effective and safe, approval for the process will also be denied (see 51 FR 6423 et. seq. in Appendix 1).

2.4 REGULATION UNDER THE RESOURCE CONSERVATION RECOVERY ACT

The Resource Conservation Recovery Act (RCRA) was passed by Congress in 1976. RCRA was intended to be a comprehensive program for the cradle-to-grave management of hazardous wastes. RCRA Section 1004(5) specifically defines hazardous waste as waste,

> "which because of its quantity, concentration, or physical, chemical or infectious characteristics may -
> (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
> (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

This definition of hazardous waste is broad. However, in Subtitle C, Section 3001(a), Congress required EPA to formulate a narrow and specific definition of the term "hazardous waste". Congress promulgated this limitation on EPA's authority because the U.S. Constitution requires that criminal defendants be given very clear and unambiguous notice of exactly which activities will be considered criminal. The intent was to make RCRA criminally enforceable.

In response to this Congressional directive, EPA formulated a comprehensive definition of hazardous waste (see 40 CFR 261) which would be enforceable against those who mismanaged hazardous wastes. It includes any waste which is ignitable, corrosive, reactive or liable to leach out of a landfill, and, in order to avoid any misunderstandings, lists a large number of compounds and many industrial process effluents by name. It does not, however, list PCBs or the types of materials UNISON proposes to treat. PCBs are not as hazardous as many of the materials used in modern society. They are not ignitable, corrosive, reactive or liable to leach out of a landfill. Since, according to these criteria, PCBs were not as dangerous as other chemicals regulated under the Act and PCBs were already regulated under TSCA, PCBs were not named in the lists of hazardous chemicals.

However, PCBs may soon be regulated under RCRA. Evidence collected by EPA since the ban on PCB manufacture indicates that the level of PCBs in the environment is not dropping as fast as expected. PCBs are much more persistent in the environment than was previously believed and an unknown quantity continues to be disposed of improperly. RCRA rules are currently undergoing consolidation and simplification. As part of this process, EPA plans to include PCB products such as those to be treated by UNISON, in the definition of hazardous wastes. Until then, such wastes remain governed primarily by TSCA.

2.5 CHEMISTRY OF POLYCHLORINATED BIPHENYLS (PCBs)

Polychlorinated biphenyls (PCBs) and related compounds are classified as aromatic hydrocarbons. Aromatic hydrocarbons are organic chemicals which are modifications of and/or combinations of benzene, the simplest aromatic compound.

Benzene is a simple ring of six carbon atoms. Most of the bonding energy of the carbon atoms is devoted to holding the ring together, but each carbon atom has one bond left over which points out and away from the ring. This bond attaches to a hydrogen atom (hence, the term hydrocarbon).

If one of the hydrogen atoms is removed and some other element or chemical group is put in its place, the benzene is converted into another chemical with different but related properties. Many important chemicals are made with similar modifications. They include perfumes, dyes, inks, glues, and various poisons. Aromatic chemistry is the study of different modifications of benzene.

PCBs are made by first joining two benzene molecules together to form a biphenyl molecule. This biphenyl molecule is made by removing one hydrogen atom from each of two benzenes so that the two rings combine. The resulting biphenyl molecule can be visualized as two hexagons stuck together with a short line. If additional hydrogen atoms are removed from the biphenyl molecule, other elements and molecules can be substituted to make a wide variety of biphenyls. If hydrogens are replaced with chlorine atoms, the resulting molecules are called polychlorinated biphenyls (PCBs).

Since there are ten hydrogen atoms on a biphenyl molecule and any one or combination of them could be replaced with chlorine, there are two choices for each of ten positions or 2^{10} (1024) possible combinations. However, many of these combinations do not have a distinct chemistry because they are exact mirror images of other combinations. There are 209 distinctly different PCBs.

PCBs can be destroyed by heating them to high temperatures. As the temperature rises, the PCB molecules collide with each other more and more violently. Above a few hundred degrees celsius, the molecules start breaking apart. The pieces recombine in a complicated series of chemical reactions that result in a great variety of new compounds. Some of these new molecules can be much more dangerous than PCBs, especially if they are formed, as is typically the case, in the presence of oxygen.

If the temperature gets high enough, the PCBs break up into individual atoms. The hydrogen atoms combine with chlorine to form hydrochloric acid or with oxygen to form water. The carbon atoms combine, if oxygen is present, with one or two oxygen atoms to form either carbon monoxide or carbon dioxide. If combustion is complete, almost all the carbon ends up as carbon dioxide. However, if the temperature does not get high enough and stay high enough long enough or if not enough oxygen is present, some of the carbon comes out as carbon monoxide. Under such conditions, there is a chance that some PCBs will not be destroyed or that they will have been converted into their more dangerous reaction products. See especially the discussion of fire in Sections 4.2.4, 5.2.1.3 and 5.2.2.5. The efficiency of the destruction of PCBs by incineration can be determined by monitoring the concentration of carbon monoxide in the emissions. If no carbon monoxide is detected in emissions, destruction of the PCB's to hydrochloric acid, water and carbon dioxide is essentially complete.

PCBs can be separated from other materials without destroying them. There are many ways to do this. Each method takes advantage of some property of PCBs that differs from the properties of other kinds of molecules the PCBs may be mixed with. For example, separations based on size differences are called filtrations, or, if an extraordinarily fine filter is used, reverse osmosis. Separations based on solubility are called solvent extractions. Those based on boiling point are distillations.

The proposed separation technology, in order to satisfy TSCA regulations, must achieve a level of performance equivalent to PCB incineration. EPA is only able to regulate "completeness" to the limits of accuracy of reasonable scientific tests. After treatment, the TF-1 must be completely free of PCB's as measured by whichever test EPA finds is most suitable.

3.0 DESCRIPTION OF PROPOSED PROJECT

This section describes the proposed project, including all stages from initial transformer draining to final incineration of the PCB residues. The location of various activities, including transportation between sites, material handling and site layout, and the proposed physical separation process are described. Information for this section has been taken primarily from UNISON's permit application.

3.1 OVERALL PROCESS

The overall process begins with mobilization of equipment and clean TF-1 at the regional warehouses which UNISON proposes to operate. UNISON technicians take the equipment and TF-1 to a nearby transformer site. At the site, concentrated PCBs are drained from the transformers and drummed for shipment to an EPA approved PCB incinerator. The transformers are then filled with clean TF-1. Equipment, unused TF-1 and drummed PCBs are then transported to the regional warehouse.

Several months later, UNISON personnel return to the transformer site with additional clean TF-1 and more empty drums. PCBs which could not be drained from the transformers in the initial visit have gradually dissolved in the TF-1. TF-1 which has been exposed to PCBs in this way is called TF-X. UNISON drains the transformers during this second visit and refills them with clean TF-1. The TF-X removed from the transformers is drummed for shipment to the regional warehouse. Shipments from the warehouse to the Henderson facility are made when a truck-load (sicty drums) has accumulated.

The draining and refilling operation is repeated every few months until the PCB concentration is low. After the last fill of TF-1 is drained (this TF-X is drummed for later shipment to Henderson) the transformer is refilled with a permanent dielectric fluid. UNISON must still return to the site to confirm decontamination. The permanent dielectric fluid must show a concentration of less than 50 parts per million PCBs after at least three months of use to be recommissioned as a non-PCB transformer (40 CFR 761.30 (a)(2)(v)). If the concentration after three months is more than 50 ppm but less than 500 ppm, the transformer qualifies for the intermediate status of "PCB-contaminated." Achieving this status has many benefits (see 50 FR 29179 et.seq.) but the transformer remains subject to a number of regulations.

At the regional warehouses, the initial drainage of concentrated PCBs is accumulated until a truck-load can be sent to one of several special PCB incinerators. Approved incinerators are located in Chicago, IL, near Houston, TX, and in El Dorado, AK*. TF-X is accumulated until a truck-load can be sent to Henderson. The warehouse also receives supplies of new TF-1 (from the manufacturer) or reconditioned TF-1 (from Henderson).

At Henderson, contaminated TF-X is received from the various regional warehouses. It is off-loaded with special drum handling equipment. The drums are drained in a part of the facility where vapors in the dead space at the top of the drum can be contained. Each drum is triple-rinsed with clean TF-1 and then refilled with additional clean TF-1 for shipment back to the regional warehouses (see 40 CFR 761.79 in Appendix 1). All materials removed from the drums, including the three rinses, are processed through the facility for separation** into clean TF-1 and concentrated PCB residues. These residues are stored on-site until a tanker-load can be sent to one of the special incinerators.

There are a limited number of PCB-transformers (at least 100,000 perhaps 150,000) still in existence. When these have been cleaned, any remaining inventories of TF-1 and the facility itself will lose their reason for existence. Leftover TF-1 will then be disposed of or sold for reuse elsewhere, which most likely will be for continued decontamination of transformers overseas. The ultimate fate of TF-1 is discussed in Section 7.1.3.

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*A fourth incinerator (the GE in-house incinerator) located in Pittsfield, MA has been approved since 1981, but, until very recently, had only processed PCBs for a single customer, General Electric. EPA has recently learned (as this document went to press) that this facility is now soliciting PCBs from other sources in small quantities. As GE runs out of PCBs, the Pittsfield incinerator will likely solicit outside work in greater quanitity. However, since GE is in the business of supplying new replacement transformers, it seems unlikely that they will ever do substantial business with UNISON. GE is an indirect competitor with UNISON.

**The separation is not perfect. Some TF-1 components are lost to the residues during processing. They are replenished at the end of the process with TF-2. TF-2 consists of the TF-1 components lost to the residues.

3.2 OFF-SITE ACTIVITIES

Off-site activities begin with the arrival of UNISON's service vehicle carrying drainage pumps and hoses, emergency decontamination and safety equipment, clean TF-1 in drums and clean empty drums for contaminated materials. The field team first drains each transformer. Experience with similar operations has shown that 85% to 90% of the concentrated PCBs will drain freely from the transformers. The remainder is absorbed in the transformer core or is trapped in undrainable pockets and slowly diffuses into the TF-1 once the transformer has been refilled.

If 15% of the concentrated PCBs remain in the transformer and all of them diffuse into the first refill of TF-1, the PCB concentration in the first batch of TF-X drained and delivered to Henderson could theoretically be as high as 15%. However, PCBs which drain poorly also diffuse poorly, and even in the most concentrated straight transformer fluid, PCBs only account for about two-thirds of the weight. Many contain much lower PCB concentrations. Because of these limitations, PCBs in the first drainage of TF-X are not expected to exceed 8%. In fact, they should average something less than half this amount, and the long term average of all TF-X drained from the transformers should be less than 2% PCBs. This is the figure EPA used in determining normal operating characteristics at the proposed facility. Higher figures, based on maximum possible concentrations, were used for some of the analyses in order to be conservative.

After draining and refilling have been completed, any drips or spills will be cleaned using EPA-mandated procedures. The cleaners and adsorbants so used will be separately drummed for incineration.

3.3 TRANSFORMER, REGIONAL WAREHOUSE AND INCINERATOR LOCATIONS

Transformers filled with concentrated PCBs are located all over the country. PCB transformers were considered superior to ordinary mineral-oil-filled transformers because they would not support a fire if the transformer shorted out. However, they were too expensive to use everywhere. Consequently, PCB transformers were installed primarily in occupied structures, including multi-unit dwellings, office buildings and certain industries. Fire codes often dictated use of PCB transformers. We now know that the disadvantages of PCBs, primarily toxicity and persistence in the environment, far out-weigh the advantage of non-combustibility (50 FR 29179 et.seq.). Unfortunately, many transformers are now located in close proximity to population centers.

The general location of most of these transformers is known to EPA (EPA 1976a). The distribution is roughly proportional to the size of populations in major metropolitan areas (USWAG 1982 Vol. I, Vol. III)

UNISON does not propose to decontaminate every PCB transformer. Competitors in the business are supplying similar services. Also, the high cost of transportation and reprocessing will probably make servicing the Western United States uneconomical from Henderson. Thus, some fraction of the transformers located in the Central and Eastern regions of the country constitute UNISON's potential market.

UNISON is under no obligation to decontaminate any transformers and may or may not conduct operations in any of the metropolitan areas shown in Figure However, UNISON is already advertising its remote-site (transformer decontamination) activities in a variety of media with wide circulation. While UNISON's exact marketing and operations strategy is confidential, one can model their activities by assuming regional warehouses will be operated in major metropoli areas east of Dallas and Kansas City and that the volume of business in each area will be proportional to the populations of those areas.

Figure 1 is a map of the United States showing metropolitan areas with a population of more than one million people. Western population centers are not shown. The areas of the circles are proportional to the number of people reported in the 1980 census.

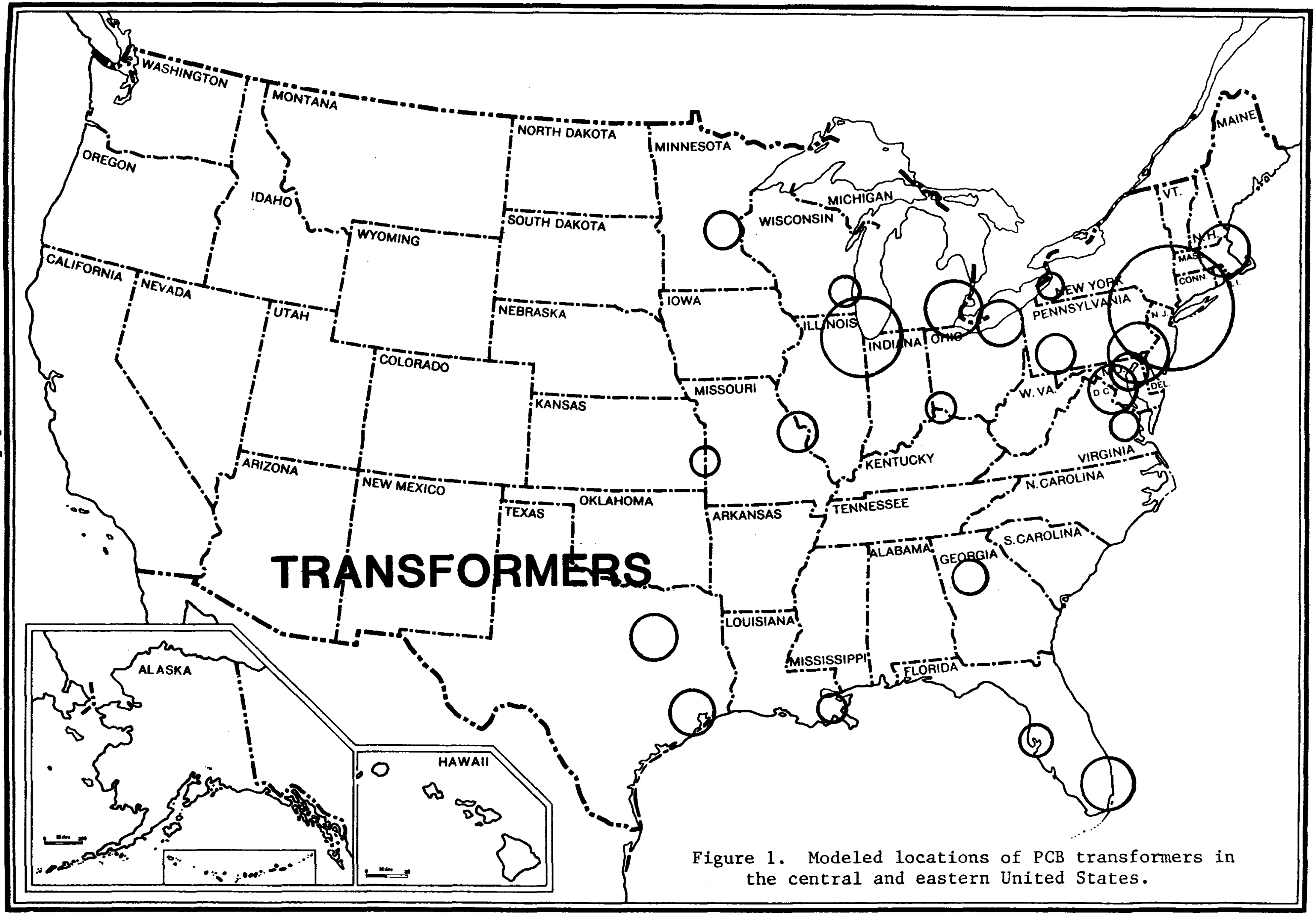

Figure 1. Modeled locations of PCB transformers in the central and eastern United States.

Table 1 lists the areas shown on the map, reported populations, percentage of business expected for each area, and mileage to or from Henderson*. The expected amount of travel between Henderson and the warehouses assuming the plant is operated at capacity is also indicated.

There are only three** incinerators suitable for destroying the concentrated residues to be separated at Henderson. Their locations are shown in Figure 2. One reason Henderson was chosen as the site for this facility is that its central location allows some flexibility in using the available incinerators. It is expected that UNISON will primarily use whichever incinerator is most reliable and economical. Generally, this means the bulk of all residues will be shipped to Chicago. The transportation risk analysis (see Section 5.2.2) assumes that 80% of the residues will be shipped to Chicago, 15% to Houston (Deer Park) and 5% to El Dorado, Arkansas. This mix is anticipated based on projected down time and total cost.

3.4 TRANSPORTATION TO AND FROM HENDERSON

TF-X and TF-2 will be shipped to Henderson. The TF-X drained from transformers and TF-2 from the manufacturer will be shipped in drum-trucks and tankers, respectively. TF-2 is a make-up transformer fluid used to replace material lost to the residues during reprocessing of TF-X into TF-1. TF-2 will be shipped to Henderson from the north (about 800 road miles) in tanker trucks carrying 23 tons each. At full capacity, the plant will consume 45 loads per year of TF-2.

Although TF-2 is not currently considered hazardous by either EPA or The Department of Transportation, a spill of TF-2 could have adverse effects on the environment. Transport of TF-2 is discussed in Section 5.2.2.

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* Distances are reported relative to Louisville rather than Henderson because that data was readily available. Louisville is 150 miles east of Henderson. This makes the reported mileage low for some sites and high for others. The total is very slightly less using this method principally because Louisville is closer to New York.

**See note on page 3-2.

Table 1. Modeled distribution of TF-1 and TF-X transport

Metropolitan Area	Population	% of Total	Trips/Year	Distance	Miles/Year
New York	17,606,680	26.34	819.10	766	627,430
Chicago	7,212,778	10.79	335.55	297	99,659
Philadelphia	4,779,796	7.15	222.37	706	156,990
Detroit	3,809,327	5.70	177.22	382	67,697
Boston	3,225,386	4.82	150.05	962	144,350
Miami	3,103,729	4.64	144.39	1088	157,098
Washington	2,763,105	4.13	128.55	601	77,256
Houston	2,521,857	3.77	117.32	941	110,400
Cleveland	2,493,475	3.73	116.00	354	41,065
Dallas	2,451,390	3.67	114.04	828	94,428
Saint Louis	1,848,590	2.77	86.00	256	22,016
Pittsburgh	1,810,038	2.71	84.21	393	33,093
Minneapolis	1,787,564	2.67	83.16	705	58,629
Baltimore	1,755,477	2.63	81.67	639	52,186
Atlanta	1,613,357	2.41	75.06	415	31,149
Tampa	1,354,249	2.03	63.00	838	52,796
Cincinnati	1,228,438	1.84	57.15	101	5,772
Milwaukee	1,207,008	1.81	56.15	382	21,450
Norfolk	1,099,360	1.64	51.14	647	33,090
Kansas City	1,097,793	1.64	51.07	513	26,200
New Orleans	1,078,299	1.61	50.16	701	35,165
Buffalo	1,002,285	1.50	46.63	545	25,412
Total	66,849,981	100.00	3,110.00		1,973,333

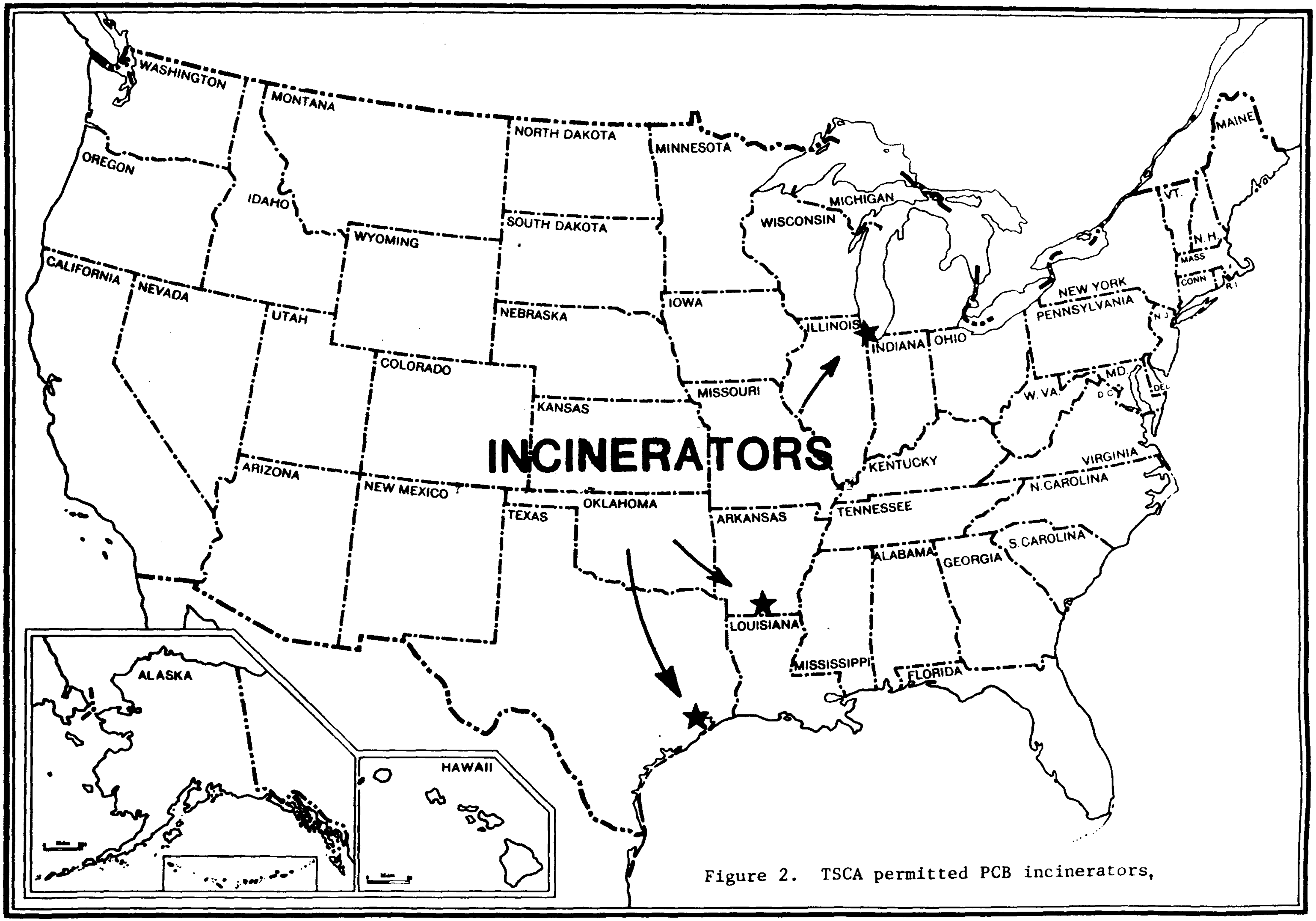

Figure 2. TSCA permitted PCB incinerators,

TF-X will be transported in specially outfitted tractor trailers equipped with a seal and liner containment system capable of preventing the release of any potential leaks or spills due to faulty welds or chimes and loose or missing bungs. Each truck will also carry emergency response materials including safety gear, clean-up materials, repair kits and over-sized drums into which any leaking drums (if discovered) can be placed. Section 5.2.2.7 discusses the chance of a drum leaking during transit.

The TF-X will be contained in heavy duty 55 gallon steel drums. Each drum will contain 650 lbs of TF-X. Assuming sixty drums per trailer, each load will equal 19½ net tons. Stacking of drums is not permitted. At capacity, the plant could theoretically handle as many as 1570 loads per year or about 30 loads per week.

Various materials will be shipped from Henderson, including clean TF-1 recovered by the plant, liquid waste residues (PCBs) and miscellaneous solid wastes. The miscellaneous solid wastes consist of soiled uniforms, spent activated carbon from the air purification system, materials used for soaking up minor leaks and spills and similar waste. Since these will be produced in small amounts and their transport involves only the most minimal hazards, they will not be discussed further in this report.

TF-1 will be returned to the regional warehouses in the trucks that deliver TF-X. A total of 1540 loads of TF-1 are expected to be produced annually by the facility if it is operated at capacity.

PCB residues separated at the facility will be shipped to the incinerators in tankers. Each truck will haul 23 tons of residues. At capacity, there will be 74 loads per year, or a little less than 1½ loads per week.

UNISON is preparing a plan for driver emergency preparedness and related matters. Such procedures will be described when available. They should be available shortly after this report is published.

3.5 MATERIALS HANDLING

The majority of all transportation related leaks and spills (in the case of drums, the overwhelming majority) take place during loading and unloading rather than during over-the-road travel. Special attention was therefore given by UNISON's engineers both to avoiding spills and to containing spills if they were to occur despite such precautions. Much of the materials handling system is automated and proprietary and cannot be legally disclosed in this report. Nonetheless, certain key features have been disclosed in proceedings before the Henderson County Board of Zoning Adjustment or the Kentucky Natural Resources and Environmental Protection Cabinet and can be mentioned here. These features are noteworthy:

- The places where trucks park during loading and unloading are protected from the weather by side-walls and a roof so that spills cannot be washed away in the rain;
- Loading and unloading areas are diked and sloped toward "blind"* sumps so that spills cannot escape - containment is sufficient for a full truck-load;
- Concrete surfaces in the loading and unloading areas have been coated with a PCB-impervious** material so that spills do not soak in and can be cleaned up more easily;
- Vents on tankers are connected to the plant air pollution control system so that vapors do not escape as the tankers fill;
- Lift trucks used for loading and unloading drums are not fitted with the "forks" one typically finds but with dedicated drum handling equipment unlikely to cause punctures;
- When the drums are opened, a special exhaust system draws vapors away and passes them through the plant air pollution control system;
- No drums are opened until they are on the automatic conveyor system; drip pans underneath this system catch any spills;
- Tractors are removed from the trailers and the trailers are chocked before they are unloaded; they are also tagged with a "Do Not Move" sign; and
- All drums are tested with pressurized air in order to detect possible leaks before they are refilled.

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*A "blind" sump is simply a low spot in the floor, usually a square pit, with no outlet.
**"Impervious" is a relative term. See the discussion on page 5-4.

3.6 SITE LAYOUT

The UNISON facility is located in the Henderson County Riverport Authority and Industrial Park at the intersection of Old Geneva Road and Riverport Access Road also known as Spencer Road (Figure 3). It is about 1500 feet south of the Ohio River at River-Mile 808. The Administration Building and employee parking lot are located along the west side of Riverport Access Road. Further to the west and surrounded by a security fence are the Recovery Center grounds. A paved area on which trucks can maneuver leads to the shipping and receiving docks.

The entire grounds are graded and sloped toward a system of ditches that surrounds the property and empties (after passing through a series of storm ditches) into Canoe Creek. The distance from the facility to the Ohio River along Canoe Creek is a little over five miles (Figure 4).

Transportation to and from the facility is along Riverport Access Road (or alternatively, from the back of the property, along Industrial Park Drive) to Highway 136 (Figure 5). Highway 136 connects with Highway 425, the Henderson By-Pass, which terminates at the Pennyrile Parkway. Here the traffic splits. The connection with southern cities is made over the Pennyrile Parkway. The connection with northern cities is over Route 41 to Interstate 64. Traffic through Evansville will be along Interstate 164 after its completion, rather than Route 41. The proposed route of I 164 is shown on Figure 24.

3.7 IN-PLANT PROCESSES

The process to be used at the Henderson facility is a physical separation. Physical separations are based on physical-chemical properties of substances and not on chemical reactions. Physical separation processes may include centrifugation, filtration, reverse osmosis, distillation, electrophoresis, solvent extraction or other processes. Which of these will be in actual use at Henderson is protected from public disclosure by Federal law. The process is not patented and UNISON believes it could be copied by their competitors with substantial savings in research and development costs.

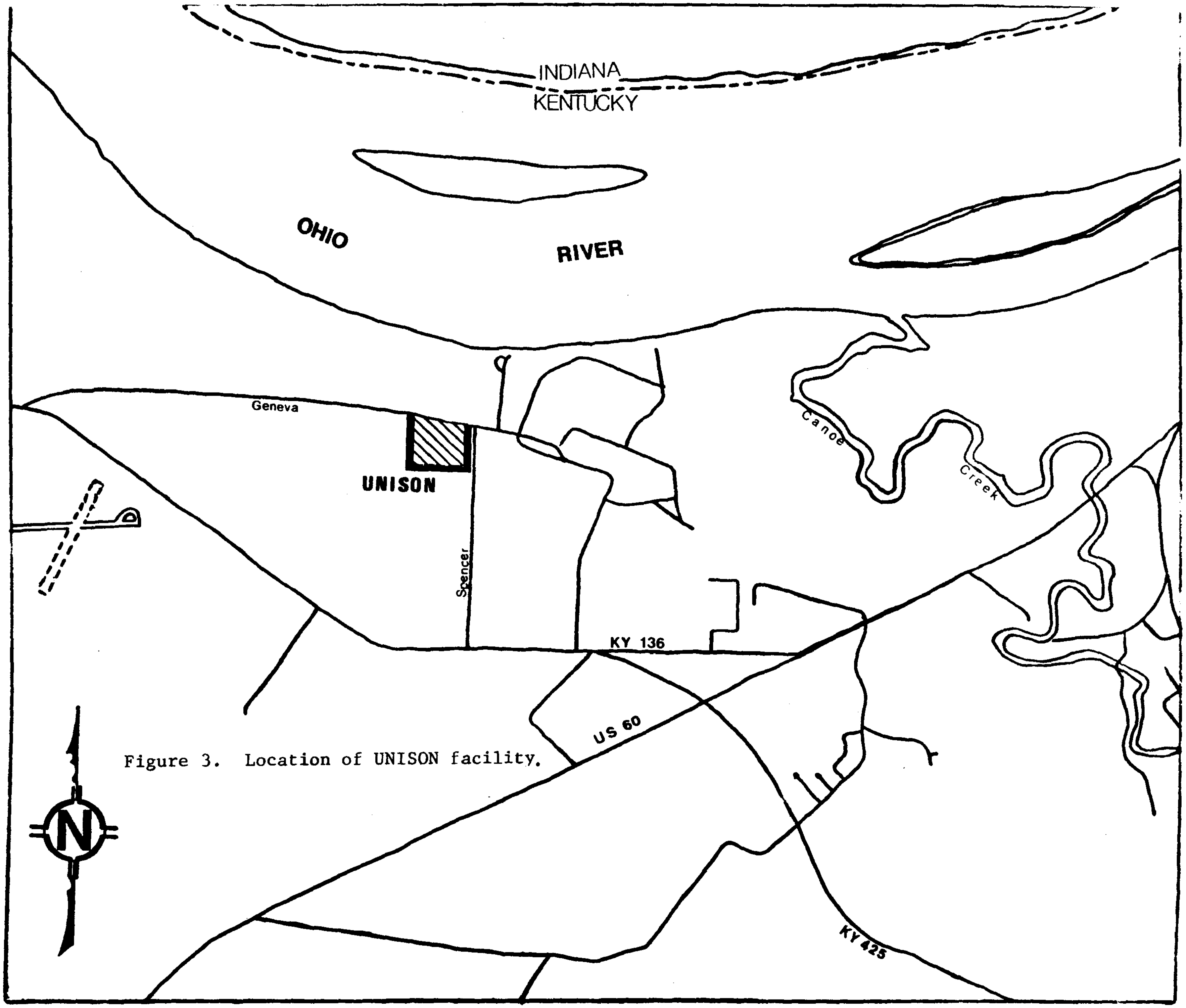

Figure 3. Location of UNISON facility.

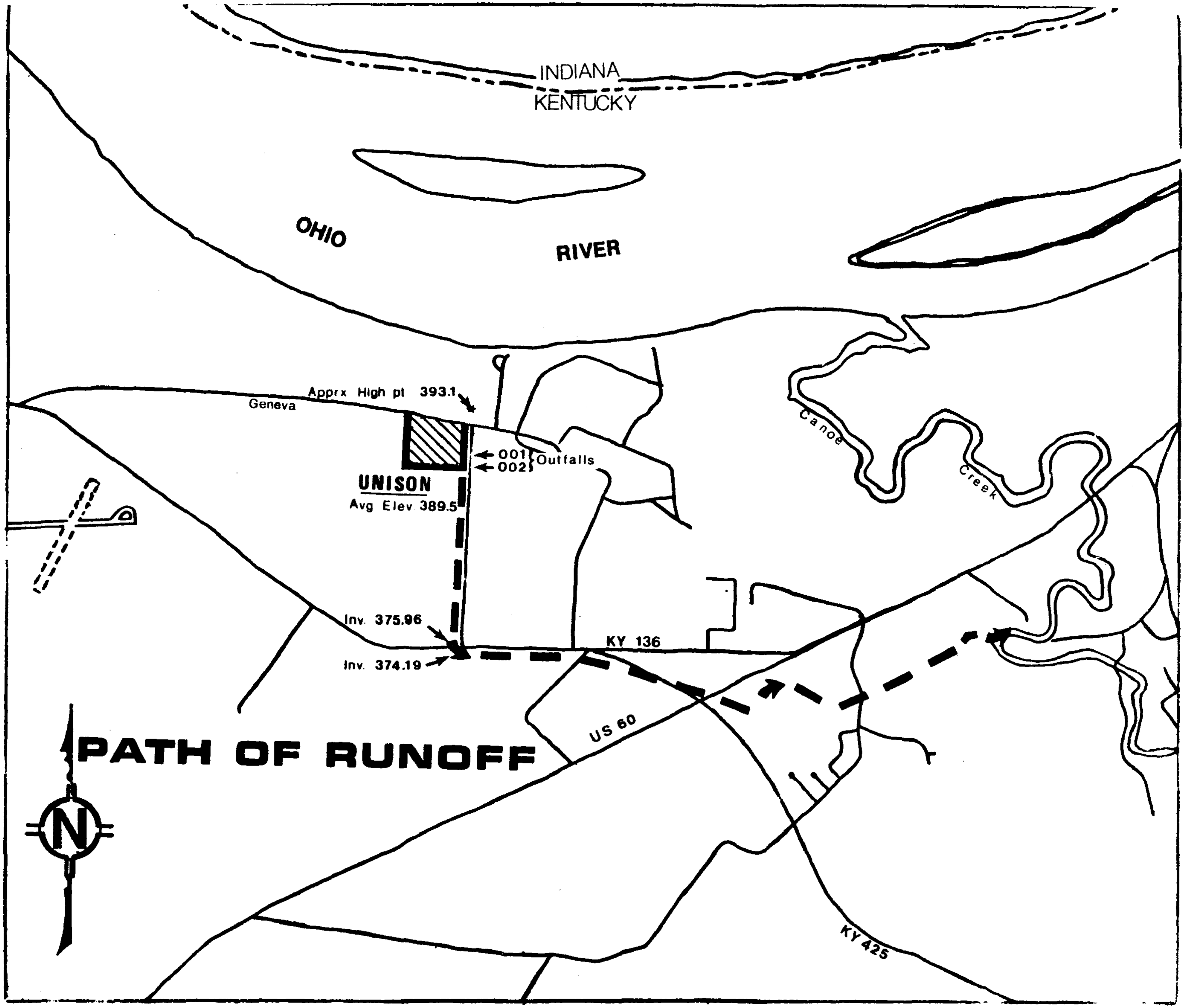

Figure 4. Flow path from ditches 001 and 002 to Canoe Creek and Ohio River.

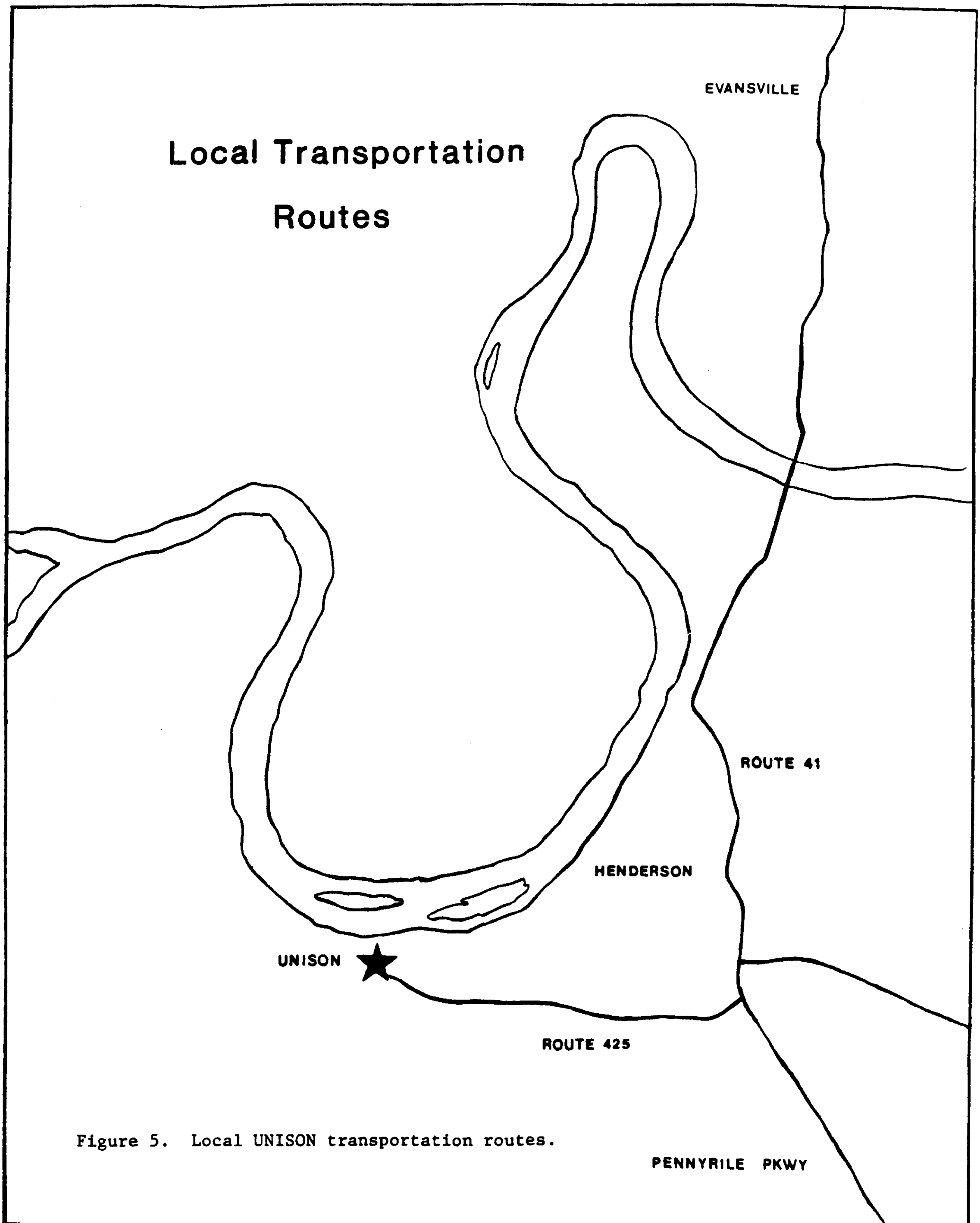

Figure 5. Local UNISON transportation routes.

The process itself cannot legally be described in this report. The equipment has been designed according to the engineering standards recommended by the National Institute for Occupational Safety and Health (NIOSH) for the processing of PCBs (NIOSH 1977). These standards are more strict than legally enforceable engineering standards and were developed by NIOSH to protect the public (including workers inside the facility) from incidental exposure to PCBs. The recommended NIOSH standards are summarized in Appendix 2.

All parts of the plant processing equipment are sealed against the escape of vapors except those few parts where it is unavoidable such as the brief opening of drums for insertion of the drainage equipment. Vapors drawn off from various parts of the process pass through one of eight vent lines to the roof where they are released to the atmosphere. Before being released to the outside air, vapors pass through beds of activated carbon at the end of each line. These remove almost all organic vapors. A vapor analyzer just past the carbon beds guards the vent lines to alarm any pass through above trace amounts allowed in the air permit.

4.0 ALTERNATIVES

This section describes alternatives which UNISON considered before deciding on the present process and before deciding to locate in Henderson County. Alternatives available to EPA, including whether or not to allow UNISON to operate and what conditions to include are also discussed. Finally, this section discusses alternatives available to owners of PCB transformers, including disposal options.

4.1 ALTERNATIVES CONSIDERED BY UNISON

UNISON considered numerous alternatives before applying for a TSCA permit. Some of the major considerations included how to engineer a process which would be both safe and profitable, where and how to build a plant using that process, and how to market the capabilities of the plant. The more important alternatives and UNISON's rationale will be presented here.

4.1.1 Site Selection

UNISON has stated that the Henderson site was selected in the following three step process. In the first screening, sites outside of Kentucky, Indiana and Tennessee were eliminated supposedly because they did not minimize total mileage. In the second screening phase, Kentucky was selected because it offered the best flexibility in using the only three permitted PCB incinerators.* In the final screening phase Henderson was selected as offering the best facilities.

Technical Factors Governing the Site

Not every parcel of land is suitable for the facility. The site should meet certain technological, environmental and economic criteria to be appropriate.

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*The Pittsfield, MA incinerator has not been considered in either UNISON's or EPA's analysis. See note on page 3-2.

UNISON's engineers felt it desirable that the site be at least ten acres, preferably fifteen. This allowed placing a fairly wide expanse of grounds around the facility to enhance security and avoid unintentional intrusion into the plant. It also protects the plant from possible accidents arising from neighboring facilities and provides an extra buffer-zone between the facility and the environment.

The site was required to be essentially flat, to be located above the base (100 year) floodplain* and have drainage paths which could be controlled should any sort of disaster occur at the facility. This was intended by UNISON to protect against contaminating surface water and groundwater resources.

Good highway access near the interstate system was another UNISON requirement. Also, it needed certain utilities, including water and sewers, electricity, police and fire protection and so on. Gas was not required.

Finally, UNISON wanted the site to be far enough away from residential neighborhoods so that it would not result in unreasonable risks, and yet close to a good sized labor pool able to supply about thirty employees, some of whom had to be highly skilled or technically trained.

There are a number of sites within one or two hundred miles of Henderson which meet these criteria. UNISON has stated that the Riverfront Industrial Park best met their requirements.

4.1.2 Alternative Processes

UNISON considered no other basic technologies besides the one proposed. On the other hand, during the early stages of developing the proposed process, UNISON considered many alternative ways of engineering and implementing the

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*40 CFR 761.65 requires that the plant be above the one hundred year floodplain because it has been ruled a storage facility.

same basic technology. Early on, substantial work was done on a truck-mounted process which could have been taken from site to site. It would have avoided the transportation risks posed by the present facility. UNISON applied for and was granted a permit to operate this mobile process. Because the process was mobile, the application was handled by EPA Headquarters. An economic analysis of this version, however, showed it to be more expensive than disposal and replacement of the transformers it was intended to decontaminate.

The engineering effort then changed course toward the present plan. As planning progressed, consideration of alternatives focused on increasingly specific engineering details. Details of all this scientific and engineering work are trade secrets which cannot be discussed by EPA publicly. It can be summarized, however, by saying that UNISON selected the process details they believed were the most economical, the most reliable and the most environmentally sound.

4.1.3 Alternative Pollution Control Systems

A number of air pollution control technologies were investigated. The activated carbon system chosen is appropriate and a proven technology. UNISON designed this system to minimize releases and maximize treatability. A backup monitoring and warning system was also installed.

The facility does not use water in the plant process and there are no floor drains. These design considerations eliminate the industrial use of water and therefore eliminate the need for water pollution control. Sanitary wastewater will discharge directly into the Henderson sewer system and treatment plant.

4.1.4 Methods of PCB Disposal

There are four methods currently allowed by law for the disposal of PCBs:

- High temperature incineration;
- High efficiency boilers (for oils contaminated with low concentrations of PCBs, <500 ppm);

- Special Permitted Landfills (for certain solids and drained* transformer carcasses); and
- Alternative methods permitted under 40 CFR 761.60(e).

Alternative methods of PCB destruction include methods which actually destroy PCB molecules and those which only separate the PCBs from whatever material they are contaminating. Permitted alternative methods which actually destroy PCBS are limited to a new kind of small scale incinerator currently being used in California and several types of chemical dechlorination processes. Chemical dechlorination removes the chlorine atoms from the polychlorinated biphenyls, leaving the simple unsubstituted biphenyl. The decontaminated fluids are generally reused but are not required to be reused. The following three reuse processes have been demonstrated:

- Colloidal Sodium;
- Sodium, Naphthalene and Tetrahydrofuran; and
- Sodium, Polyethyleneglycol and Oxygen (DOE 1982, Kokoszka and Kuntz 1985)

A number of other alternative methods not involving chemical dechlorination are in the experimental stage including:

- Plasma arc pyrolysis;
- High-temperature fluid wall reactors;
- Light activated reduction;
- Countercurrent, rotating plate solvent extraction;
- Catalytic wet oxidation; and
- Genetically engineered microorganisms.

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*Carcasses are drained, filled with a solvent, held for 18 hours and drained again before landfilling.

Physical separations include:

- Centrifugation;
- Filtration;
- Reverse Osmois;
- Distillation;
- Electrophoresis;
- Adsorption; and
- Solvent extraction.

Of these, the only ones which have been demonstrated on PCBs so far are several kinds of filtration, distillation, adsorption and several varieties of solvent extraction.

4.2 ACTIONS AVAILABLE TO EPA

EPA has three options under TSCA in responding to a permit application. The request can be approved, it can be approved with certain specified conditions, or it can be not approved.

4.2.1 Approval

Approval would allow UNISON to operate the process at the Henderson facility subject only to operating protocols proposed by UNISON in its application. These protocols cover key areas of plant operations, including instrument and control settings, calibration techniques, laboratory procedures, safety rules, employee health check-ups, alarm systems, driver training, transportation routes, reporting periods and forms, processing rates, security measures and so on. EPA has never granted a permit application under TSCA subject only to protocols proposed by the applicant.

4.2.2 Approval With Conditions

Approval with conditions would allow operation of the facility according to UNISON's proposed operating protocols subject to additional conditions imposed by EPA. EPA has always imposed the general conditions listed in Appendix 3. Additional conditions specific to the particular project have also been imposed. These are used to clarify any matters in the permit application which are vague or ambiguous and to impose additional health, safety or operational protocols when EPA determines that these might reasonably lessen risks associated with the facility (Section 7.0). If UNISON objects to any of the additional conditions, it may decide not to operate the facility, or it may petition for a modification. Should UNISON petition for a modification, the facility must be operated, if at all, in compliance with the disputed conditions until EPA makes a final ruling.

4.2.3 Non-Approval

Non-approval constitutes the "no action" alternative in this case. If this option is selected the facility would not be permitted to operate. EPA does not approve whenever it determines that a process may present an unreasonable risk to health or the environment. EPA also does not approve if the demonstration test does not satisfactorily establish that the process can achieve complete destruction (see 51 FR 6426 in Appendix 1). EPA will determine whether the process for the proposed facility works based on analyses of the TF-1 to be recovered. The levels of PCBs in the TF-1 must be below the detection limits of the test. Failure to successfully demonstrate the process is a common reason for non-approval. However, non-approval can be based on any deficiency presenting unacceptable risks. After non-approval, an applicant may correct noted deficiencies and petition for a second demonstration test or EPA review.

4.2.4 Effects of Non-Approval (the "No Action" Alternative)

The bulk of this report describes effects anticipated if UNISON is allowed to operate. This section describes what could be expected if UNISON is not allowed to operate.

The majority of PCB filled transformers are being kept in service. New transformers with PCBs cannot be manufactured and existing transformers are only allowed to stay in service "for the remainder of their useful lives," 40 CFR 761.30(a). Certain maintenance procedures are allowed to keep them functioning properly, 40 CFR 761.30(a)(2). A small percentage of these transformers develop leaks each year and contaminate surrounding soils until they are discovered and cleaned up.

A much smaller number short-circuit and spark away until they are noticed by maintenance personnel or automatic safety equipment turns them off. During this sparking, small amounts of PCBs are converted to certain carcinogenic and toxic chemicals called dioxins and dibenzofurans (NIOSH 1984). One of these chemicals (2,3,7,8 TCDD) has been previously characterized as "one of the most toxic substances known to man," and as "the most potent carcinogen" EPA has evaluated (50 FR 29174). These chemicals, together with the PCBs from which they formed, can be carried by the soot and smoke caused by the sparking and drift through the air. Many transformers are cooled by ventilation systems that draw air from around them and distribute it throughout the building. When this happens, very serious damage is often caused because everything the soot contacts becomes contaminated and is dangerous to touch or work around (NIOSH 1986, EPA August 1984).

A fire on February 5, 1981 generated an estimated half an ounce of these toxic materials. The materials contaminated an office building in which 700 people worked in Binghampton, New York. After more than five years of cleanup efforts and more than $30 million, the building still cannot be used. Working in the building might still present a risk of getting cancer.

EPA is very concerned about incidents like this because serious transformer fires appear to be happening to 0.003 to 0.004 percent of all large transformers located near commercial buildings each year (EPA June 1985a). There are more than 75,000 such transformers (see Appendix 4). These transformers are, on the average, expected to last another twenty years. EPA estimates there will be another 50 serious incidents before these transformers are decommissioned (50 FR 29179). The cleanup costs alone are estimated at $399 million (50 FR 29188). "Given that a single serious PCB Transformer fire in a commercial building can potentially expose thousands of people to PCBs and oxidation products in soot in air, water or on surfaces, EPA has concluded that PCB Transformer fires... pose significant risks to human health and the environment" (50 FR 29186).

TSCA does not allow the immediate banning of these transformers since it would result in a loss of needed electric power throughout the country. Manufacturing capacity does not exist to replace the transformers rapidly. The costs for replacement, if possible, would be high. EPA amended the PCB regulations on July 17, 1985, to protect public health and the environment in these circumstances (40 CFR 761, 50 FR 29179) adding the so-called "fires" rule, which:

- Requires removal of the most dangerous* (high voltage*) PCB transformers from commercial buildings by October 1, 1990;
- Requires installation of special* sophisticated circuit breakers* and other electrical safety equipment* on the less dangerous PCB transformers which are being allowed to stay in service in or near commercial buildings;
- Prohibits anyone from moving an existing PCB transformer* to the vicinity* of a commercial building*;
- Requires registration and marking of all dangerous PCB transformers* with local fire departments and building owners, and notification of the National Response Center whenever there is a fire*; and
- Requires removal of anything which might burn* from storage* around PCB transformers.

In conclusion, the No-Action Alternative does not involve simple maintenance of the status quo. Rather, it involves a variety of changes with regard to PCBs and PCB transformers. EPA realizes that making these changes will be expensive for the nation as a whole and transformer owners in particular. Cost estimates are complex (EPA June 1985b) but totals near $2 billion are not unrealistic. The choices for transformer owners are few. The high-voltage transformers must either be removed or decontaminated. The low-voltage transformers could be decontaminated or retrofitted with special safety equipment.

Transformers taken out of service permanently are drained of the bulk of their PCBs, rinsed once and buried in landfills under requirements listed in 40 CFR 761.60(b)(1)(B). The transformer carcasses usually contain substantial quantities of PCBs that do not drain or rinse out readily.

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*These concepts are defined more precisely in the regulations.

Therefore, if there is no way to decontaminate existing transformers, the costs of removal or safety retrofitting must be borne by transformer owners. The disposal of PCB contaminated carcasses in landfills also has associated environmental and economic costs which must be considered.

The extent to which the above costs might be avoided if UNISON is allowed to operate is one of many factors EPA has weighed in determining whether to grant or deny the permit. This is required by TSCA Section 6(c)(1)(C) and (D). Savings to transformer owners are discussed in Section 5.1.4.

4.2.5 Alternatives Available to Transformer Owners

Decommissioning, or removal from service, has been discussed in the previous section. This section covers available methods of decontamination.

Several methods are permitted and in current use. It is not necessary to describe in detail how each works. All of the existing methods have one or the other of two drawbacks. The first major group of processes can only be used on transformers with low concentrations of PCBs because these processes have not been demonstrated to be effective on high concentrations (the fires rule applies only to transformers with a high PCB content). The other group of processes requires that the transformers be temporarily taken out of service while they are cleaned. Cleaning can take several months to a year.

UNISON's process is the first to show real promise of avoiding both drawbacks because the TF-1 acts both as a solvent to extract the PCBs and as a temporary dielectric fluid so the transformer can remain in service.

4.3 OTHER REGULATORY PROCESSES

EPA is not the only regulatory body from whom UNISON must secure a permit. UNISON is subject to regulations at every level of government, including building, fire and electrical inspectors, the City of Henderson sanitary district, the County Zoning Commission, the state Environmental Cabinet, and OSHA, EPA and other agencies at the Federal level. In deference to the authority of each of the other agencies in its own area of jurisdiction, EPA will not allow UNISON to operate unless all agencies approve the project.

The key agency at the county level is the Henderson County Board of Zoning Adjustment (HCBZA). The HCBZA has exercised jurisdiction over UNISON on the basis of UNISON's use of storage tanks for holding materials in various stages of the process. The HCBZA has the responsibility of protecting public health and the environment from dangers that might be associated with such storage. After an investigation and several hearings, the HCBZA granted UNISON permission to operate at the site under certain conditions. This is the Conditional Use Permit recorded in Book 4, page 121 of Proceedings of the HCBZA. The conditions themselves are comprehensive and too numerous to review here.* Possible effects of operations at the plant on residents of the area were considered. The HCBZA had no authority to demand engineering details of the plant itself although possible quantities of hazardous materials present were reviewed.

The key agency at the state level is the Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection (KDEP). Two divisions within KDEP have jurisdiction over UNISON, the Division of Air Pollution Control and the Division of Water. The former has jurisdiction over any vapors which might come from the site, the latter over any waters, including surface runoff of rainwater. EPA has been working in close cooperation with both divisions within KDEP throughout this project.

The investigation within the Division of Water has been the less comprehensive of the two because materials being processed at the plant are isolated from sewer lines and natural drainage from the site by a number of containment structures in conformity with KDEP and EPA regulations and NIOSH recommendations covering PCB processing facilities. Of course, a thorough examination of possible releases from the site and runoff routes has been made. However, once the Division of Water confirms adherence to the contain-

*However, the Conditional Use Permit is reprinted in Appendix III.

ment regulations, issuance of a permit under the Kentucky Pollutant Discharge Elimination System can be expected*.

Investigation within the Division of Air Pollution Control has been more comprehensive. There are eight vents coming from various parts of the process which emit vapors. Each of these vent lines is fitted with a variety of traps and condensers to contain vapors within the plant, and indeed within the system itself so that workers are not exposed. Each vent line passes through a bed of activated carbon at its terminus before releasing gases to the outside. The Division of Air Pollution Control has attempted to determine the volume and mass of vapors of each kind of chemical inside the plant which might pass through the vent lines during ordinary and extraordinary operations at the plant.

These calculations are based on well tested principles and the known characteristics of each of the chemicals and devices in use. However, in their analysis, the Division of Air Pollution Control had to make certain simplifying assumptions to keep the calculations manageable. The assumptions overstate the actual amount of vapors. For example, there is no way to calculate the actual amount of vapors which come out of a drum when it is opened. The drums contain fluids from different transformers, they are filled and later opened at different temperatures and the amount of air space above the liquid in the drum varies. Drums are expected to be filled warm, opened at room temperature and have only about three gallons of air space at the top. The KDEP analysis is based on drums filled at 50°F (10°C), opened at 86°F (30°C) and having ten gallons of air space. This vapor calculation gives values which are certain to be more than what might actually occur. The other calculations are similarly conservative.

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*The proposed permit, number KY 0082571, became available as this document was undergoing final editing. The Division of Water proposes to require monthly monitoring of rainwater runoff for possible contaminants along with comprehensive preventative measures, the Best Management Practices Plan. Like HCBZA, KDEP is requiring a baseline survey to establish existing levels of contamination at the site and in the ditches downhill.

By adding together the vapors produced in each part of the process and then accounting for the effects of pollution control devices, KDEP obtained a total emission rate of 400 pounds per year total organics. Using this value, a computer model was run of atmospheric dispersion around the plant to determine where the vapors might blow. The Industrial Source Complex (ISC) model was used. The computer was given five years of weather data from the Evansville Weather Station and the calculated quantity of vapors emitted. Long experience with the computer model used has shown that it accurately predicts the movement of emissions from industrial facilities. Similar modeling conducted by EPA is described in Section 5.1.1.

Based on the results of this work, the Division of Air Pollution Control determined to grant UNISON a permit to construct the facility. (Permit number C-85-264, File number 077-1760-0099). The Air Division will review its work and additional data to be submitted by UNISON before issuing an operating permit.

5.0 PUBLIC HEALTH AND ENVIRONMENTAL EXPOSURE ASSESSMENT AND RISK EVALUATION

This section develops estimates of the potential exposure of the public to hazardous materials related to UNISON's activities both in Henderson and around the country. It develops estimates of how great those exposures are likely to be and their duration. It discusses concerns raised by the public, by other agencies and by EPA. Questions raised about possible exposures due to events which EPA believes are extremely remote or cannot occur are also discussed. In each case, the strength of the evidence on which the assessment was based is reviewed.

The discussion is divided into three broad areas. Section 5.1 deals with ordinary operations, while Section 5.2 deals with accidents and disasters. Section 5.2 is further divided into disasters at the plant site and accidents during materials transportation. Section 5.3 evaluates the risks associated with the exposure estimates developed in Sections 5.1 and 5.2.

5.1 ORDINARY OPERATIONS

This section estimates health and environmental exposures related to ordinary operations at the facility. The bulk of the discussion covers air emissions since no surface water or groundwater emissions are expected from ordinary operations.

5.1.1 Air Emissions

Air emissions from the facility during ordinary operations were estimated in cooperation with KDEP as described in Section 4.3. Total emissions will be less than 400 pounds per year, probably much less. This is a little more than one pound per day, or about three quarters of an ounce per hour. These emissions will be almost entirely TF-1 vapors (99.99+%). They are expected to contain less than 0.0001% PCBs (less than one part per million).

A breakdown of the chemical composition of the vapors was derived from the known characteristics of materials to be used at the plant and the nature of the parts of the process which generate the vapors. These figures cannot be given in this report because they are derived from confidential business information. However, the analysis of risk in Section 5.3 is based on this complete breakdown with one exception. For toxicological purposes, EPA uniformly made worst case assumptions that raised the concentration of PCBs by a factor of ten to twenty depending on the circumstances. The concentrations of the other organic vapors were adjusted downward slightly so that the totals would remain 100%.

Using a method similar to that used by KDEP, EPA entered the 400 lbs/yr vapor emission rate into a computer program (ISC model) along with Evansville Weather Station wind and temperature data. The output from the program gives average annual concentrations at thirty different distances from the plant along the cardinal points of the compass, i.e. North, North-northeast, Northeast, East-northeast and so on. The distances ranged from 0.17 km (0.1 miles) to 50 km (thirty miles). Similar results are obtained using the simpler model given in Versar (1984 Vol. IV).

By interpolating between data points, estimates were made of average annual concentrations at three nearby receptors. The highest average annual concentrations found were at the Riverport Warehouse and Docks. There are usually twelve employees there. The concentration of organic vapor at the warehouse was predicted to average 82.7 nanograms per cubic meter (parts per trillion*).

If these vapors were 100% PCBs, they would still meet EPA and NIOSH standards for workplace air. Those standards were set twelve times higher at 1,000 nanograms per cubic meter based on a large body of data which supports the belief that one could work in such air 40 hours per week without risk of injury.

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*Nanograms per cubic meter are only very approximately parts per trillion. The first measure gives the mass of contaminants in a given volume of air, the latter gives the weight of contaminants in a given weight of air. The former is not affected by temperature, the latter, however, changes as air gets more dense in the cold or less dense as it heats up. Because nanograms and cubic meters may be unfamiliar to many readers, we have included parts per million, billion or trillion at various places in the text. The two systems are identical only at 176°F (80°C). At 77°F (25°C), the actual parts per million, billion or trillion is about 30% less than the value reported in the text.

The second highest annual average concentration of those examined at the three nearby receptors was at Henderson Community College, just over a mile South-southeast of the plant. The concentration here was predicted to be 9.45 nanograms per cubic meter (parts per trillion) or a little more than one tenth of the concentration at the Riverport Warehouse and Docks.

The third location examined was a residence located 1.4 km (0.84 miles) west of the facility on Highway 136 just across the street from the airport. Although a little closer than the College, it is upwind more often and because of this the concentration will average only 8.48 nanograms per cubic meter (also about one tenth of the Riverport Warehouse concentration). A complete printout of the annual average predicted values is included in Appendix 5.

Concentrations, of course, decrease with increasing distance from the facility. At Henderson City Hall, concentrations were predicted to average 0.58 ng/m^3, while at the Evansville Civic Center they would average 0.06 ng/m^3.

The 1980 census data was combined with the distribution of vapor concentrations to find the total quantity of vapors to which various groups around the facility would be exposed. The major assumption used was that each person breaths in 22 cubic meters of air in a day.

According to the 1980 census data, 383,151 people live within 50 km (approximately 30 miles) of the facility. All these people together would inhale a total of about 0.59 grams of organic vapor per year or about two hundredths of an ounce. Of course, this total is not divided evenly. People closer to the facility would inhale disproportionately more. 21,932 people, mostly in Henderson County, would inhale just over half of the total amount. The 2419 people in the closest census tract would inhale just under a third of the total (7.81×10^{-5} grams/person/year). The greatest concentrations will be to the Southeast.

There are no known effects on nearby flora and fauna of concentrations this low. The health effects of these concentrations and the other concentrations reported in Sections 5.1.2 through 5.2.2.5 are covered in Section 5.3. "Normal" background concentrations of PCBs in air are sufficient to cause exposures of 3.5×10^{-7} grams/person/year in rural areas and 3.5×10^{-5} grams/person/year in urban areas (Versar 1984 Vol.I).

5.1.2 Surface Water Releases

Surface water releases will not occur during regular operations. All processing is performed inside the containment structure. Loading and unloading activities are within buildings which are enclosed except for the places where trucks drive in and out. Loading and unloading areas are graded and diked to contain any spills (minor in-plant spills are considered a part of ordinary operations). Drums trucks have a dual-layer inner-liner containment system so that leaks cannot escape the vehicle. Tankers also have special fittings which make leaks extremely unlikely. There are no pipes leaving the facility other than the sewer line and the plant sewerage system does not serve the PCB processing areas.

5.1.3 Groundwater Releases

Groundwater releases will not occur under normal operating conditions. There are no underground lines containing PCBs or other hazardous materials which could leak. The only underground lines are the water lines bringing drinking water to the plant and the sewer line serving the lavatories. All sumps in the facility (places where spills would run) are "blind" in that they have no outlet and must be sucked out with a pump and hose in the event of a spill. All concrete surfaces in the plant are sealed with a material that is relatively impervious* to PCBs to minimize leakage through the concrete. As

*40 CFR 761.65(b)(1)(iv) requires storage facilities to have "Floors and curbing constructed of continuous smooth and impervious materials, such as Portland cement concrete or steel". UNISON's coating, applied to concrete surfaces in the plant at a cost of approximately $100,000, goes well beyond EPA requirements. The coating, a three layer system manufactured and applied by Products Research Chemical Corporation of Glendale CA, absorbs less than 0.001 ounces per square foot when soaked in PCBs for 14 days. Under similar conditions, untreated concrete absorbs 4.7 oz./ft^2.

noted in Section 5.1.2, trucks are not expected to leak on the drives and roads outside of the facility.

5.2 ACCIDENT EXPOSURES

Accidents may happen at the facility or they may happen during transportation. On-site accidents are considered in Section 5.2.1 while transportation accidents are considered in Section 5.2.2.

5.2.1 On-Site Accidents

Discussions with the public, within the Agency and with other agencies generated a list of major types of accidents and/or disasters which could occur at the facility. These include the following:

- Processing Failure
- Pollution Control Equipment Failure
- Fire or Explosion of Materials Being Processed or Stored
- Earthquake
- Flood
- Tornado
- Airplane Impact
- Meteor Impact
- Nuclear Explosion
- Terrorist Bombing

Not all of these types of disasters merit additional detailed discussion. Meteor impacts, nuclear explosions and terrorist bombings affecting the site are exceptionally unlikely and there is no good way to predict them. They have little relation to what will actually occur at the site and, as far as anyone can predict, are about as likely to happen in one place as another. In the case of nuclear explosions, PCB contamination would be the least of our worries. The case of meteors is similar. Large bodies striking anywhere in Henderson County or small bodies at relativistic velocities would have blast and radiation effects like a nuclear explosion. Intermediate force meteors would seem to have the greatest potential for adverse effects due solely to the spread of contaminants, but the probability of such meteors is so small that it appears inappropriate to conduct further analysis. The potential for a terrorist attack on the facility certainly exists, but it appears remote and we know of no way to measure the risk. No further discussion will be devoted to these scenarios.

The other listed disasters will be covered in some detail. They are discussed in the following sections in the order they appear in the list.

5.2.1.1 Potential for Releases due to Process Equipment Malfunction

An engineering study of the process and processing control system uncovered nothing which might release hazardous materials outside the plant other than vapors (fugitive emissions) from leaks and spills.

There are many hazards within the plant which require caution, proper implementation of procedures, and on occasion, protective gear. However, with respect to the environment outside, the plant is designed with substantial inherent safety. All operations are carried out inside containment basins capable of holding the entire contents of all vessels and tanks simultaneously. Containment, except for small quantities of vapors, would not be compromised by a complete power outage. All containment is passive. There are no dangerous contained gases on the premises other than the liquid nitrogen and this gas presents only minimal cryogenic and asphyxiation hazards. Nitrogen presents no hazards to those off-site. There are no chemical reactions utilized on-site and no potential reactions or cross-reactions in which materials present might participate. No combustible materials are stored at the site. In summary, there is nothing on-site which could produce a disaster off-site by merely failing or from causes within the plant itself.

If part of the process does fail, such events will be detected before any release could occur inside the plant. Dozens of process parameters are monitored continuously by a redundant computer and alarm system so that the process will produce a clean separation. Anomalous readings cannot persist for long and values cannot drift far from their set points without triggering a variety of responses from the control system. Corrective adjustments are made continously. Adjustments and low level alarms are triggered by any significant drift. Substantial drift triggers high level alarms, and if the drift could increase certain hazards, initiates emergency shutdown. The control necessary to produce a clean separation is within closer tolerances than that required for safety reasons.

Minor spills and leaks can be expected to occur from time to time. There is no basis at this time for judging either the size or frequency of these events. However, the air permit to be issued by KDEP will forbid release of PCB vapors to the atmosphere in detectible quantities and will limit the amount of other vapors to safe levels. Based on a study of engineering details of the plant, it appears unlikely that emission limitations will be exceeded due to in-plant accidents.

Sabotage, however, could result in a substantial release of vapors. Minor sabotage could be accomplished by anyone with access to the facility and a few simple tools. Minor sabotage, however, would not threaten health or the environment off-site. This sort of sabotage could only cause minor leaks and spills. Major damage could only be accomplished by someone with access to the control panels and an intimate knowledge of the computer codes used to program the control and alarm systems. Sabotage on this scale could result in releases similar to those discussed in Section 5.2.1.7.

In summary, there is very little potential for releases due to process equipment malfunction.

5.2.1.2 Potential for Releases Due to Pollution Control Equipment Failure

UNISON's pollution control system is simple and can be expected to be reliable (Lees 1980). The plant has eight vents which release emissions to the atmosphere. At each of the eight vents, vapors pass through beds of granular activated carbon that adsorb the organic vapors and allow the air to pass through. As a precaution against failure, each treated stream of air is monitored for the presence of organic vapors. If organic vapors are detected, the monitor activates the main plant alarms, which are the same alarms that would go off if one of the process tanks developed a massive leak. If it ever goes off, it is unlikely to be ignored.

The activated carbon beds are periodically emptied and replenished. The schedule on which this is done is based on extremely conservative assumptions. Consequently, if carbon is not changed on schedule, it is unlikely to result in vapors even getting to the detector, much less past it. For a release to occur, UNISON must either fail to replenish the carbon for a long time or it must empty the used carbon and not replace it at all.

Even under these circumstances, a release could not last more than a few minutes unless either the monitor or the alarm system fails at the same time. Since the monitor is scheduled to be checked once each shift and recalibrated once per week, more than a few people have to neglect their duties and the monitor must fail for a release to be prolonged.

EPA is not aware of any way to estimate the chance of simultaneous equipment failure and multiple party negligence. Nonetheless, an air model, INPUFF, (EPA October 1984) was run using input data which assumes one of the carbon units does in fact become overloaded from not being changed and that the full strength of this stream is discharged to the air above the plant. Because the emission rate is constant, concentrations downwind soon reach equilibrium. They maintain the same value until the vent is fixed or the wind changes. The worst wind conditions are low velocities and stable patterns. At 2.5 m/s wind speed and stability class E, downwind concentrations in nanograms per cubic meter (ng/m^3, parts per trillion) would be:

Distance (m)	Concentration (ng/m^3)
300	3549
500	1567
1000	470.7
2000	141.5
4000	34.97

These vapors would be almost entirely TF-1. The vapors would be less than 0.002% PCB's. The effect of such concentrations is discussed in Section 5.3.

5.2.1.3 Potential for Fire or Explosion Related Releases

Fires or explosions occur whenever conditions favor rapid oxidation or combustion. Generally, this means three ingredients must be present:

- A fuel - something capable of oxidizing rapidly (technically, an electron donor);
- An oxidizer - usually air or some other source of oxygen, but any material will do which can rapidly accept the electrons given up by the fuel; and
- A spark, flame or sufficient heat for autoignition (Sax, 1979).

With minor exceptions, none of these ingredients is present at the facility.

Fuels

PCBs, TF-1 and TF-2 are inherently incapable of behaving like fuels (NIOSH 1977; Versar 1983 Vol. III). Technically, they can be burned in high-temperature, high-oxygen environments of special incinerators, but they have no potential for burning outside such environments. The potential for sustaining combustion is measured in a laboratory test by attempting to light the vapors above a pool of the liquid. If the vapors do not burn at low temperatures, the liquid is heated until the vapors do burn or until the liquid boils away. This is called the fire point test. A variant is called the flashpoint test. The value reported is the temperature at which the material will burn.

Gasoline and alcohol, for example, will both burn at room temperature. Diesel fuel, however, will not; it must be heated to at least 100°F before it will burn in a closed container and even higher before it will burn in open air. PCBs, on the other hand, have no fire point; they can only be burned if they are heated well above their boiling points (ASTM D2283, NIOSH 1977). The American Society for Testing and Materials has also tested TF-1 and TF-2 for both flashpoint and fire point and has reported that, like PCBs, these materials will not support combustion (the citation for this report cannot be given without revealing the composition of these materials). Some of these materials have a pseudo-flash point below the boiling point. This does not indicate a fire hazard. Such flashing happens because the material used to create the test flame contributes fuel to the test material to create a pseudo flash. Once the flame producing material has burned, the TF-1 and TF-2 cannot sustain combustion.

There is no storage of combustible materials at the plant. Wooden benches, originally specified for the employee locker rooms, have been replaced with steel benches. To the extent possible, all combustible materials are absent from the plant.

Oxidizers

UNISON's processing system at Henderson is totally enclosed, in compliance with EPA and NIOSH directives on the handling of PCBs. There are no open vats or containers in the entire process except the vent lines going to the air pollution control system from the area where drums are opened. These are necessarily open at the input end in order to scour vapors from the workplace air. Special measures are taken throughout the plant to make sure air does not come into contact with the materials being processed. The space above the liquid in various tanks and containers is filled with nitrogen, an inert gas, rather than with air. This has been done to protect the TF-1 from the small amount of moisture usually present in air (i.e., humidity) because small amounts of water can ruin the electrical properties of TF-1. Of course, it has the added benefit of keeping oxygen away from the material, and hence, doubly insuring that no combustion can take place.

Sparks, Flames and Heat

All of the more likely sources of sparks and flames have been eliminated from the processing area. Smoking is prohibited anywhere within the reprocessing center. While this is primarily a health measure designed to prevent inadvertent PCB contact with lips and mouth, it also serves to eliminate the most common source of flames.

Similarly, electrical equipment in the processing area is all contained within sealed enclosures following standards contained in Class I, Group D, Division 2 of the National Electrical Code. These standards are not required by the electrical code for this type of facility but appear to have been followed more to protect the electrical equipment from possible PCB contamination than for safety reasons. Nonetheless, they serve to keep a common source of sparks away from possible vapors.

One source of sparks and flames not eliminated is from welding operations which may be necessary at some future date in connection with repairs. Here again, health measures intended to protect workers from PCB vapors also serve to keep sparks and flames away from possible vapors. Repairs can only be performed under the Hazardous Work Permit provisions of UNISON's Health Plan which calls for testing the air in the area for the presence of organic vapors before the work can proceed. Hence, this possible ignition source, although not eliminated, is at least segregated. Given the non-flammable nature of materials in the plant, this would not have been required merely for fire prevention.

Other sources of sparks not eliminated are static electricity, the scuffing of shoe nails on concrete and so on.

While sources of sparks or flames are virtually absent from the facility, there are sources of heat. The residue tanks, for example, must be kept warm to prevent the residues from solidifying; they are too thick to pump at room temperature. These heat sources have been carefully examined with regard to the possibility for a runaway heating event. A number of scenarios were analyzed where runaway heating could occur, but they all involved a number of peculiar and unlikely events happening simultaneously. The chance of this happening was determined to be so small that it did not warrant further analysis.

Potential for Fire

After careful review of the data presented above, it was determined that a fire was not possible from causes within the facility itself. Fire could, however, occur in connection with a terrorist incident or an aircraft impact (see Section 5.2.1.7).

5.2.1.4 Potential for Earthquake Related Releases

Although it is not widely known outside the region, the Central Mississippi Valley is one of the most seismically active areas in the world. In the winter of 1811-1812, three large earthquakes centered near New Madrid, Missouri, rocked the region. Witnesses wrote that the ground moved vertically several feet as well as horizontally and that large amounts of sand and sulfurous gas were spewed out. For a brief period, the flow of the Mississippi River appeared to be reversed. A cypress forest in northwestern Tennessee was lowered several feet and formed what is now known as Reelfoot Lake (Eblen 1986).

Various estimates of the magnitude of the December 1811 earthquake exist, but all place it above 8.3 on the Richter scale (see Figure 6). Some authorities rank it among the most powerful earthquakes of all time. Two aftershocks early in the following year were of a force comparable to the recent earthquake that toppled buildings in Mexico City.

Concern that a major earthquake may again rock the Central Mississippi Valley has generated demands that the potential earthquake impacts on UNISON's facility be thoroughly investigated before it is allowed to operate. This section discusses potential earthquakes and their effects, including: (1) a description of the fault system and causes of earthquakes in the area; (2) estimates of the probability of earthquakes of various magnitude; and (3) a description of potential effects including possible releases of hazardous materials at the site.

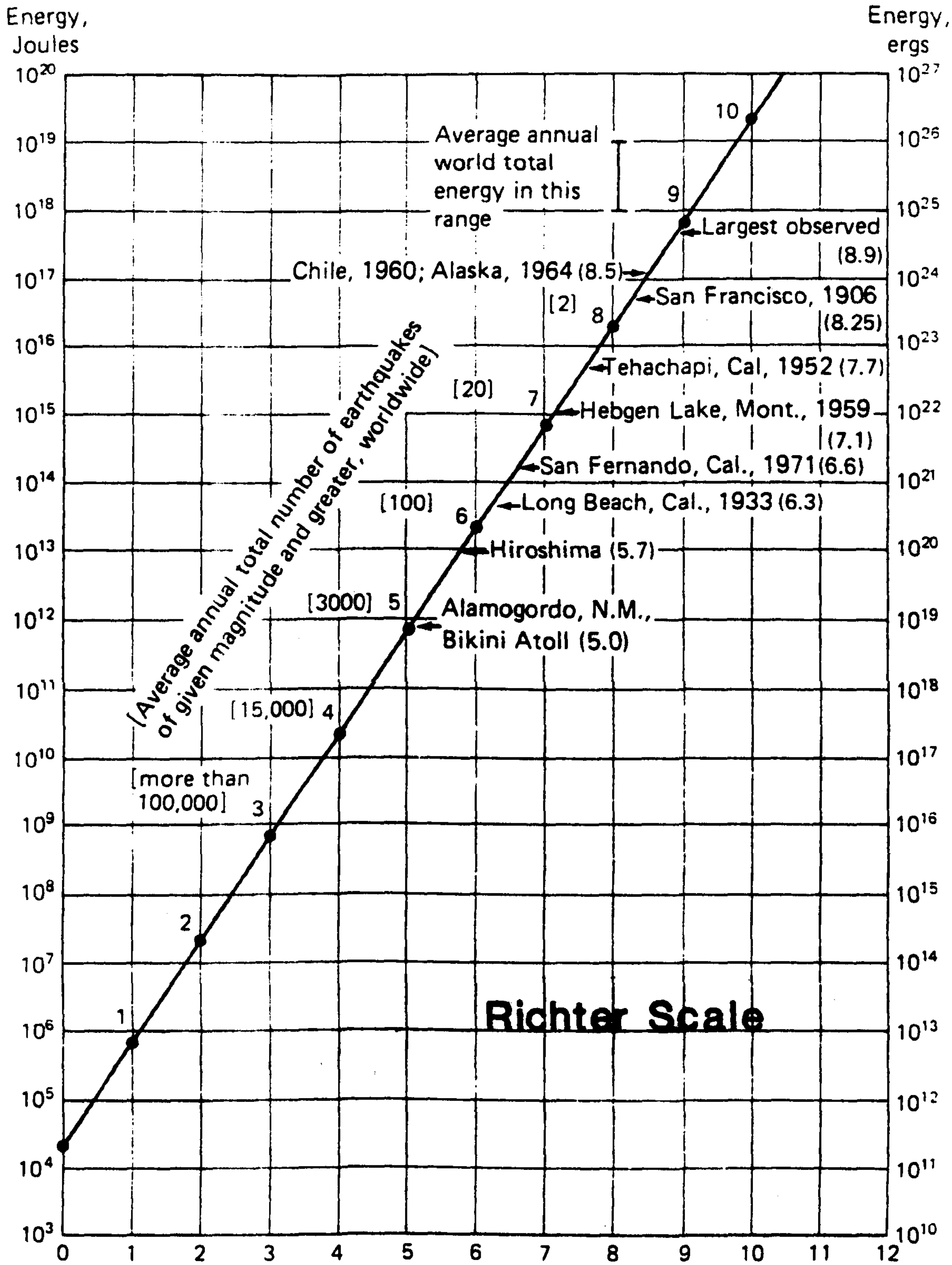

Figure 6. Richter earthquake scale and distribution of earthquake magnitudes.

The New Madrid Fault System

The New Madrid Fault System is named for the Missouri town located at the epicenter of the 1811-1812 earthquakes. It consists of numerous irregularly overlapping faults (weak points) in the bedrock several thousand feet below the surface that criss-cross each other in a broad zone that starts near Memphis at the southern end (Figure 7). From there it runs north-northeast under the Mississippi River to southern Illinois. Near the confluence of the Ohio River and the Mississippi, the fault splits. One branch runs beneath the Mississippi River ending south of St. Louis. The other runs east under southern Illinois until it also splits. Here, one branch turns north, following the Wabash Valley halfway up the western border of Indiana. The other continues east under the coal fields of Western Kentucky. The latter fault zone is located near the southern boundary of Henderson County beneath the towns of Tilden and Sebree, and is sometimes called the Cottage Grove or Rough Creek fault zone (see Figure 8). Other smaller faults have been found in surrounding areas in deep bedrock, although none have been found beneath Henderson County itself.

The origin of this deep faulting along the new Madrid zone has been obscure until recently. Geologists now believe that this zone coincides with a very ancient rift (about 600 million years old) which began to break apart the landmass now known as the North American continent. However, the rifting subsided before the continent was split. After the rifting abated, a zone of weakness remained but lay dormant for hundreds of millions of years. Then, approximately 65 million years ago, the combined continental mass composed of Europe, Africa, and the Americas (which had drifted together) began to separate to form the Atlantic Ocean. This mid-Atlantic rifting is still going on today and North America continues to drift westward. Compressive forces associated with this movement are theorized to have reactivated the ancient fault systems within the New Madrid rift zone. These forces are strong enough to periodically create powerful earthquakes like the ones centered near New Madrid in 1811/1812. Extremely weak tremors occur nearly every day along this zone, although few are strong enough to be felt. Noticeable but generally weak temblors are felt every few years. Massive quakes occur every several hundred years (Nuttli 1983).

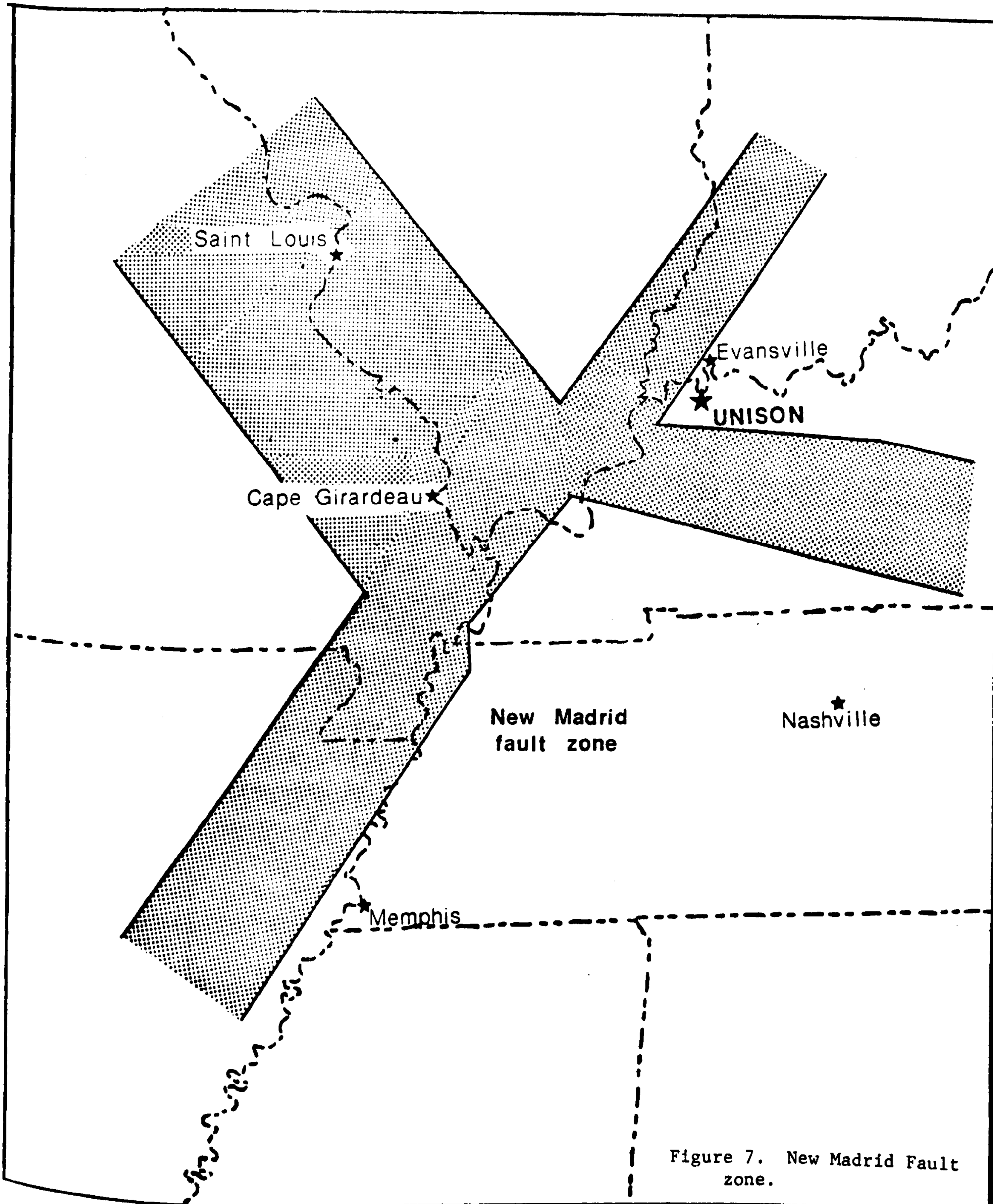

Figure 7. New Madrid Fault zone.

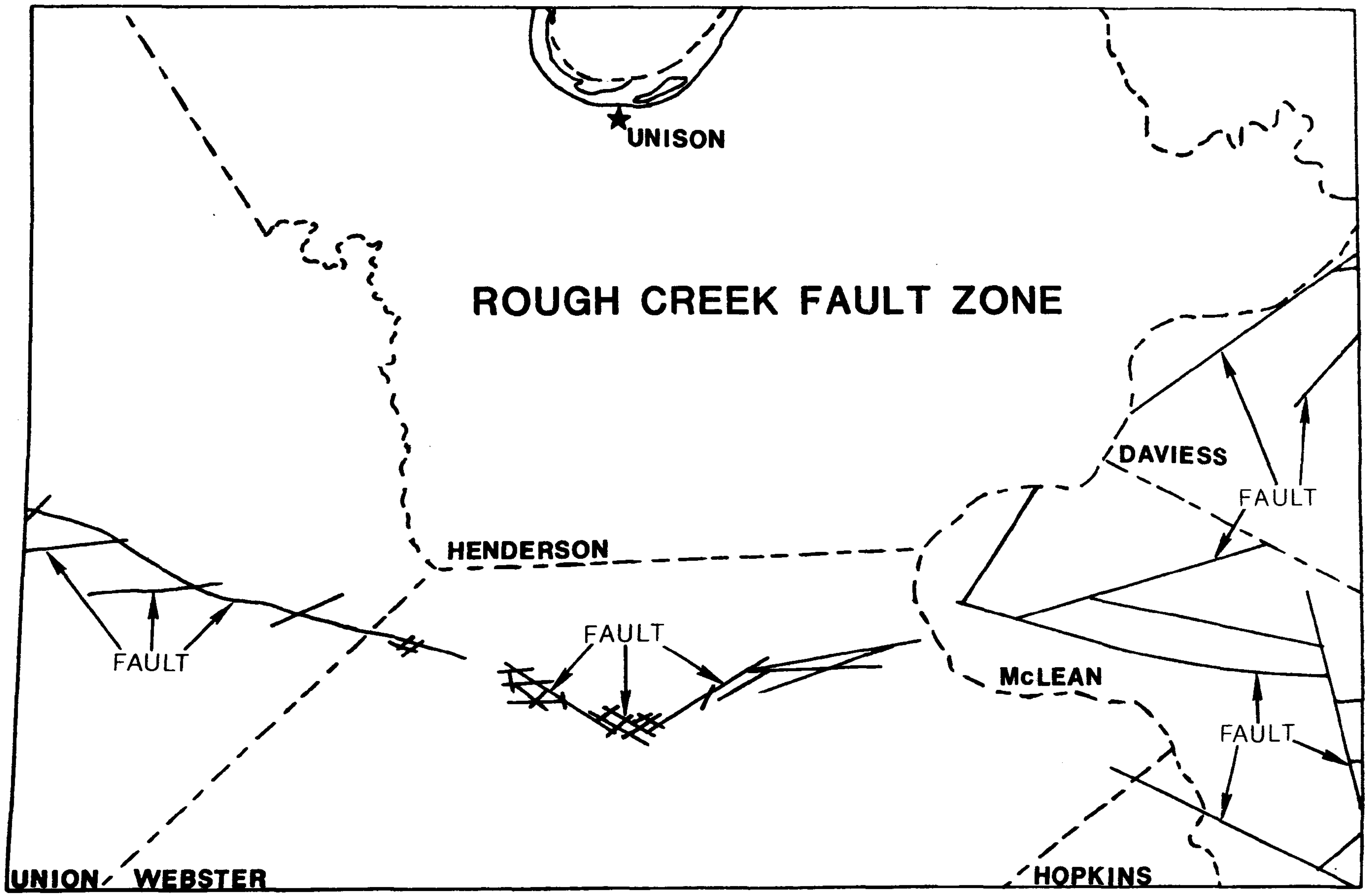

Figure 8. Rough Creek fault zone. Based on the number 7 coal horizon (Maxwell and DeVaul 1972).

Recent studies have shown that seismic activity is concentrated along the main north-south New Madrid rift zone (Figure 9). The most likely earthquake to affect the UNISON site would have its origin 100 to 150 miles to the west or southwest along this zone. However, an east-west trending fault zone (the Rough Creek fault) lies less than 15 miles to the south of the facility. This zone is an inactive branch of the active New Madrid zone to the west; no major tremors or earthquakes have been recorded along this zone (Figure 8). If the currently accepted model of earthquake activity in the area is correct, the Rough Creek fault zone could not give rise to a major earthquake. However, if it is wrong, one must concede some remote chance of a major earthquake with an epicenter near Henderson County. Such a quake would theoretically be capable of doing greater damage than a quake near the Mississippi and could conceivably destroy the facility. However, resultant severe soils contamination would be of little consequence compared to the loss of nearby cities.

Chance of an Earthquake During the Life of the Facility

The chance of a major earthquake occurring near the site has been estimated by scientists using accepted theory that it would occur near the Mississippi. The USGS estimates that there is only a 10% chance that ground motions due to an earthquake will exceed four or five percent of the acceleration due to gravity at any time in the next fifty years in the Henderson area (USGS 1972). This estimate is based on a calculation of the forces which have built up in the deep layers of rocks. There is a 90% chance that no earthquake of this magnitude will occur. If it does occur, objects near Henderson will move sideways as though they were being moved by a force about four or five percent as strong as gravity ordinarily pulls downward (Figure 10).

The force-of-gravity estimate is stated differently in a more recent study by the U.S. Geological Survey (Hopper et. al. 1983). Instead of accelerations due to some fraction of gravity this study uses the Mercali scale, which directly relates the kind of damage an earthquake might do (Table 2). The USGS estimates that if the New Madrid earthquake of 1811 were ever repeated, Henderson County would experience destruction at the levels of VIII and IX on the Mercali Scale. Under these conditions, the UNISON site would be expected to be hit by forces which would reach IX on the Mercali Scale.

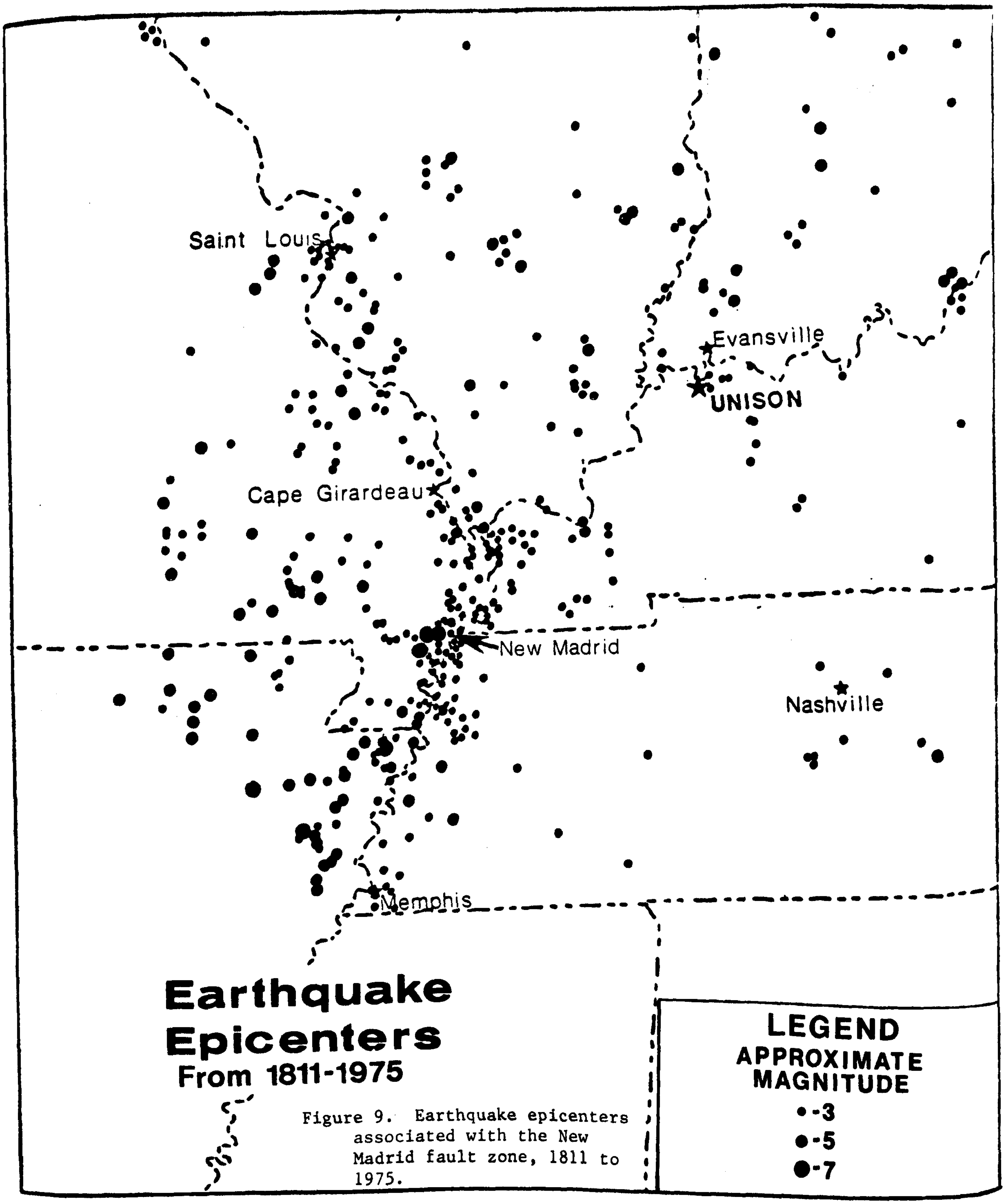

Figure 9. Earthquake epicenters associated with the New Madrid fault zone, 1811 to 1975.

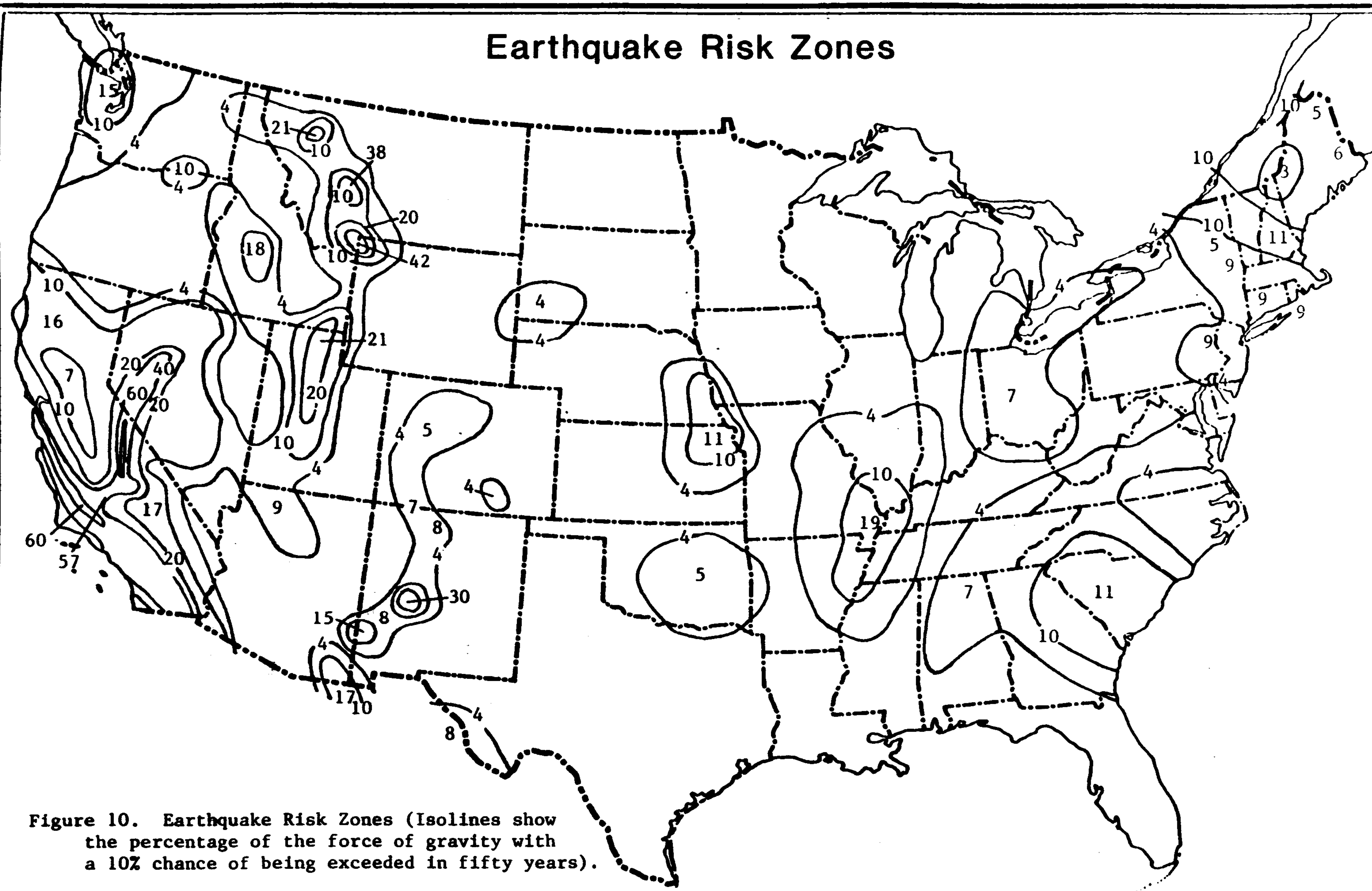

Figure 10. Earthquake Risk Zones (Isolines show the percentage of the force of gravity with a 10% chance of being exceeded in fifty years).

Table 2. Mercali earthquake intensity scale and levels of damage caused by quakes of various magnitude [Photocopied from Strahler (1981)].

The Modified Mercalli Intensity Scale (Richter, 1956)

Masonry types	The quality of masonry, brick or otherwise, is specified by the following letter code:
Masonry A	Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B	Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C	Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D	Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

Intensity value	Description
I.	Not felt. Marginal and long-period effects of large earthquakes.
II.	Felt by persons at rest, on upper floors, or favorably placed.
III.	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV.	Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frame creak.
V.	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI.	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc. off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken visibly, or heard to rustle.
VII.	Difficult to stand. Noticed by drivers. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, also unbraced parapets and architectural ornaments. Some cracks in masonry C. Waves on ponds, water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII.	Steering of cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX.	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames cracked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, earthquake fountains, sand craters.
X.	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI.	Rails bent greatly. Underground pipelines completely out of service.
XII.	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Source: C. F. Richter, (1958), *Elementary Seismology*, W. H. Freeman and Company, San Francisco, p. 136–138. Minor editorial changes, following B. A. Bolt, (1978), *Earthquakes: A Primer*, W. H. Freeman and Company, San Francisco, Appendix C, p 204–205

These estimates of the kind of forces which might affect the Henderson facility, although based on the best evidence, are subject to numerous uncertainties. Earthquake prediction is a recently developed science, and confidence in these predictions is far from universal. Because of this, EPA considers it important to consider what might happen in earthquakes of larger magnitude than those suggested by the prevailing theories.

Potential Earthquake Effects

Earthquakes are caused by sudden movement of rock along a fault zone, in response to various kinds of stresses acting within the rocks. Earthquakes have three potentially devastating effects. First, the energy waves generated by the quake can literally shake buildings apart. Second, the vibrations can turn saturated sandy soils into a thick mud-like fluid which can flow. This effect is known as liquefaction and can result in the sinking and/or tilting of buildings which rest upon these soils and the cracking of foundations. The third major effect is a sudden rise or fall of bedrock. Such changes in bedrock elevation are almost always confined to the immediate vicinity of the earthquake epicenter.

Shaking

Mere shaking of the UNISON facility at the recently predicted rate would have little effect. In the recent earthquake in Mexico City, there was little damage within the chemical processing industry and none that was sufficient to cause concern. Much greater shaking, such as might result from a major earthquake located in the Rough Creek fault zone, could cause some breakage of pipes and vessels with resulting PCB leakage within the containment structures. However, unless the foundation itself were cracked, a significant release would not occur. If there were a release inside the building and if the foundation did crack, some losses to nearby soils could be expected. However, due to the strong affinity of PCBs for soils, it seems unlikely that even a heavy rainfall concurrent with the event would result in significant transport of the pollutants to groundwater or surface water resources. Because of strong adsorption of the PCBs by the soil, cleanup of such a release would be costly but could be complete. Figure 11 shows the limited migration of PCBs

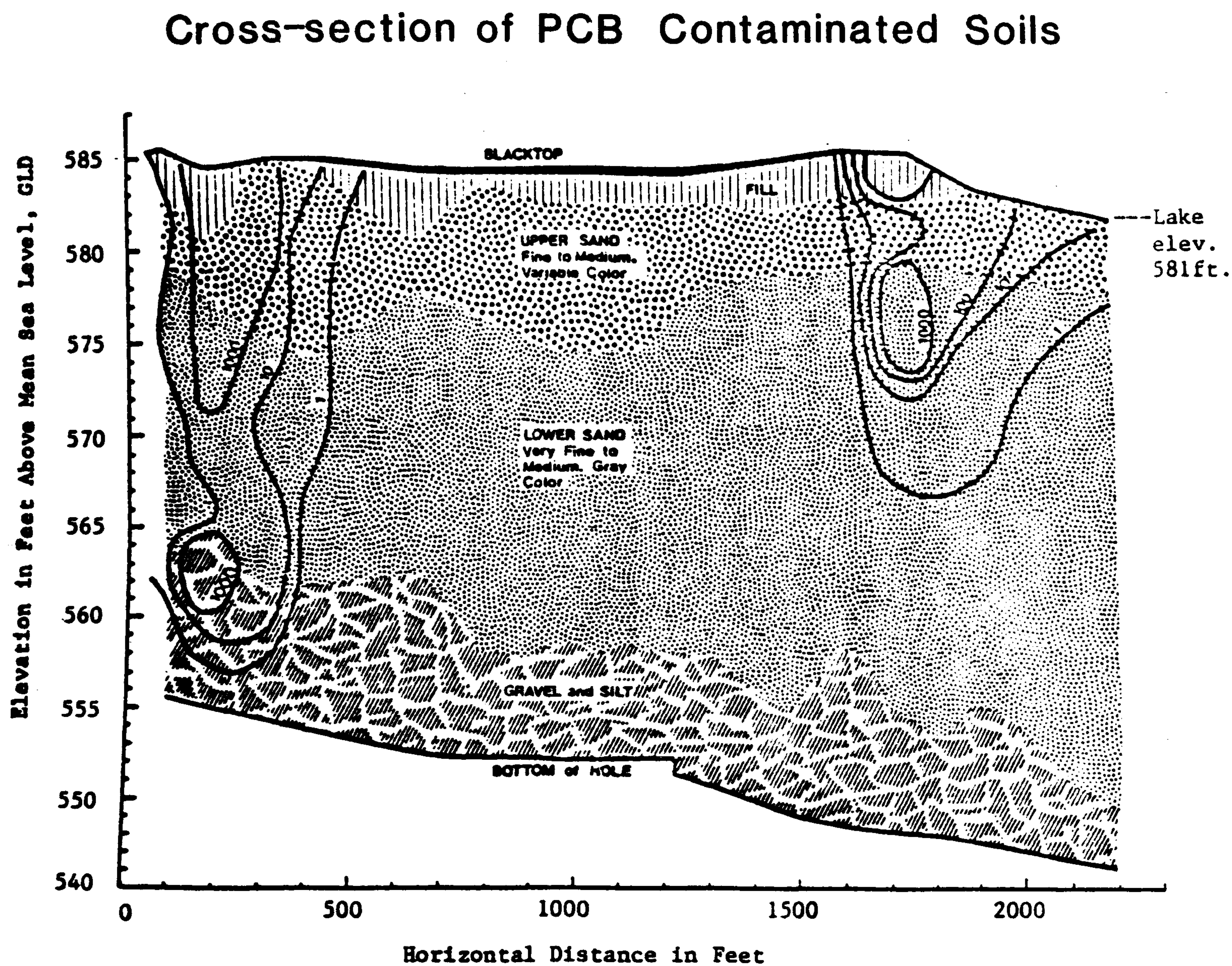

Figure 11. Cross-section of PCB-contaminated soils at a site near Waukegan Harbor. Isopleths show PCB concentrations in micrograms/gram.

in soils, even sandy soils. The soil cross-section is of a site near Waukegan Harbor where spills occurred over a period of twenty years. Shaking effects pose a minimal threat to human health or the environment due to hazardous materials exposure no matter how great the shaking.

Liquefaction

Liquefaction occurs when a saturated sandy soil is subjected to rhythmic shaking or other stress. This stress causes the sand grains to settle and realign in relation to each other. In this process, expelled water causes the soil to lose its shear strength or ability to stay firm. As a consequence, the sandy soils may begin to flow like a dense liquid (Dobry et al. 1981).

There are three effects of liquefaction which could hypothetically threaten the UNISON site. First, massive and widespread flowage of liquefied soils underneath the facility might conceivably move the facility towards the Ohio River (1500 feet away). If this happened, a massive release to the river would result. Second, the facility might topple as underlying soils lose their ability to support the foundation. This effect was seen in the Niigata, Japan earthquake of 1964. Third, as they flow, the soils beneath the plant might spread in a manner that could tear the facility apart.

The potential for liquefaction is related primarily to the type and depth of soils beneath the site, the depth to groundwater and the magnitude of the earthquake itself. In general, only sandy soils will liquefy. This is due to larger pore spaces between individual particles. Fine soils such as silts and clays, in contrast, are not known to liquify. Liquefaction is also increasingly less probable as depth to groundwater increases (Seed 1979).

Surface soils beneath the site are of three basic types: Henshaw silt loam, Robertsville silt loam, and Calloway silt loam (USDA 1967). The unconsolidated deposits in this area consist mostly of fine grained alluvium and loess materials derived from the Ohio River (Harvey 1956). Silty to clayey soils and alluvium underlie the facility to a depth of at least 40 feet. Because of their fine particle size and great thickness, such materials are unlikely to experience liquefaction in an earthquake (Seed 1979). However, flowage of deeper sandy layers could in turn cause disruption of overlying silty soils. There is a thick layer of sand beginning about 50 feet beneath the facility. Despite this, a major episode of liquefaction at the facility does not seem likely, but it cannot be ruled out without in situ seismic study of sediments underlying the site.

If liquefaction does occur, the bluffs along the Ohio River would likely collapse. However, the plant site is far enough south of the bluffs that it is impossible for the plant itself to be carried to the River (Figure 12). The drawings in Figure 12 are vertical planes through the plant running north/south. The upper drawing has a ten-fold vertical exaggeration to show elevations more prominently and is typical of such drawings in the geological literature. The lower drawing is to scale. In the upper drawing, it appears possible that if the bluffs collapsed the plant could be carried to the river. In the lower drawing, however, one can see that this is plainly impossible. Mudslides of any consequence can only occur in hilly terrain. There is no danger from this effect at the Henderson site.

Toppling of the Henderson plant could not occur although some degree of tilting is a distinct possibility. Toppling occurs when soils can no longer support the foundation. Large angles of tilt are only possible with multi-story buildings. Small angles of tilt are possible, however, even with single story buildings. If all tankage at the site had ruptured so that the containment bays were full of fluids, a tilt of about half a degree (approximately 1%) in the north/south direction would be sufficient to cause spillage. While greater slopes could be tolerated in the east/west direction because of the shape of the containment structure, the most likely direction of tilt is to the north. Although tilting is unlikely to be substantial, it is impossible to rule out slopes of one or two percent. Consequently, if most of the tankage inside the plant ruptures due to shaking, soils contamination outside the plant could well occur. If major spillage inside the plant does not occur (and it will not if the quake only registers IX on the Mercali scale,) tilting of several degrees would result in no release to the environment.

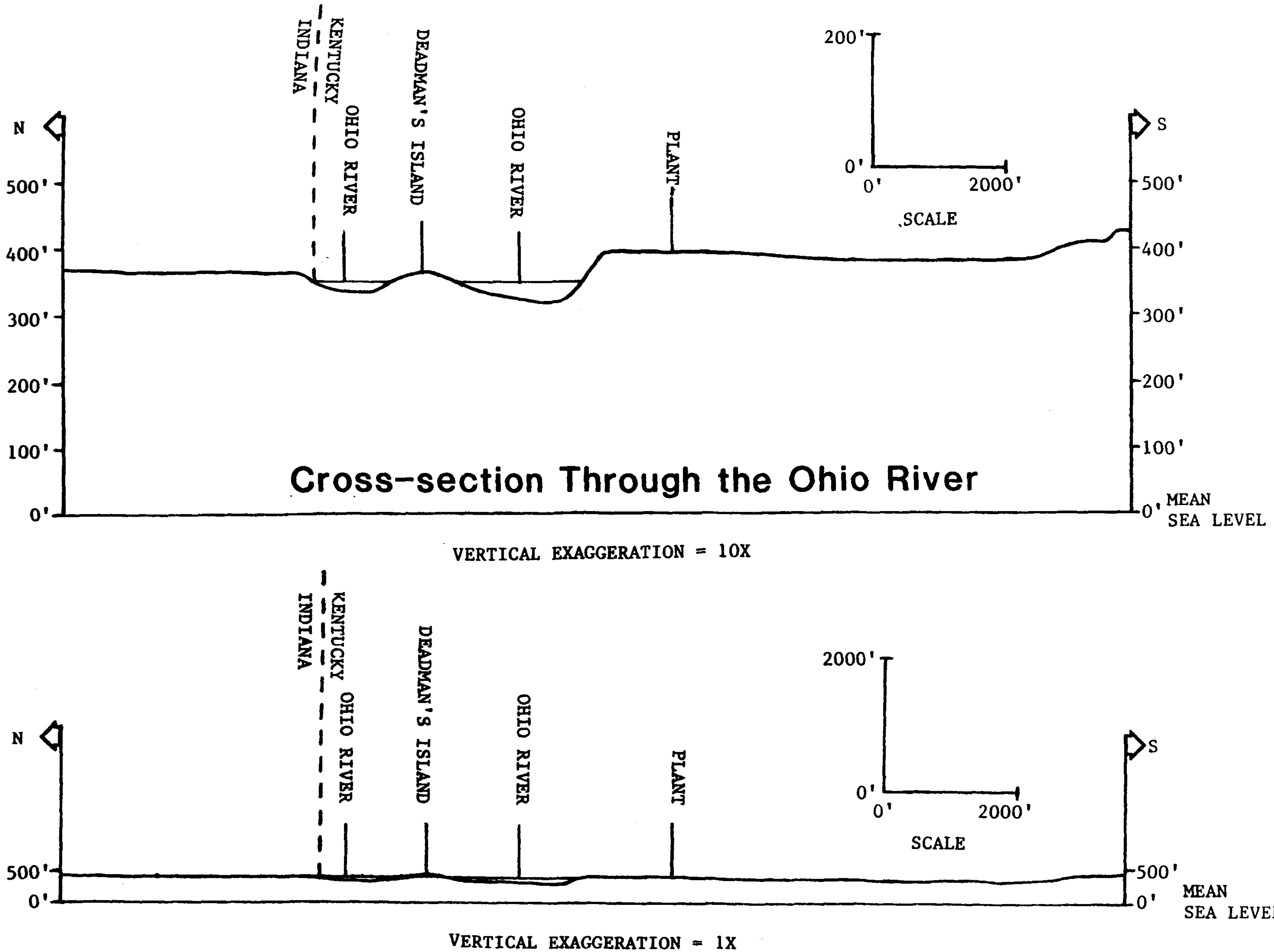

Figure 12. Cross-section through Ohio River showing elevation of UNISON plant relative to river elevation.

The third dangerous liquefaction effect is spreading of surface soils with consequent cracking and dislocation of foundations. In the San Fernando earthquake of 1971, most of the damage to the Jensen (water) Filtration Plant was due to this effect. If similar effects occurred at UNISON's Henderson facility, it is likely that lines would crack as the foundation broke, releasing contaminants to the soils beneath the facility. While no general release to the environment would be possible other than vapors of little consequence, the clean-up would be costly and would likely require demolition of the facility.

Subsidence

The third major hypothetical consequence of an earthquake would involve an abrupt uplift or subsidence of the ground surface via movement of underlying bedrock. Such effects are almost always confined to the area near the epicenter of a major earthquake which in this case is likely to be 150 miles from the site. Unless a major earthquake occurs in the nearby Rough Creek fault zone, subsidence sufficient to damage the facility is exceptionally unlikely. If it does occur, the effects would be similar to those caused by spreading of soils due to liquifaction.

Conclusions

Of all three earthquake effects, liquefaction appears to have the greatest potential of directly affecting the UNISON site. However, the character of underlying soils at the facility suggests that liquefaction effects, if they occur at all, would be very minimal. Of the three types of liquefaction described above, some degree of tilting or sinking of the entire building would be most likely. Any PCB spills resulting from such settling could be contained within the immediate vicinity of the facility. Similarly, a spill could be contained if the facility were damaged by a spreading flow pattern. Large scale flowage of the entire sediment pile into the Ohio River cannot happen.

5.2.1.5 Potential for Releases Due to Flooding

The UNISON facility is located in the Canoe Creek drainage basin, approximately 1¼ miles west of the confluence of Canoe Creek and the Ohio River (Figure 13). It is located only a few hundred feet south of a low ridge which rises two to three feet above the level of the property. North of the ridge, run-off is directly towards the Ohio River; south of it, to Canoe Creek. Thus, flooding could come from either the Ohio River or from Canoe Creek. However, since there is virtually no land up-hill from the facility within the Canoe Creek drainage basin and because it is so near Canoe Creek's juncture with the Ohio, flooding, if it occurs at all, would have to come primarily from back-up of the Ohio. Nonetheless, the potential for flooding from both the Ohio River and Canoe Creek was studied.

A recent study by the Corps of Engineers (COE 1985) reports on the potential for flooding in the vicinity of the project site:

> "Significant flooding on Canoe Creek is caused by frontal system storms and convective storms. Frontal system events are characterized by rainfall that is widespread in aerial coverage and generally moves up the Ohio River valley on a track from southeastern Missouri to western New York. Runoff is often increased by antecedent conditions. Convective storms are typified by the thunderstorm. They are often marked by periods of intense rainfall for short durations and may be extremely variable in the area covered.
>
> Flooding on the lower portion of Canoe Creek is controlled by the Ohio River. Notable floods on the Ohio River at Henderson, Kentucky, include those that occurred in February 1884, March 1913, January 1937, December 1942-January 1943, March 1945, April 1948, and March 1964. Profiles of these floods, except the 1884 event, are shown on [Figure 14].
>
> January and February 1937 witnessed levels of flooding previously unknown on the Ohio River resulting from numerous storms that occurred between 26 December 1936 and 25 January 1937. Rainfall totals for this period ranged from 8 inches on the northern fringe of the basin to 25 inches near the center of the basin. An isohyetal map [showing where and how much rain fell] of the Ohio River Basin is shown on [Figure 15]*. A series of reservoirs have been constructed on tributaries of the Ohio since 1937; therefore, a recurrence of the same flood stages would be less likely today.

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*Compare the rainfall pattern on this Figure with the shape of the Ohio Basin itself shown on Figure 16.

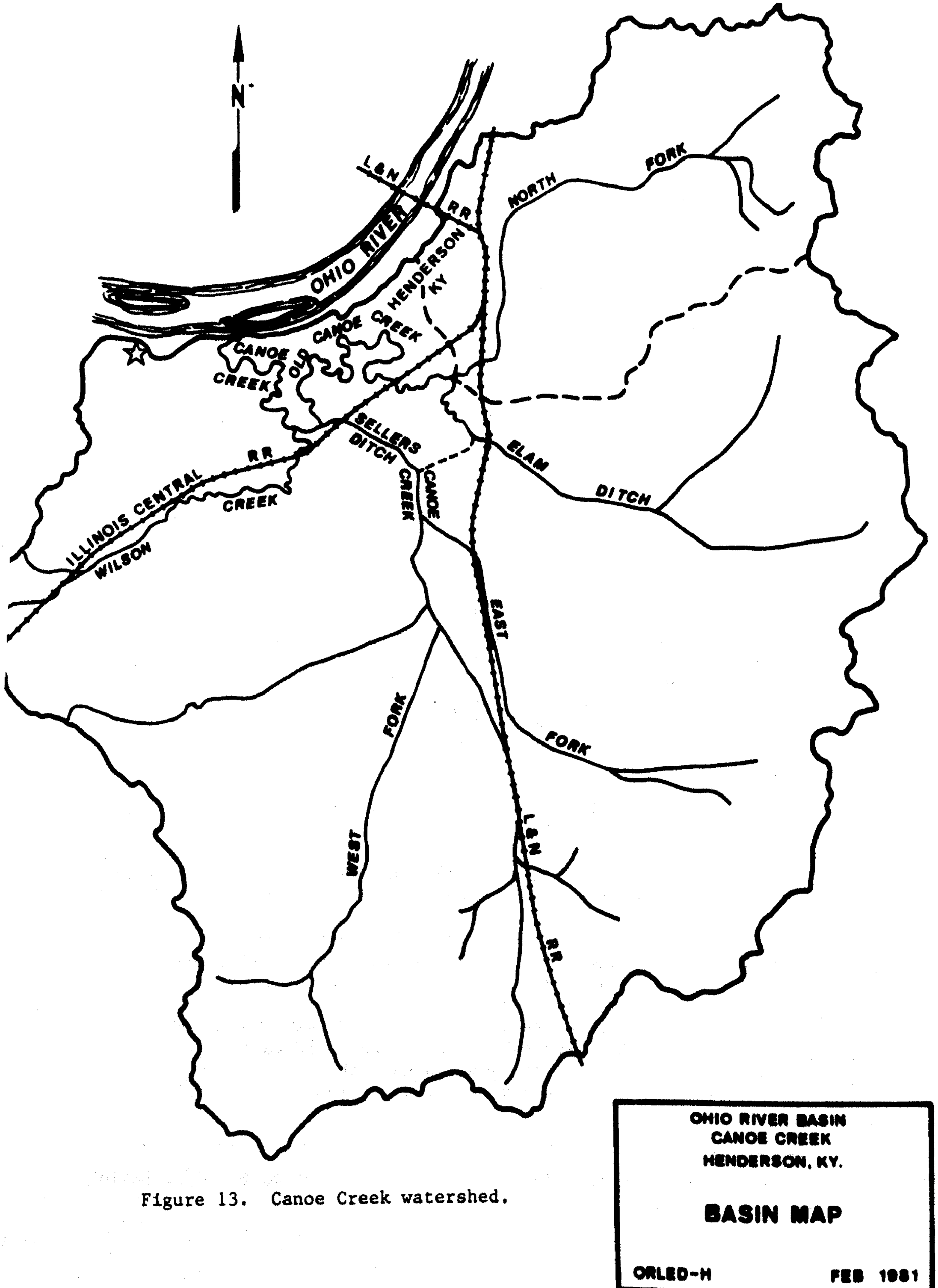


Figure 13. Canoe Creek watershed.

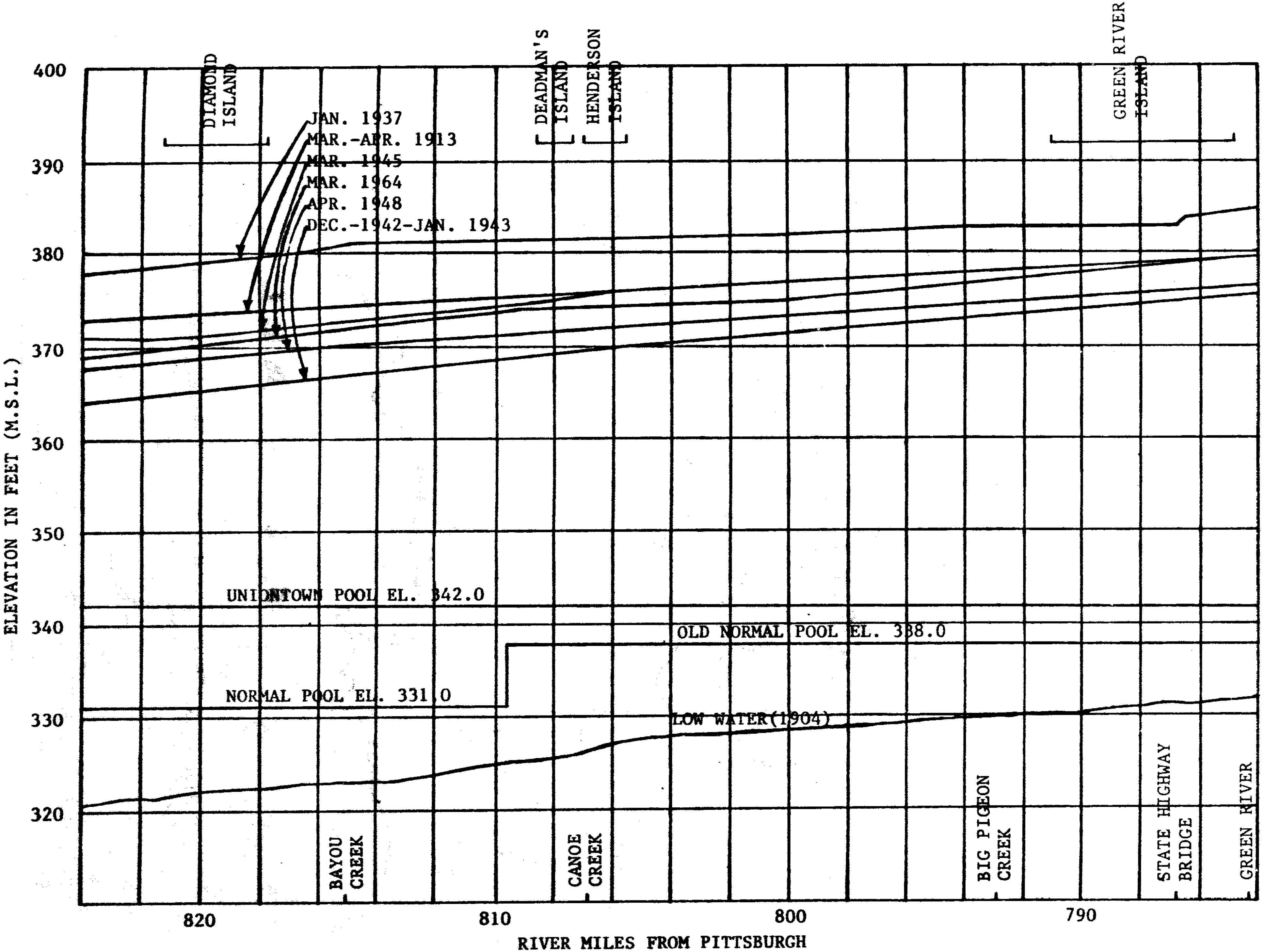


Figure 14. Elevations of notable floods in the vicinity of Henderson Co. (COE 1985

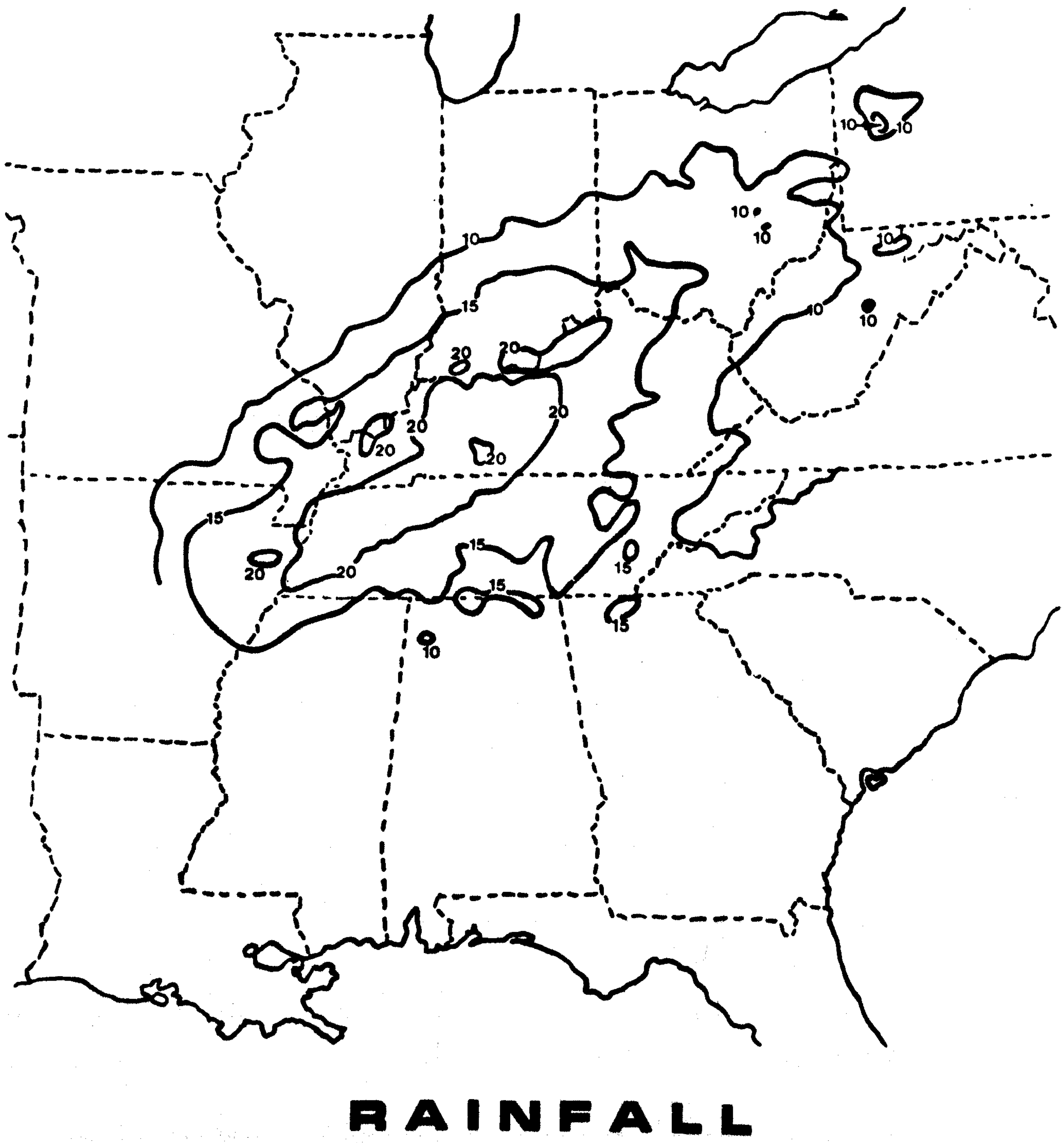


Figure 15. Total precipitation in inches, December 26, 1936 to January 25, 1937. (COE 1985)

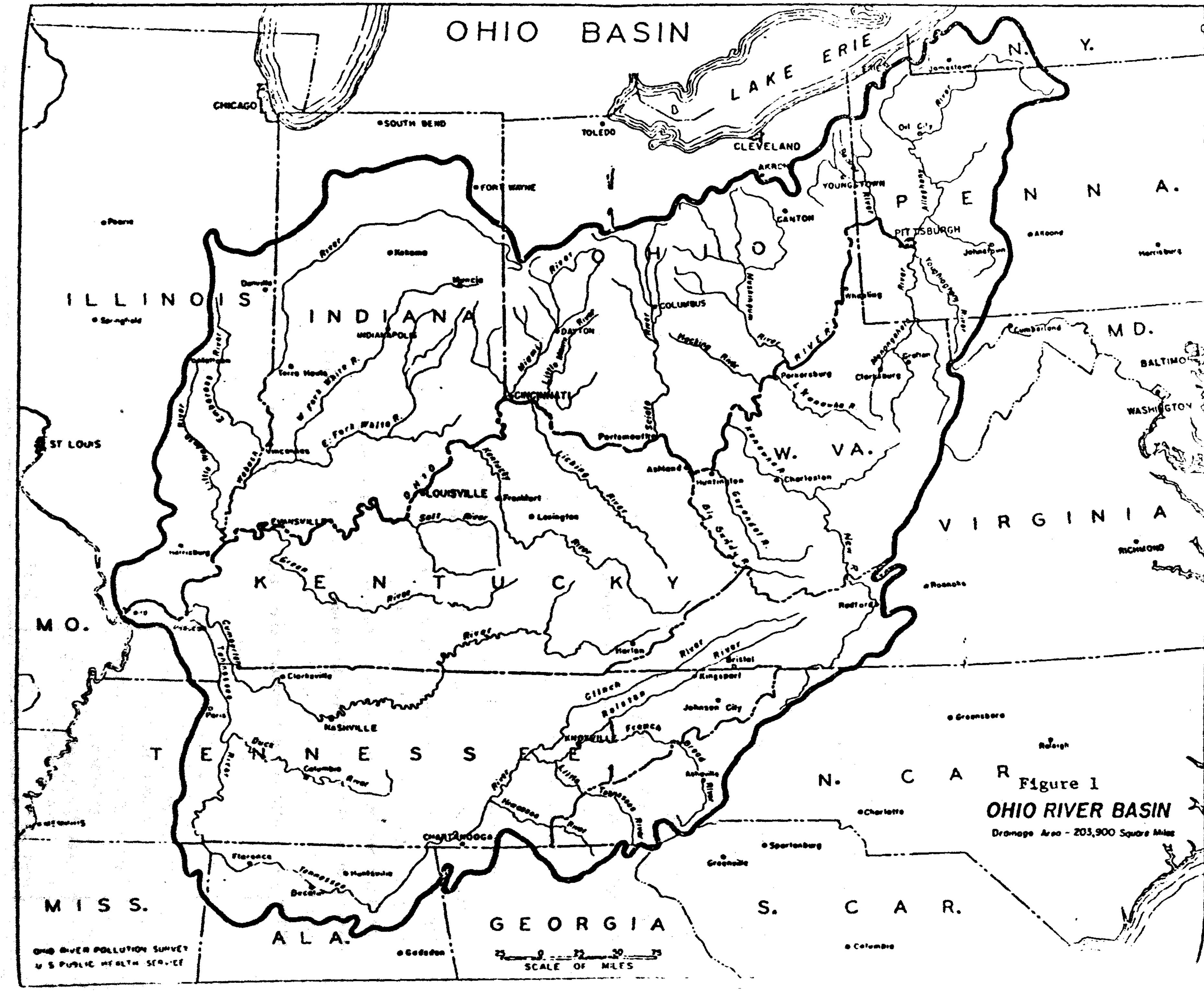


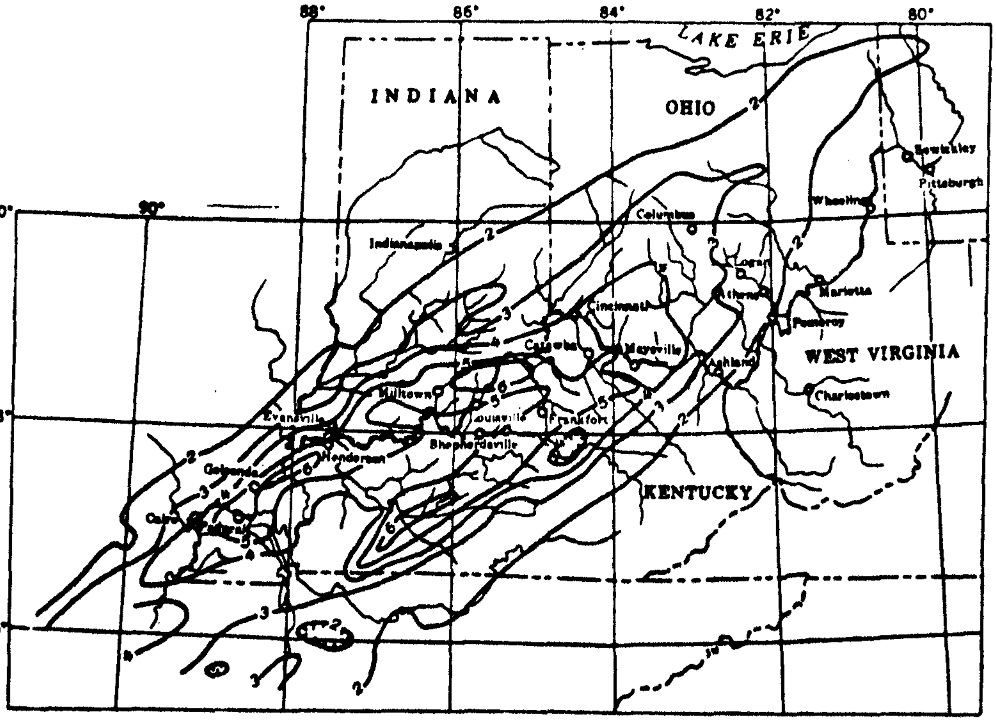
Figure 16. Ohio River watershed.

A more recent event occurred in March 1964 when two periods of heavy rainfall produced severe flooding along the Ohio River. Prior to March 1964, soil moisture was seriously deficient in Ohio, Indiana, and Kentucky. The dry period ended abruptly when rain fell in two periods on 2-5 March and 8-10 March. Heavy rains during the first period covered a broad area paralleling the Ohio River from southeastern Ohio to western Kentucky. These rains were a part of strong thunderstorm and wind activity. Tornadoes killed three people in western Kentucky. A second series of storms hit the area again in less than a week. Heaviest concentrations were centered along the Ohio River again with maximum amounts in southern Indiana and northern Ohio. This time the precipitation extended farther up the basin into central Ohio and western Pennsylvania. Isohyetals for both storm periods are shown on [Figure 17]. The March 1964 flood on the Ohio River at Evansville, Indiana, reached a stage which was 0.6 to 1.1 feet lower than the floods of 1883, 1884, 1913, and 1945, and 6.0 feet below the flood of 1937."

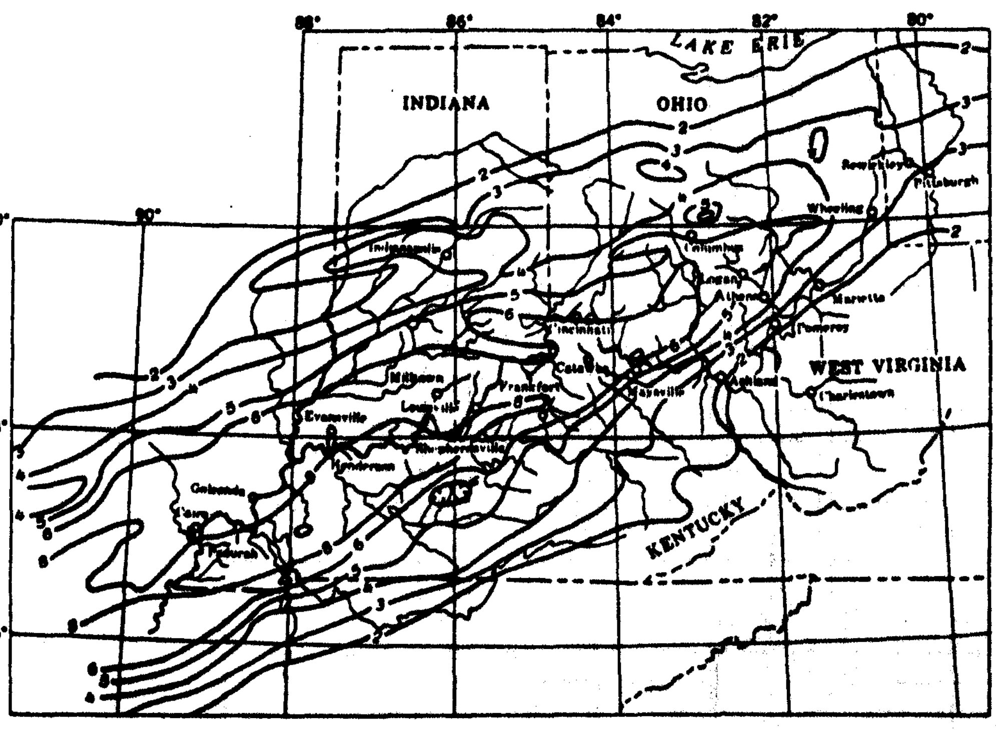
Ten-year, one-hundred-year and five-hundred-year flood levels are shown for the Ohio River on Figure 18 and for Canoe Creek on Figure 19. Based on this information, waters could be expected to rise as high as 376 feet above sea level once every one hundred years and as high 378½ feet above sea level once every 500 years. In the great flood of 1937, water rose to about 381 feet (McCabe 1962) (Figure 20) . These levels are now considered to be about as high as the river could possibly get barring only the most extraordinary events. Since the project site is located at an elevation of greater than 389 feet, it is not within an area considered capable of flooding.

Nonetheless, even the most remarkable events do, on rare occasions, occur. If one extrapolates from the available data, the chance of a flood as high as 390 feet is so small it is likely to happen only one to five times every million years. Such a flood would barely wet the foundation of UNISON's facility but would put much of Evansville under more than ten feet of water. Extent of a 390 foot flood is shown in Figure 21. Even higher water can be imagined but the chances of this occurring are extremely small. In conclusion, there is no significant hazard from this facility associated with flooding.

FLOODS OF MARCH 1964 ALONG THE OHIO RIVER



Isohyetal map of total precipitation, March 2-5, 1964.



Isohyetal map of total precipitation, March 8-10, 1964.
Prepared from U.S. Weather Bureau data.

FROM U.S.G.S. WATER-SUPPLY PAPER 1840-A

Figure 17.

OHIO RIVER BASIN
CANOE CREEK &
NORTH FORK CANOE CREEK
HENDERSON, KY.

TOTAL PRECIPITATION IN INCHES

U.S. ARMY ENGINEER DISTRICT
LOUISVILLE KY.

ORLED-H FEB 1981

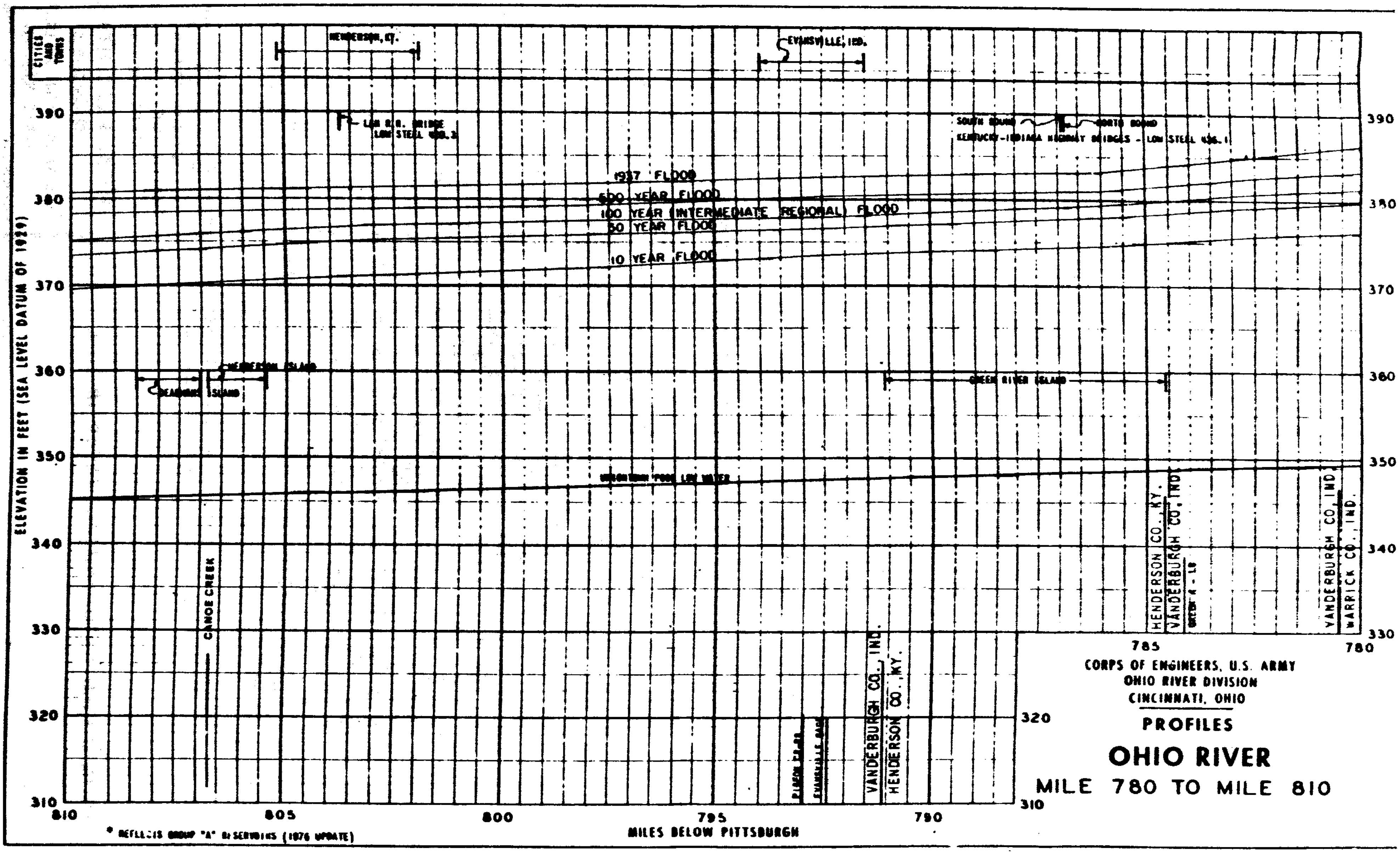


Figure 18. 10 year, 50 year, 100 year, 500 year, and project flood profiles in the Henderson area.

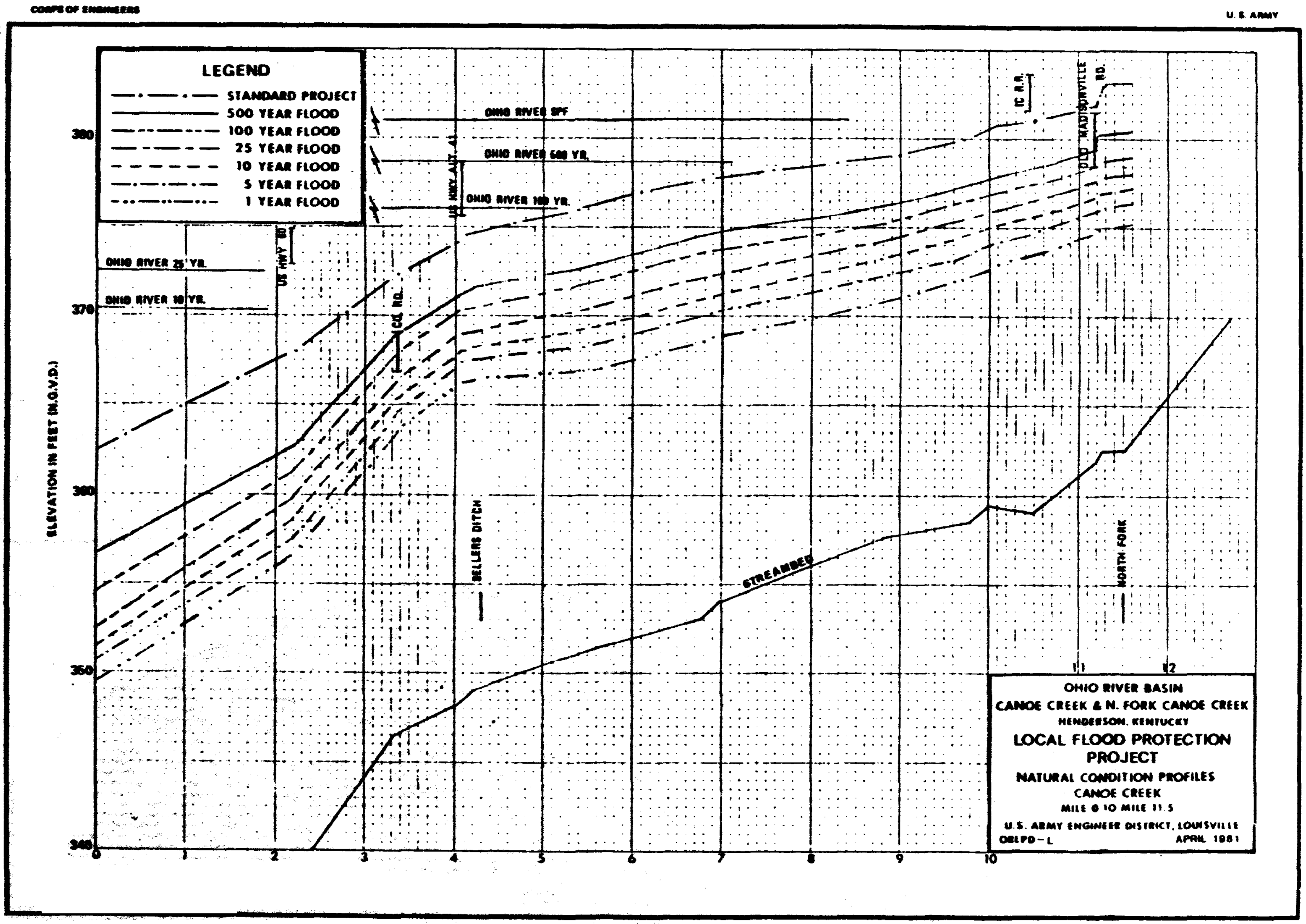
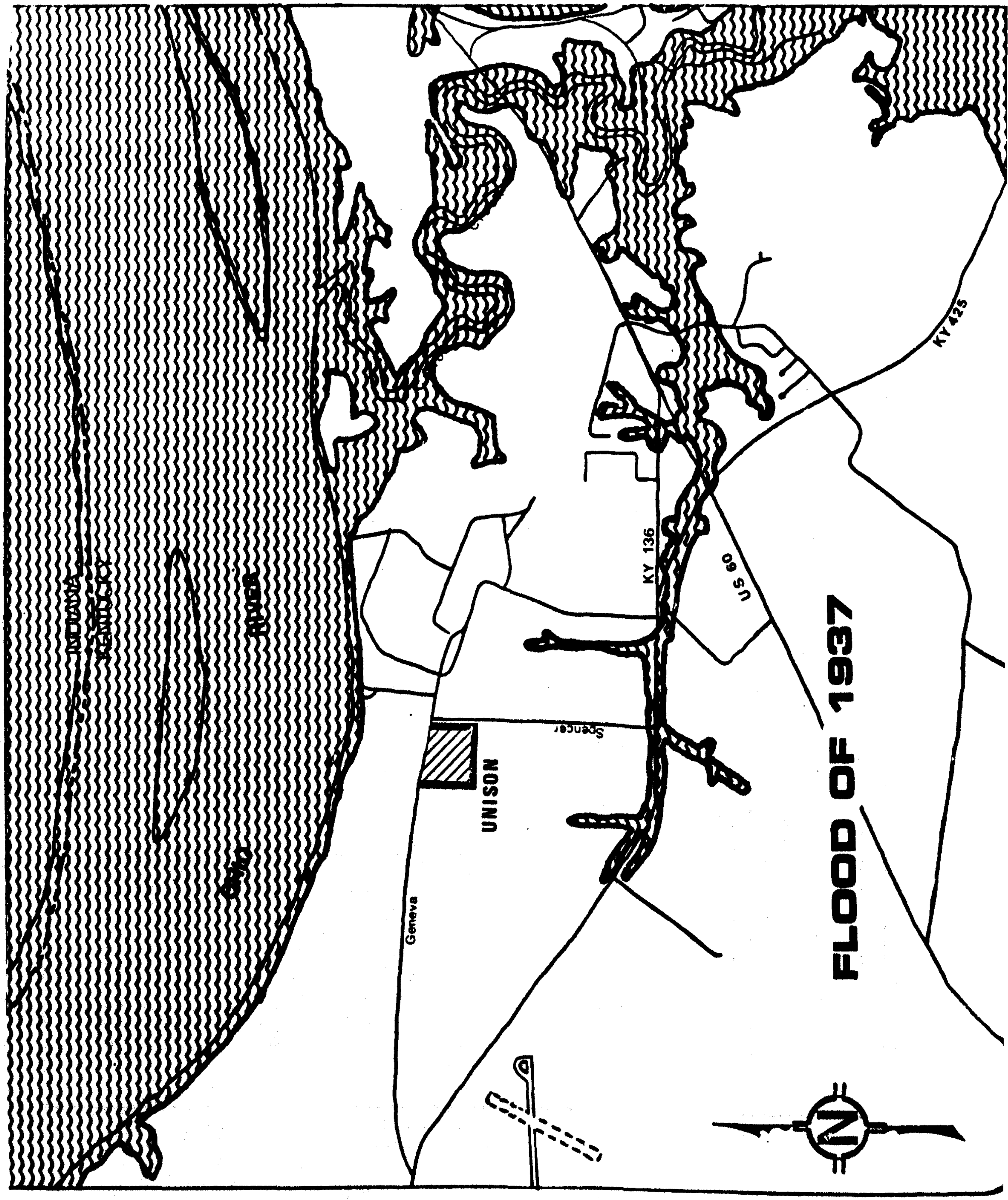


Figure 19. Flood profiles for Canoe Creek.

Figure 20. Flood of 1937.



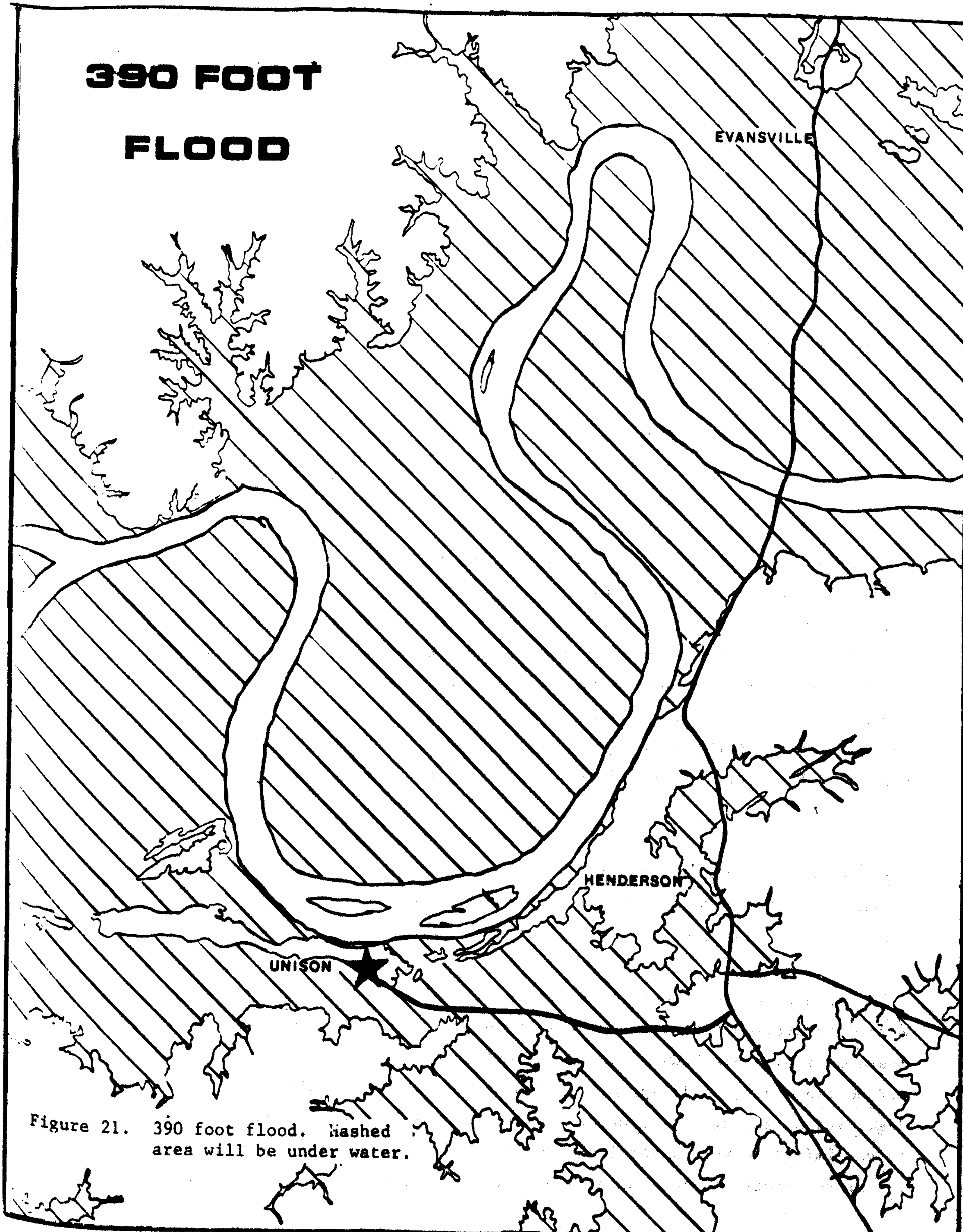


Figure 21. 390 foot flood. Hashed area will be under water.

5.2.1.6 Potential for Tornado Related Releases

The chance of a tornado strike at the Henderson facility was estimated based on data kept by the National Climatic Data Center (NCDC) of the National Environmental Satellite, Data and Information Service of the National Oceanic and Atmospheric Administration (NOAA). For the period 1953 to 1984, tornadoes have occurred in Kentucky at a rate of 2.01 per 10,000 square miles per year (NOAA 1984). However, Eastern Kentucky experiences very few tornadoes, while Western Kentucky experiences proportionately more (see Figure 22). Note that Western Kentucky storm frequencies are closer to Illinois and Indiana frequencies than those further east. The NCDC gives tornado frequencies of 4.80 and 5.70 per 10,000 square miles per year for Illinois and Indiana, respectively (Ibid). For the purposes of this report, we will assume that Henderson County experiences tornadoes at a rate of 5/10,000 mi^2/yr.

Tornadoes vary widely in the amount of destruction they cause. Some never touch the ground. Others touch, skip and touch again. Some die out quickly and other continue for many miles. The NCDC has no data on average characteristics. Based on conversations with several meteorologists, we estimate that the average tornado touches down along a path 100 yards wide and continues for less than one mile. Based on these assumptions, the chance of a tornado strike at the facility is about one in 35,000 per year or 28 strikes every million years. Most of these are weak tornadoes (Snow 1984).

Fewer than 25% of all tornadoes are classed as strong and fewer than 3% are violent (see Figure 23 and Table 3). While any tornado might cause roof or wall damage to the structure, only a strong or violent storm would be capable of causing a release of pollutants from the proposed facility.

Estimating the effects of a strong or violent tornado on the facility is made more difficult by the fact that tornadoes are capable of freakish results. Based on a sizeable body of anecdotal evidence accummulated by the Weather Bureau (Appendix 6), it appears as though the facility could be substantially destroyed by any strong tornado. However, the resulting releases are likely to be limited to what might leak from damaged drums and tanks tossed about by the storm. Most of the leakage would probably occur after the tornado had

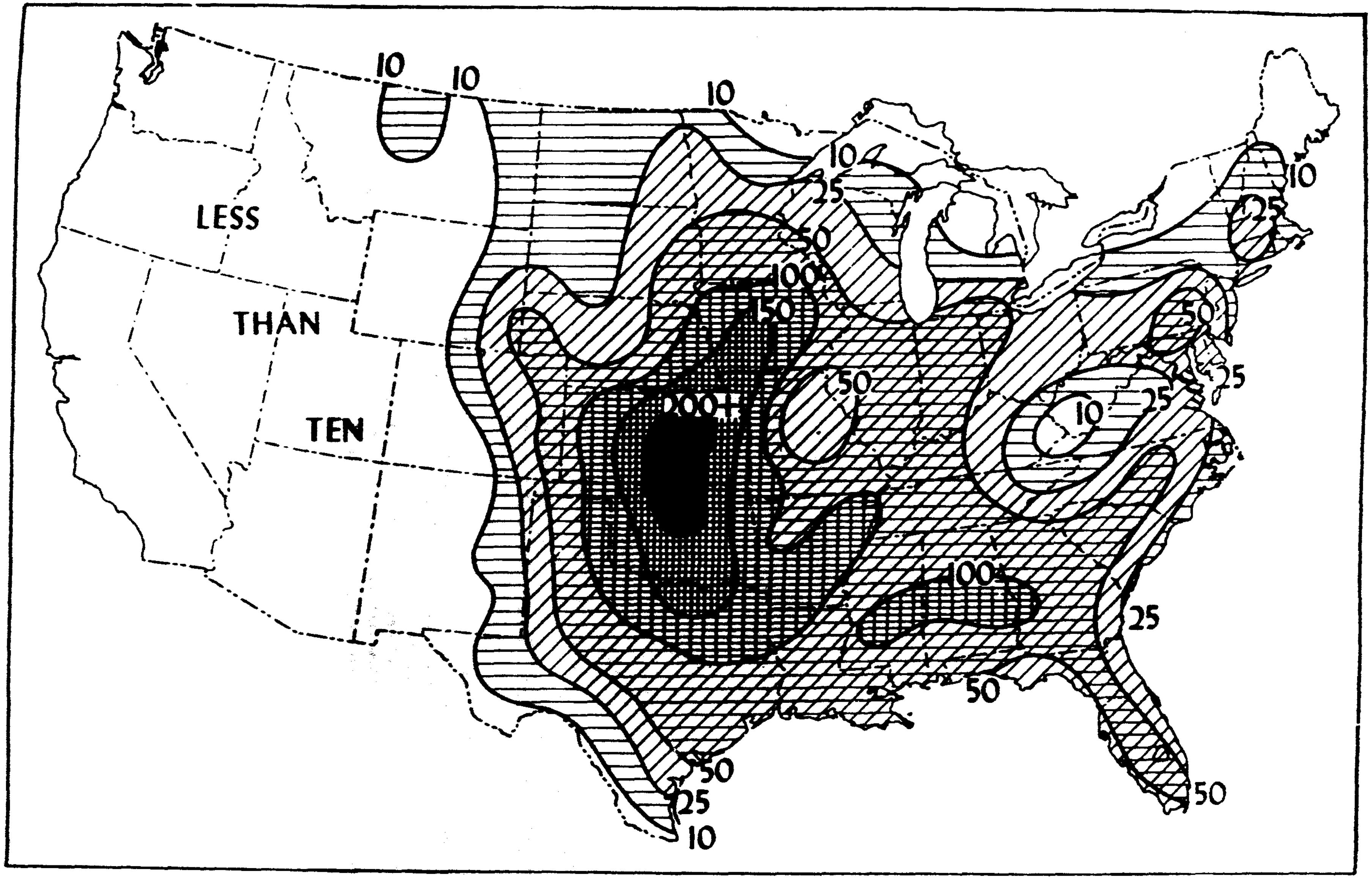
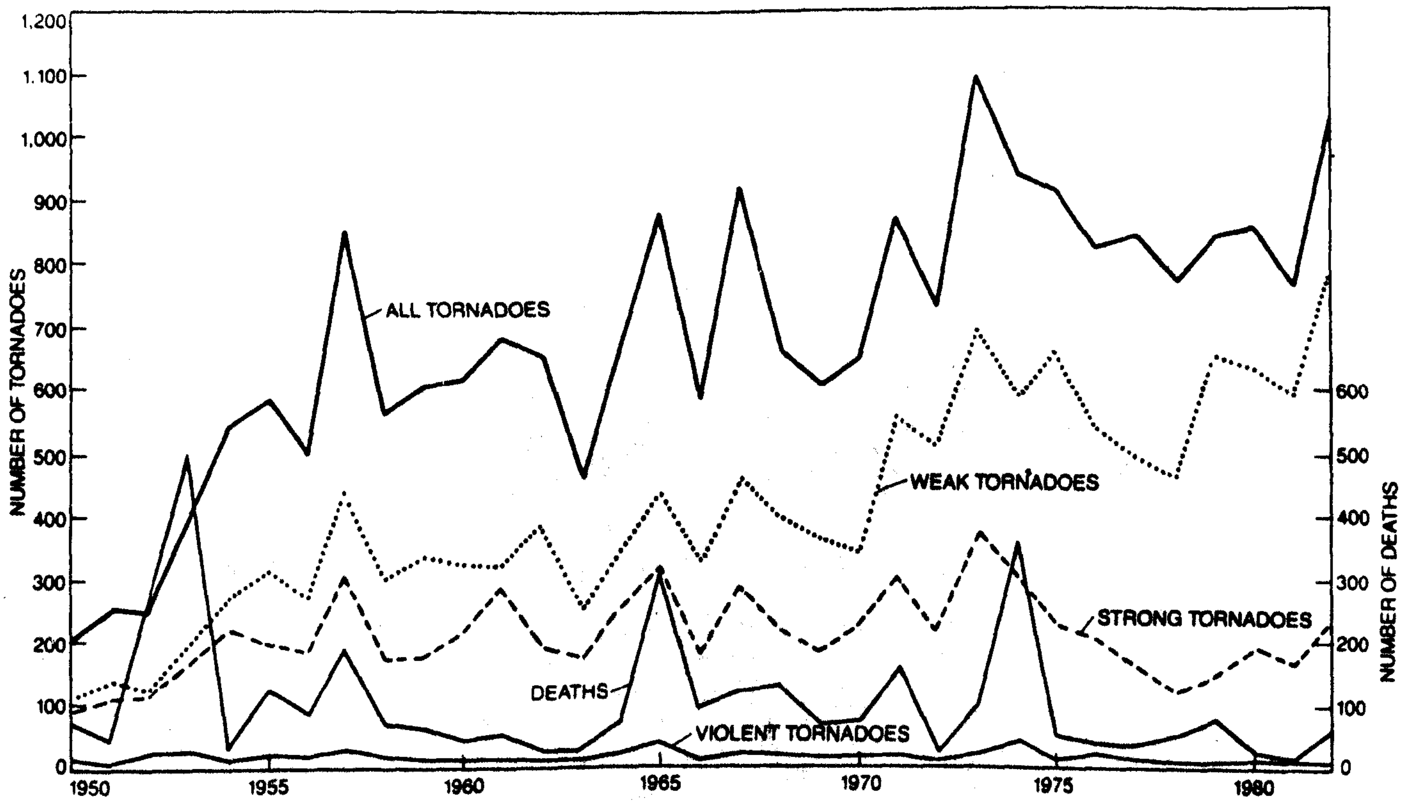


Figure 22. Distribution of tornadoes.

TORNADOES 1916-55

(Isolines based on total number by 2° squares, counting first point of contact with ground of 7,206 tornadoes.)

Figure 23 . "The Tornado", John T. Snow, Scientific American, April 1984



ANNUAL TOTAL of tornadoes recorded in the U.S. shows a steady increase that is attributed to improved record keeping rather than to a real rise in frequency. The Federal Government began collecting tornado reports systematically in 1953 and has since extended its data base (maintained by the National Severe Storms Forecast Center in Kansas City, Mo.) back to 1950. Tornadoes are classified whenever possible according to the Fujita wind-speed scale as weak, strong or violent; since not all of them can be rated, the total is greater than the sum of the three categories. The increase in the total primarily reflects increased reporting of weak tornadoes. The number of strong and violent tornadoes, which are less likely to escape detection, shows little change. Fewer than 3 percent of all tornadoes are classified as violent, but they account for two-thirds of all tornado deaths; the peaks in the death curve reflect those in the violent-tornado curve.

Table 3. Definition of Fujita Tornado Scale (F scale)

(F0) Gale tornado (40-72 mph): Light damage
Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage sign boards.

(F1) Moderate tornado (73-112 mph): Moderate damage
The lower limit (73 mph) is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads.

(F2) Significant tornado (113-157 mph): Considerable damage
Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

(F3) Severe tornado (158-206 mph): Severe damage
Roofs and some walls torn off well-construcced houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.

(F4) Devastating tornado (207-260 mph): Devastating damage
Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.

(F5) Incredible tornado (261-318 mph): Incredible damage
Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 m; trees debarked; incredible phenomena will occur.

(F6-F12) (319 mph to Mach 1, the speed of sound):
The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

(F0+F1) Weak Tornado
(F2+F3) Strong Tornado
(F4+F5) Violent Tornado

From J. Atmos. Sci., August 1981, p. 1517-1519 passed and it is most unlikely that any of these containers would move more than 1/4 mile from the facility (NOAA 1981; Weather Bureau 1960). Thus, the more probable result of destruction of the facility by a tornado is isolated areas of severe soil contamination capable of being cleaned up with existing technology and posing minimal long term threat to human health or the environment (USWAG 1982 Vol.IV).

However, in the very remote event of a double strike by two tornadoes on the same day or by two funnel clouds in the same multi-funnel cloud storm, human health and the environment could be severely compromised. The worst possible case is for spillage from the first tornado to be spread by the second. If the spreading is wide enough, few effects could result because the PCBs might only be present below detectable concentrations. However, if the entire contents of the facility were spread over a one square mile area, the resulting vapors in areas immediately downwind would be very concentrated and clean-up of the soils exceedingly costly. We believe the chance of such an incident to be less than one in one hundred million annually.

5.2.1.7 Potential for Aircraft Related Releases

This section discusses the potential for releases of hazardous substances caused by a small airplane crashing into the facility. First, the position of the facility relative to Henderson/Henderson County airport is described and the accident history at the airport is reviewed. The chance that a plane might hit some part of the facility is then estimated. Finally, a model is developed to describe the worst case emissions from such an accident and the results of the model described.

Location

The UNISON plant is located approximately one mile east of the Henderson/Henderson County Airport. The parking lot of the proposed plant is located exactly one mile east by north (or more precisely, at a bearing of 76°) from the nearest end of the principal runway). Since the main runway is very nearly due east/west, the plant is located 14° north of the direct line of sight along the runway and slightly less than a mile away depending on the part of the plant under consideration. A distance of exactly one mile is used in the calculation below without correction.

There are no other airports nearby, so that the chance of a plane from some other airport hitting the facility is very small and not considered further. Data on such occurrences based on records kept by the National Transportation Safety Board and the Federal Aviation Administration are presented in Appendix 7. The only foreseeable aircraft accident at the UNISON facility would be due to takeoffs or landings at the Henderson/Henderson County Airport (H/HCA).

Accidents and other incidents associated with H/HCA.

At EPA's request, Glyn Parsons of the Aircraft Owners and Pilots' Association in Oklahoma City searched AOPA's computer records for all incidents associated with H/HCA. While three incidents were found, it is not clear whether the craft involved were operating out of H/HCA or whether H/HCA was simply the reporting field. One incident occurred at the airport itself but amounted to little more than a rough landing. The location of the other two incidents is not known to EPA.

The three incidents/accidents that have been reported in connection with the Henderson/Henderson County Airport since January 1980, are:

- On June 15, 1981, the alternator control wire in a private Cessna P206 overheated, filling the cabin with smoke. The pilot flew to Henderson for an emergency landing. There were no injuries, but the plane sustained minor damage.
- On September 28, 1984, the oil filler tube fell out of a Piper PA28R, causing the engine to quit as a result of oil pressure loss. The pilot attempted to land on a road, turned sideways and lost control. Although there were no injuries, the plane suffered substantial damage.
- The third incident was fatal. On August 9, 1980, a Cessna 150B was observed "flying low and making abrupt manuvers." The craft was later found demolished.

Only this last incident would have been sufficient to threaten UNISON's plant.

The Chance of a Crash into the Plant

The chance of a plane hitting some part of the plant was calculated according to a method developed by Sandia National Laboratories for use by the Navy in estimating the risk to its Strategic Weapons Facility at the King's Bay (Georgia) Submarine Base (US Navy 1985). The Base is located near St. Mary's Airport, St. Mary's, Georgia, a single-runway field with no control tower and serving general aviation. "General Aviation" is a term which refers to aircraft flown under rules other than 14 CFR 121 and 14 CFR 135. Since these two rules cover large airlines, charter craft, air cargo operations, commuter airlines and on-demand air taxies, "general aviation" is usually limited to small private craft (FAA 1984).

The Sandia method is based on a study of accidents related to busy, single runway fields with no control tower and serving general aviation in areas without substantial hills (Cornell 1973; Smith 1983; Solomon 1975; US Navy 1985). To use the method, one must know the size, shape and orientation of the facility, its direction and distance from the airport runway, and how many takeoffs and landings occur annually. The method determines takeoff associated crashes separately from crashes associated with landings. The analysis considers crashes which would hit the facility initially as well as those which strike the ground in front of the facility and then skid into it. Persons familiar with operations at H/HCA estimate that there were 22,000 takeoffs and landings in 1985. A more comprehensive description of the calculation is given in Appendix 7.

Using this data in the Sandia method for crash estimation gives the chance of an accident in any given year as 0.0000133 or 1.33×10^{-5}. This is 13.3 times every 1,000,000 years or about once every 75,000 years. Looked at another way, we can say there is a 50:50 chance of it happening sometime in the next 52,000 years or a 99.973% chance that it will not happen in the next twenty years. These calculations assume H/HCA traffic volume remains constant.

If we assume the volume of traffic at H/HCA grows at 6% per year for the next twenty years, there would be 70,557 takeoffs or landings in the year 2005. That would be 193 per day or one every 7½ minutes around-the-clock. The chance of no plane crash into the UNISON plant in the next twenty years, assuming 6% growth, is 99.679%. Conversely, the chance of one or more crashes into the facility would be 0.321%.

Possible Effects of an Airplane Hitting the Plant

Because the 0.321% figure is by no means negligible, EPA determined the possible range of effects of an airplane hitting the facility and modeled a "worst case" event.

The most likely event would tear open the roof and break open some pipes or drums, causing minor spillage and consequent release of small quantities of vapors to the atmosphere. There is some likelihood that a low velocity, low angle-of-approach accident would result in the airplane bouncing off the roof or becoming entangled in the roof support structure without doing any damage to the storage or processing equipment. There is some chance, roughly estimated to be 10%, of a large spill inside the plant due to rupture of a large tank or major pipe resulting from a major crash. This would allow somewhat larger quantities of vapor to escape. Emissions would be similar to the phase III emissions described in the worst case analysis below.

In a major crash, the processing system would go into emergency shutdown mode, which kills power to everything except the safety and pollution control equipment. If all power to the facility were lost, the safety equipment would not function and greater quantities of vapors would be released. However, spilled materials would be contained within the concrete containment basin. Clean-up could be completed within a few days at most.

A hypothetical "worst case" accident was created which involves a high angle of impact and high velocity. It requires that the bulk of the craft penetrate the roof without substantial loss of energy and subsequently lodge in the storage tank holding concentrated PCB residues. It will be recalled that this tank is kept warm to prevent the residues from solidifying. The "worst case" accident further assumes that the fuel tank on the plane is full and that all of the fuel spills and catches fire. Finally, warm residues are assumed to spread across the floor in the main containment basin and give off vapors until emergency response personnel can either clean them up or restore vapor containment. The probability of a crash affecting the site resulting in this worst case accident is estimated to be significantly less than 1%.

In order to model this accident, it was divided into three phases. During the first phase which lasts a few seconds, the plane penetrates the residue tank. All of the plane's kinetic energy turns to heat and boils off a quantity of residues creating a hot cloud of concentrated vapors which rises out through the hole in the roof. During the second phase, the fuel mixes with the PCB residues and burns creating soot containing dioxins and dibenzofurans. This would last a few minutes. The third phase involves evaporation from the spill and is assumed to last 72 hours.

In order to model phase one, it is necessary to know the size and velocity of the plane. Calculations were based on a 4-passenger propeller driven model fully loaded with fuel and cargo. It was assumed that the terminal velocity was 90 knots (103.5 mph) and the weight of the 4-passenger fully loaded plane was 2635 pounds. Since kinetic energy is equal to one-half the mass times the square of the velocty, the analysis indicates 3.066×10^5 joules of energy are liberated as heat.

If the plane passed cleanly through the roof and the side of the storage tank without losing energy, 73,300 calories of heat would be delivered to the residue tank. This is clearly an unrealistic assumption. It does not consider energy released through movement of materials or the heating of parts of the facility other than the PCB residue. But there is no simple method for estimating the energy lost going through the roof and the side of the tank and energy lost through deformation or movement of materials, so this energy was not considered.

In order to make a conservative analysis, a second assumption was made that the residues were not merely warm but that they were just below the boiling point. This raises the quantity of vapors released by sixty to ninty percent. This was done because each component of the residue has a different specific heat and a different boiling point. Detailed calculations were avoided because they could have been used by UNISON's competitors to determine the kinds of chemicals in the residues.

Finally, it was assumed that the latent heat of vaporization, or amount of heat necessary to evaporate the material, was 100 BTU's per pound (55.6 calories/gram). Each component actually requires somewhat more heat than this to evaporate.

Based on these assumptions, the quantity of vapors released by the initial impact would be 5.52 kilograms or about 12 pounds. This figure was used as input to the Phase I analysis. The Phase I analysis involved use of a computer model, "PUFF", (Petersen 1982) which determines how vapor clouds caused by explosions might affect people downwind. Various kinds of atmospheric conditions were used in the PUFF model to estimate worst case wind and turbulence conditions. The results of this modelling are reported below.

In order to model phase II, EPA had to determine whether burning of the spilled fuel would be used simply to add more heat and increase vapor concentrations or whether to assume incomplete combustion, soot formation and the formation of highly toxic by-products. It was decided that the more conservative approach, given concerns over toxics formation, would be the latter. Consequently, a fire model developed by Versar, Inc. (EPA June 1985a) in connection with transformer fires exacerbated by the presence of combustible materials was used. This model was simplified somewhat by assuming that the quantity of soot produced would be about 20% of the total weight of fuel.

Finally, it was assumed that the soot produced would have the same composition as soot produced in transformer fires. This was done because there is no data on the kind of soot produced in burning UNISON residues (no one has ever burned them). Also, the residues have similar physical-chemical characteristics to typical transformer fluids.

Soot dispersion was modelled using INPUFF (EPA October 1984) assuming a fire temperature of 400°C. While this temperature is too low to permit substantial dioxin or dibenzofuran formation, INPUFF calculates plume rise based on wind speed and temperature (the higher the temperature the higher the plume). The lower temperature caused the plume to be modeled as close to the ground as possible in order to exaggerate exposures and keep the scenario conservative. The results of phase II modeling are reported below.

In order to model phase III, evaporation rates were calculated for the spilled residue by assuming that they spread across the entire surface of the main containment basin. This basin has a surface area of 401 square meters, counting equally areas covered by equipment as well as open areas. It was further assumed that the residue would remain warm (60°C) rather than slowly drop in temperature. The results of phase III modeling are presented below. Because the crash might destroy a wall as well as the roof, the vapors in phase III were modeled using a computer program (D2PC) developed by the Army (US Army 1986) to determine the effects of chemical weapons on exposed populations. This was chosen over INPUFF because it can handle vapors close to the ground more accurately.

Modeling Results

The results for phase I show that the greatest concentrations are found using low wind speeds (1.0 meters per second) and unstable atmospheric conditions (stability class 1). These are not common conditions but they are possible. They bring the vapor cloud to the ground the shortest distance from the plant. The highest concentrations are projected at about half a kilometer downwind (0.3 miles) from the plant and occur between eight and nine minutes after the accident. Concentrations peak at 965.3 micrograms per cubic meter (parts per billion*) and over the first minute average 891.3 ug/m^3. Values drop rapidly after that as the cloud moves on.

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*See note page 5-2.

Concentrations at one kilometer downwind peak at 595.5 ug/m^3 about 17 minutes after the crash, average 582.0 ug/m^3 for the first minute and 375.8 ug/m^3 for the first five minutes. Again, values drop rapidly thereafter as the cloud moves on.

At ten kilometers downwind (6 miles), concentrations peak at 3.722 ug/m^3 and average 3.460 ug/m^3 for about fifteen minutes. Under stable atmospheric conditions, these more remote receptors could be exposed to concentrations that would peak at 48.88 ug/m^3 and average 34.51 ug/m^3 for about five minutes before dropping off. The effects of these exposures are discussed in Section 5.3.

After the initial vaporization of materials, a fire was hypothesized to begin. The greatest exposure to soot was found to occur at wind speeds of 1.5 meters per second in unstable air (stability class A). The highest concentration was at one kilometer downwind where the plume first touched ground about 11 minutes after the accident. Concentrations average 406 nanograms per cubic meter for the first five minutes of exposure and average 50.7 ng/m^3 for the first hour. With higher wind speeds (5.0 and 10.0 m/s) stability class D produces the greatest exposures. At 5.0 m/s, these occur at 2 kilometers from the site and average 135 ng/m^3 over five minutes. At 10.0 m/s, maximum concentrations occur at 4.0 kilometers and average 220 ng/m^3 over five minutes.

Soot deposition was not modeled based on the small size of this fire. Levels found after the much larger Jacksonville, Florida fire of Janury 29, 1984 were barely detectible (BESD 1984). Toxic organic compounds in soot are assumed to have the same breakdown of composition as found in the soot produced by the Binghampton, New York fire, that is (EPA June 1985a):

- 92.0% polychlorinated biphenyls;
- 1.19% 2,3,7,8 tetrachlorodibenzofurans;
- 0.68% other tetrachlorodibenzofurans;
- 3.75% other chlorinated dibenzofurans;
- 0.065% 2,3,7,8 tetrachlorodibenzo-para-dioxin;
- 0.012% other tetrachloro dioxins; and
- 1.35% other chlorinated dioxins

The effects of this exposure are discussed in Section 5.3.

In the third phase, because the emissions are prolonged, downwind concentrations come to equilibrium and remain the same until the wind changes or the spill is cleaned up. If the wind changes, concentrations rapidly reach a new equilibrium. If the spill is cleaned up, concentrations drop to zero. Downwind concentrations are greatest at low wind speeds in very stable air (stability class F). At 2.5 m/s wind speed, concentrations of toxic organics downwind are predicted to be as follows:

Distance	Concentration
10 meter	37.1 ug/m^3
50 meters	10.6 ug/m^3
100 meters	5.64 ug/m^3
500 meters	950 ng/m^3
1.0 kilometers	201 ng/m^3
2.0 kilometers	42.2 ng/m^3
3.0 kilometers	16.6 ng/m^3

Possible effects of these exposures are discussed in Section 5.3.

5.2.2 Potential for Transportation Related Releases

Transportation related releases are a possibility each time a truck-load of materials travels on our nation's highways. Despite the greatest safety precautions, accidents will happen. The chance of an accident happening to any one truck-load, however, is small. This section estimates the risk associated with moving materials to and from the Henderson site. The potential for releases is estimated from both local and national perspectives. Possible exposures from several different "worst case" accident scenarios are also discussed.

The national analysis is in Sections 5.2.2.1, 5.2.2.2 and 5.2.2.7. These sections present estimates of total annual mileage by type of cargo, releases of bulk liquids from tankers, and losses from drums carried on box trucks.

Sections 5.2.2.3 through 5.2.2.6 describe potential transportation accidents. Section 5.2.2.3 describes land uses along UNISON's transportation routes and notes places where impacts of accidents would be greater. Section 5.2.2.4 decribes a worst case accident in a residential neighborhood. Section 5.2.2.5 considers the chance of a fire in connection with an accident. Section 5.2.2.6 describes a loss of PCB residues to the Ohio River at the route 41 bridge.

Sections 5.2.2.8 and 5.2.2.9 develop estimates of the chance of accidents along the routes to be used by UNISON in Henderson and Vanderburgh Counties, respectively. Section 5.2.2.10 compares the risks discussed in the preceding sections with other risks associated with hazardous materials transport.

5.2.2.1 National Analysis-Annual Mileage by Type of Load

The quantity of materials going to and from Henderson was reported in Section 3.4 based on the plant operating at full capacity 24 hours a day. Full capacity calculations are based on operation at the maximum hourly rate permitted in the Kentucky Air Permit twenty-four hours per day for 286 days per year. This gives the maximum allowed annual operation permitted in the air permit. Alternatively, one could consider full capacity to involve operation at 78% of maximum permitted hourly rate continuously, 24 hours per day, 365 days per year.

Few plants ever run at full capacity, however, and the UNISON facility is unlikely to be an exception to the rule. In fact, even if marketing efforts are exceptionally productive, it is not likely the plant will be brought up to capacity for several years. As a conservative measure, however, estimates of the probability of transportation related releases have been based on operation at full capacity.

The annual mileage for each type of cargo is based on the known distances from Henderson to the incinerators and to the TF-2 production facility, and on the estimated market for UNISON's services. The following table shows the mileage by type of cargo based on production at full capacity.

Component	Annual Miles	Type of Container
TF-1	977,151	drums
TF-2	36,000	tankers
TF-X	996,184	drums
Residues	35,927	tankers

5.2.2.2 Estimated Tanker Release Rates

According to the U.S. Department of Transportation, Bureau of Motor Carrier Safety, over-the-road trucks are involved in 1.2 accidents for every million miles travelled. The present analysis assumes tanker trucks have the same accident rate. Of tanker truck accidents, seventy-one percent are minor and involve no release of cargo. Conversely, 29% involve some loss of load. Additionally, tankers develop leaks from causes unrelated to accidents at a rate of 0.43 per million miles (EPA March 1985). This gives a total release rate of 0.78 releases per million miles (1.2 times 0.29 equals 0.348; 0.35 plus 0.43 equals 0.78).

DOT's office of Hazardous Material Transportation maintains a computer record of every reported transportation related release of hazardous materials. A printout was obtained of every such release in Indiana and Kentucky which occurred between January 1, 1981 and January 31, 1986. There were 142 such incidents involving tankers. The quantity released is charted in Table 4. Forty-three incidents (30.3) involved less than ten gallons and accounted for 0.1% of the total quantity released. Twenty-five incidents (17.6%) involved

Table 4. Distribution of cargo losses from tankers during transit in Kentucky or Indiana from January 1981 through January 1986.

Size of Spill (gallons)	Number of Incidents	Percentage of All Incidents	Total Lost (gallons)	Percentage of All Losses
0.1 - 0.3	2	1.4	0.4	0.00
0.4 - 1.0	8	5.6	6.5	0.00
1.1 - 3.2	13	9.2	30.0	0.02
3.3 - 10	20	14.1	135.0	0.08
11 - 32	20	14.1	437.0	0.24
33 - 100	18	12.7	1,033.0	0.58
101 - 316	12	8.5	2,814.0	1.58
317 - 1000	13	9.2	7,441.0	4.17
1001 - 3163	11	7.7	20,985.0	11.75
more than 3163	25	17.6	145,680.5	81.59
Total	142	100.1	178,562.4	100.01

more than 3200 gallons and accounted for 81.59% of the total quantity released. Based on these figures, the chance of releases of various sizes was calculated as follows:

Annual Chance of Various Releases

Gallons Released		TF-2	Residues
less than 100		0.016	0.016
101-316		0.002	0.002
317-1000		0.003	0.003
1001-3163		0.002	0.002
more than 3163		0.005	0.005
	Totals:	0.028	0.028

This means that if the facility operates for 1000 years, one could expect 28 releasing incidents involving TF-2 and 28 involving residues. This would equal one releasing incident involving some type of cargo every 18 years. Of these incidents, only half would involve PCBs. These numbers mean that there is a 31.6% chance of no releasing incident occuring during the twenty-year projected life of the facility and that there is a 56.7% chance that there would be no release of PCBs. The most likely result is that there will be exactly one release and a 50% chance that this release will involve PCBs.

These figures must be qualified, however, because they probably overstate the chance of a tanker release. In the first place, the data are based on releases from all tankers, many of which have a aluminum bodies. The tankers UNISON will use are stainless steel, which are less likely to puncture. Secondly, the tankers UNISON will use have special caps and seals on the valves and hoses, which substantially reduce the chance of leaks. Third, UNISON will use only experienced drivers given special safety training. Finally, EPA's records regarding hazardous waste shipments show that in general, hazardous waste tanker drivers have a much better safety record than truck drivers. After more than nine million road miles, there has been no release due to an accident from a hazardous waste tanker (EPA March 1985).

Nevertheless, EPA considers any release of PCBs to be significant. EPA is especially concerned with the potential for tanker related releases because large amounts might be released and because the chance of such a release associated with the Henderson facility is by no means negligible. Because of these concerns, EPA analyzed several possible "worst case" accidents. These are accidents where a whole load is lost and which happen at the worst possible places, including residential neighborhoods or where the spill might pose the greatest threat to public water supplies. The chance of fire in connection with an accident was also investigated. These "worst case" accident scenarios are considerably less likely than a release in general. This should be kept in mind by the reader when reviewing the scenarios. The reader should also bear in mind the relative risk of this facility compared to risks we live with every day.

Before we relate the "worst case" scenarios, it is necessary to first discuss "sensitive receptors" that might be impacted.

5.2.2.3 <u>"Sensitive Receptors"</u>

"Sensitive receptors" is a term used in environmental regulation to denote living organisms or resources which, if exposed to a hazardous material, might suffer in some special way. In this particular case it consists of schools, nursing homes, public water supplies and nature preserves. In connection with the UNISON project, EPA identified all sensitive receptors along the routes to be used by UNISON and along the Ohio River for fifty miles downstream from Evansville.

EPA interprets the term "sensitive receptor" broadly. Residential areas were determined first. Areas located along Route 41 through Evansville are plotted on Figure 24, while areas located along the routes to be used by UNISON in Henderson County are plotted on Figure 25. Schools are also noted on these figures. Group homes for Evansville and Henderson were determined exhaustively and are listed in Appendix 8. Much of this information is from Area Plan Commission (1985).

Every water supply company which takes water from the Ohio River downstream from the Route 41 bridge was contacted. The intake location and treatment method used was recorded. Locations of water supplies are shown in Figure 26. Not surprisingly, all water supply treatment companies use alum coagulation for suspended solid removal and have activated carbon on stand-by

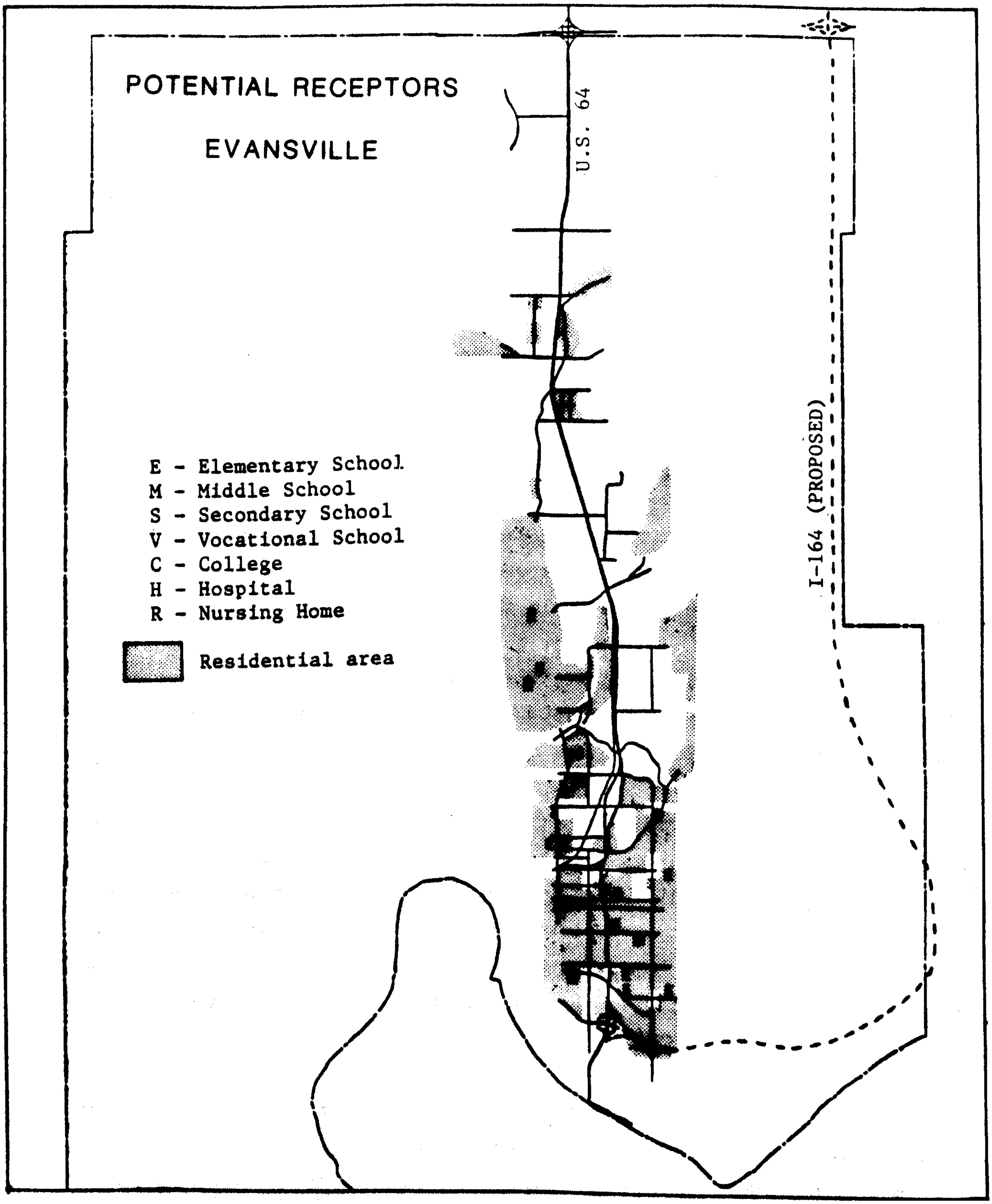

Figure 24. Potential receptors in Evansville area.

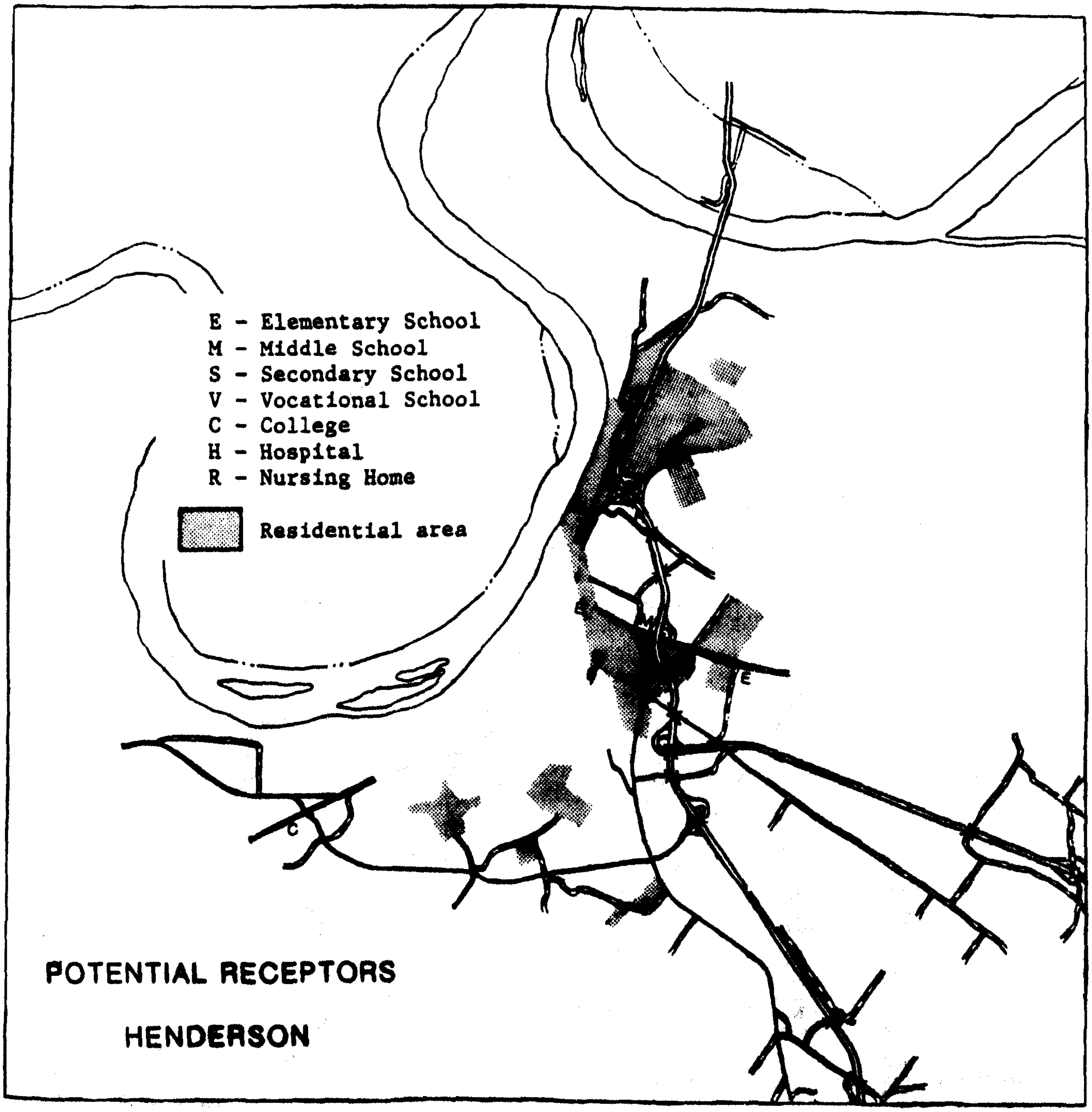

Figure 25. Potential receptors in the Henderson area.

Downstream Water Intakes

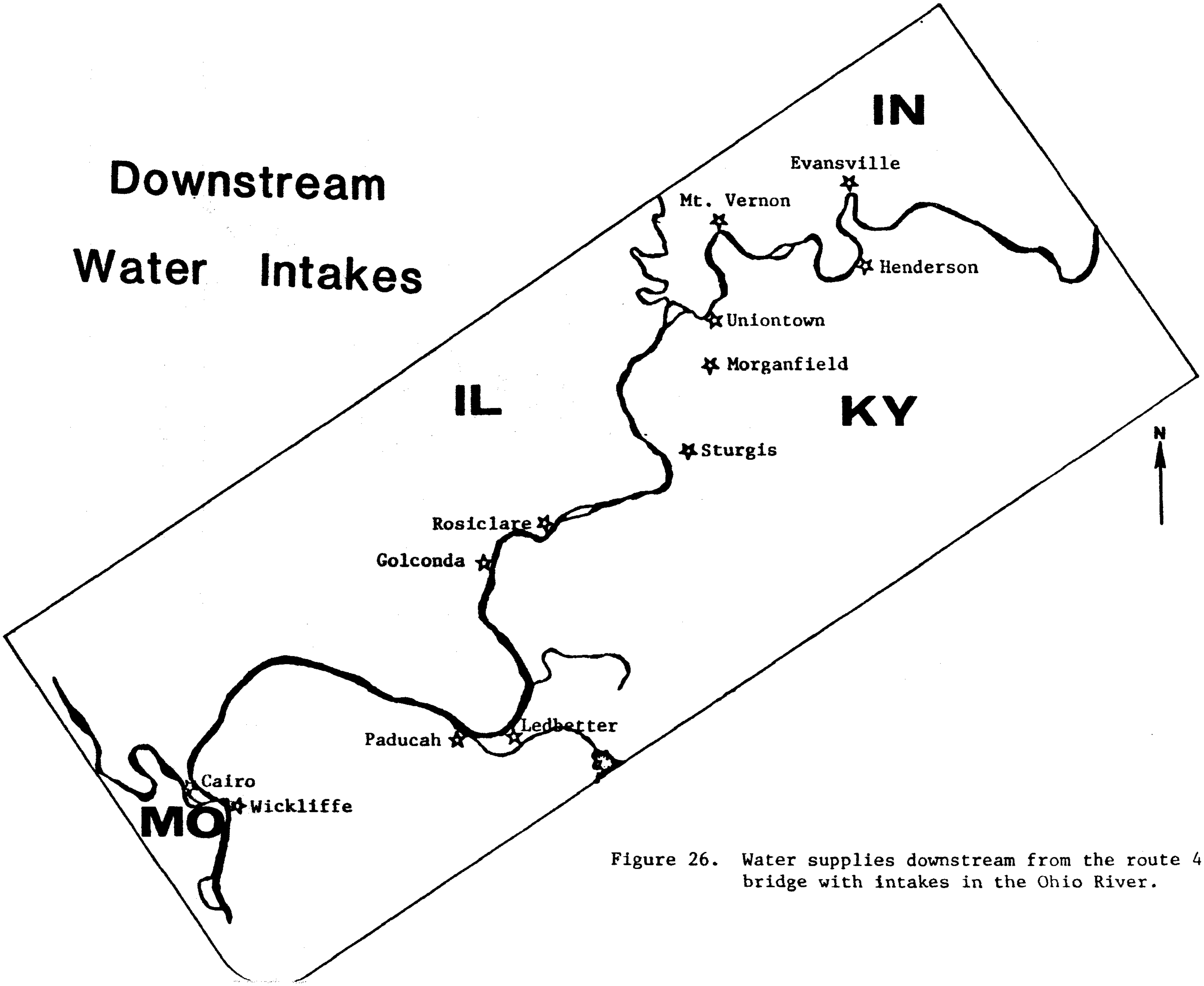

Figure 26. Water supplies downstream from the route 41 bridge with intakes in the Ohio River.

should the Ohio River ever become contaminated with organics such as PCBs. Activated carbon is particularly effective in removing such organic chemicals. PCBs are only one of many contaminants these water supplies might experience; hence, mechanisms are already in place to clean the water for drinking should the supply become contaminated.

5.2.2.4 Worst Case Residential Accident

A precise location for this accident scenario was not picked because there are many residential areas along Route 41 through Evansville. The most likely accident scenes are discussed in the local accident analysis in Sections 5.2.2.8 and 5.2.2.9. The purpose of this exercise is only to determine the maximum concentrations of PCBs and other transported materials to which people near the scene of an accident might be exposed.

First, it was assumed that whatever caused the accident would cause a release of the entire load. Second, it was assumed that the spill occurred on hot pavement so that the maximum amount of material would become airborne. A pavement temperature of 60° celsius (140° fahrenheit) was used. This is too hot to touch but pavements occasionally get this hot on summer afternoons. Next, it was assumed that the spill would spread over a large area. Because all parts of Route 41 are crowned or sloped and because the PCB residues are viscous (like a thick syrup), the largest area which is likely to be covered was estimated to be 50 square meters (538 square feet). However, as a conservative measure, this figure was arbitrarily raised by a factor of nine to 450 square meters (4842 square feet).

The next step in the analysis was to determine the rate of evaporation of the various chemicals in the residues. This depends on a number of factors, the most important of which are the concentrations of the various ingredients in the residues, their vapor pressures, temperature and wind speed. As noted before, we assumed a temperature of 60°C. Wind speeds were varied systematically to find which wind conditions would represent worst case conditions. While high wind speeds promoted the greatest evaporation, they also tended to disperse the vapors. Concentrations of various chemicals which might be in the residues were calculated based on the known composition of TF-1 and various PCB transformer fluids using a computer model (which has proved very accurate in similar situations) of UNISON's process. A problem, however, developed regarding which vapor pressures to use.

Vapor pressure is a measure of the tendency of liquids to evaporate. When the vapor pressure of a liquid is equal to the barometric pressure of the surrounding air, the liquid boils. Water, for example, boils at 212°F when the barometer reading is 29.92 inches because at 212°F water has a vapor pressure of 29.92 inches. At 68°F, water has a vapor pressure of less than one inch (0.69 inch). PCBs have vapor pressures which are much lower than water. The following table compares a typical PCB with water at various temperatures. The vapor pressures are stated in millimeters rather than inches.

Vapor Pressure Comparison

Temp.	Water	Hexachlorobiphenyl
32°F	4.58	0.00000005
68°F	17.54	0.000001
140°F	149.38	0.00012
212°F	760.00	0.005

The problem which vapor pressure presented in this analysis is that there are 209 distinct PCBs, no two of which have the same vapor pressure at any particular temperature. Many of these PCBs have never had their vapor pressure measured. Of those which have been measured, the one which evaporates most readily does so about a million times faster than the slowest to evapora UNISON will be processing many kinds of PCBs most of which are complex mixtur There is no good way to estimate the actual vapor pressure of the PCBs in th spill model.

EPA decided to assume UNISON would only be processing a mixture of PCB known as Arochlor 1242. This mixture is known to have the greatest tendenc to evaporate of all the commercial mixtures UNISON might be processing but constitutes less than 10% of the PCBs in UNISON's potential market. It wa further assumed that the mix of PCBs in the Arochlor 1242 was such that ea homolog was composed entirely of that isomer having the greatest volatili For example, Arochlor 1242 contains about 25% tetrachlorobiphenyl. Varic tetrachlorobiphenyls have vapor pressures at 140°F that range from 0.0004 mm up to 0.0020 mm. For this spill model we assumed all the tetrachlorobiphenyl had the highest known vapor pressure, 0.0020 mm. The net effect of all these assumptions is that the PCB exposures produced by the model are much higher than what would be produced by a real worst case accident. The values are certainly five times too high and possibly 50 times. However, unless and until actual measurements can be made on UNISON process streams, a conservative approach is the best method available.

Based on these assumptions, evaporation rates were calculated using the methods of EPA (1974) and Fuller (1966). Rates were calculated for each component of the residues; in the case of PCBs, assumed components were used as discussed above. Rates were calculated using wind speeds which varied from 1.0 to 10.0 meters per second (2.2 to 22.4 miles per hour). Various types of atmospheric conditions were assumed to determine the effect of stable or turbulent air flow and so on. All these values were entered into a computer program used by the Army to determine the effects of chemical weapons on exposed populations. The Army model was chosen over several models used primarily for industrial emissions because it can model the behavior of vapors close to the ground more accurately.

The worst meteorological conditions for nearby receptors were found to be high winds of stability class D. These wind speeds (10 meters per second) may be inconsistent with the assumed pavement temperature of 140°F. The worst conditions for distant receptors were found to be gentle breezes with no turbulence (2.5 meters per second wind speed and stability class F). Stability class F only occurs at night. A sample of exposures at various distances from the spill (directly downwind) and under various conditions is presented in the following table:

Exposures (in mg/m^3) - Hot Pavement Scenario

Wind Speed (in m/s)	10	5	2.5	1.5
Stability Class	D	D	F	A
At Spill - all vapors	2517	2817	1160	541
- all PCBs	10.9	12.2	5.02	2.34
50 meters - all vapors	107	93	67	5.2
- all PCBs	0.46	0.40	0.29	0.022
500 meters - all vapors	1.78	1.14	1.92	0.011
- all PCBs	0.0077	0.0049	0.0083	0.00005

Exposures which would result with different assumptions regarding spill size and pavement temperature can be calculated from the tabulated values. Evaporation from a circular spill is proportional to the 1.8 power of the spill radius (Fuller 1966). A fifty square meter spill would produce vapor concentrations 0.138 times as great as those reported above. (The square root of 50/450 raised to the 1.8 power is 0.138). A large spill of PCB residues is much more likely to be this size ($50m^2$) than the size reported above ($450m^2$). In this case, emissions would be slightly less than one seventh the values for the extreme worst case. The relative proportion of PCBs in the vapors would remain the same.

Evaporation rates would be much less if the spill were not on hot summer pavement (60°C, 140°F) but more likely on warm pavement (35°C, 95°F). Under these conditions, evaporation rates would be about one fifth of the rate given for 60°C. Based on the same assumptions, the evaporation rate for total organics would be 0.189 times the value reported. Moreover, PCBs would constitute only 0.259% of the total organics rather than 0.4325%. Hence, the PCB evaporation rate would only be 0.113 times as great or about one ninth.

At 25° (77°F) the total organics evaporation rate would be 0.0985 times the rate at 60°C (less than one tenth). The PCB evaporation rate is only 0.1777% of the total organics rather than 0.4325%. Hence, PCBs would evaporate at only 0.04 times the 60°C rate (about one twenty-fifth).

Combining these figures, a typical large spill ($50m^2$) at 35°C (77°F) would produce vapors at 0.026 times the rate reported above (one thirty-eighth) and would produce PCB vapors at only 0.0156 (one sixty-fourth) times the rate reported. At 25°C the rates are lower still by factors of 0.52 and 0.69, respectively. Hence, at 25°C, a $50m^2$ spill would produce total organic vapor 0.0135 times (one seventy-fourth) those reported in the table above; the PCB evaporation rate would be 0.0108 times (one ninty-third) the tabulated rate.

The exposure rates presented will persist directly downwind until the spill is covered by emergency response personnel. Typical response times for an urban spill are on the order of ten to twenty minutes. In a worst case, the spill could be covered in less than an hour. A discussion of what health effects might result from these exposures is presented in Section 5.3.

5.2.2.5 Chance of Fire in Connection with an Accident

Department of Transportation data (ORI 1978) indicate that trucks are involved in accidents involving fires at a rate of four per billion vehicle miles travelled. These data include gasoline powered vehicles and trucks carrying flammable cargos. The trucks UNISON will use are diesel powered and will carry non-flammable cargos. This makes the chance of fire much less. Diesel fuel simply will not burn unless it is heated (see Section 5.2.1.3). While cases are known where diesel fuel ignited after spilling over a hot engine, such cases are exceptionally rare. Nonetheless, if this happened and PCB residues dripped onto the fire, soot could be produced which would be more dangerous than the PCBs. However, the dripping would have to be at just the right rate; if it were too slow, only negligible amounts of soot could be formed, if it were too great, it would dowse the fire. The PCB residues UNISON might be transporting would behave like chemical fire extinguisher fluid in such a case.

Another possibility considered by EPA was a collision with a second vehicle carrying a flammable cargo. This too is exceptionally unlikely to happen. A fire could, of course, result from collision with any gasoline powered vehicle. After modeling a fire at the UNISON facility in connection with an aircraft impact and finding low levels of soot production (see Section

5.2.2.7), EPA has determined not to separately model a fire in connection with a traffic accident.

5.2.2.6 Worst Case Water Impacts Accident

The site for this accident is the northbound Route 41 bridge which crosses the Ohio River between Henderson, Kentucky and Evansville, Indiana. There are two structures, one southbound, the other northbound. PCB-laden residues will only be transported north on their way to incineration in Chicago, never south across the other bridge. The bridge is located just upstream from river mile 787. It was chosen as the "worst case" site because it is located 4½ miles upstream from the water supply intake for the City of Evansville.

As with the other accident scenarios, it was assumed that an entire load of residues would be released (in this case, to the River). As noted earlier, a load of residues weighs 23 tons (net). Unlike the earlier scenarios, no particular release characteristics and/or river characteristics were assumed. Instead, a range of possible conditions was investigated, not only the worst case situation.

Four possibilities of how the residues might get from the bridge to the River were examined:

- The tanker itself could plunge through the guard rail and drop to the River with its cargo;
- A spill on the bridge could drip into the River;
- A spill on the bridge dripping into the River could be dispersed by high winds; and finally,
- The tanker could break the guard rail on the approach to the bridge, spilling residues along the banks of the River into which they could later be washed by rain water.

Obviously, if the tanker itself plunges into the River, the entire 23 tons would be lost. With the other three scenarios there is a substantial probability that some (perhaps most) of the 23 tons could be kept from entering the River. If the tanker itself fell into to the River, the residu would likely form a pool on the river bottom near the accident site and the area of contaminated sediments would likely be smaller in total areal extent than that resulting from drippage.

This sort of accident has never happened before, so estimating these effects involves a certain amount of speculation. However, the behavior of PCB's in water has been extensively studied. These studies have shown that PCB's have very little solubility in water. The most soluble commercial mixture which UNISON will handle is Arochlor 1242. It is soluble to about 0.2 parts per million (mg/l). Other commercial mixtures have solubility limits one or two orders of magnitude less than this (EPA June, 1985a). Gallon for gallon, PCB's are 35% to 58% heavier than water. Because of this greater density and the low solubility, when they are dropped into water they sink and form a pool on the bottom.

Other studies have shown that PCB's have a strong chemical attraction for dirt and sediments, especially if the sediments are rich in organic matter. If one mixed equal amounts of water and sediment in a container and then added PCB's in amounts which did not overwhelm the binding capacity of the sediments, the PCB concentration in the sediments would be about a million times greater than the concentration in the water. Consequently, even in the very worst spills, the concentration of PCB's in the water never gets near the solubility limit because the PCB's are so much more strongly attracted to sediments.

Finally, studies have shown what happens to PCB's if they are never cleaned out of the water. The isomers with only one or two chlorine atoms are totally destroyed by algae and bacteria in the water within a few days. Isomers with three chlorines take one to six weeks to disappear. With four chlorines, several months are required. With five or more chlorines, the PCB's last a very long time. They gradually accumulate inside the algae and bacteria that are trying to digest them.

Algae and bacteria are at the base of the aquatic food chain. Small animal plankton feed on these organisms and further concentrate the PCB's. This is primarily a result of partitioning into lipid fractions. When animal plankton are eaten by small fish and these in turn by larger fish, the PCB's get passed along at concentrations that become larger and larger. This is called biomagnification. Because of this, if PCB spills are left in water and not cleaned up, after several years the fish that feed in that area can become highly contaminated and unfit for human consumption.

In order to estimate what might happen to a load of residues lost to the Ohio River, we need to look beyond laboratory and ecological studies and examine the record of previous accidents.

The largest single recorded spill occurred on September 13, 1974, in Seattle, Washington. A transformer filled with Arochlor 1242 was being loaded onto a barge in the Duwamish River near river-mile 2 (two miles from Puget Sound) when the sling broke, dropping the transformer onto the edge of the dock. While the broken transformer remained on the dock, approximately 1½ tons of concentrated PCB's were lost to the River (EPA 1976b).

There were no labeling requirements at that time and people at the site assumed that the transformer had been filled with mineral oil (the recent spill at Louisville was of low concentration PCBs in mineral oil). The normal oil spill procedures at the dock were instituted. Workers, however became suspicious when none of the "mineral oil" floated. Two or three days later someone figured out that the supposed "mineral oil" might have been PCB's and notified EPA and the State of Washington, Department of Ecology.

When laboratory tests indicated the presence of PCB's, emergency clean-up procedures were instituted. At that time, about 30% of the spill was still present on the bottom in visible pools which were recovered by divers using hand held dredges. The remaining 70% had spread to the surrounding sediments. These were not removed for another two years, at which time dredging of approximately 40,000 cubic yards of sediments was required.

Based on this case and other lesser spills, EPA believes that loss of a tanker to the Ohio River at the Henderson site would result in pooling of a substantial fraction of the load on the river bottom with some contamination of the surrounding sediments. The extent of physical spreading of the pool of PCB's would depend primarily on the current speed at the time of the spill.

It also seems likely that clean-up, if attended to promptly, would not be prohibitively expensive. It is worth noting that Arochlor 1242 was the mixture which spilled into the Duwamish River. It is the lightest PCB mixture, gallon for gallon, that UNISON might handle and is also the most soluble in water (overall solubility is very low, however, as explained above). It appears that despite these properties, PCB's have little tendency to migrate once they fall into water.

If this were a complete picture of PCB's in water, there would be little cause for concern from a river-spill. However, other factors are involved. PCB's have a small but measureable tendency to slowly diffuse into surrounding waters where they can be transported for some distance by the currents (McKay et al. 1981). The strong affinity of PCB's for binding to small particles also means that they are likely to move with particles that get suspended in river water even without much turbulence. Transport of these suspended particles is the principal mechanism by which PCB's in water move from one place to another. It is not a rapid process but it is continuous (McKay et al. 1981).

The best data on solubility and transport of PCB's have been gathered at two large spills in the Great Lakes. One, in Waukegan Harbor (just north of Chicago) involved the release of almost 40 tons per year for twenty years. Most of these PCB's (an estimated 1.6 million pounds) still lie on the bottom of Waukegan Harbor. Of key interest here are the amounts that are actually in surface waters and capable of being transported. Water column data gathered by Hydro Qual in 1979 (EPA 1981) show that the dissolved concentration plus the suspended concentration of PCBs in Waukegan Harbor ranges from about 0.1 to 1.0 ug/l* (parts per billion) (Figure 27). It is fair to assume that levels of PCBs in the Ohio River water would be unlikely to exceed these values following a spill unless there were substantial turbulence capable of lifting sediments from the bottom.

Returning to our discussion of how PCB's might enter the river after an accident on the Route 41 bridge, we can see that loss of the tanker itself to the river bottom would present the best chance for a rapid and inexpensive

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*"micro", ordinarily abbreviated with the Greek letter mu is abbreviated "u" in this document.

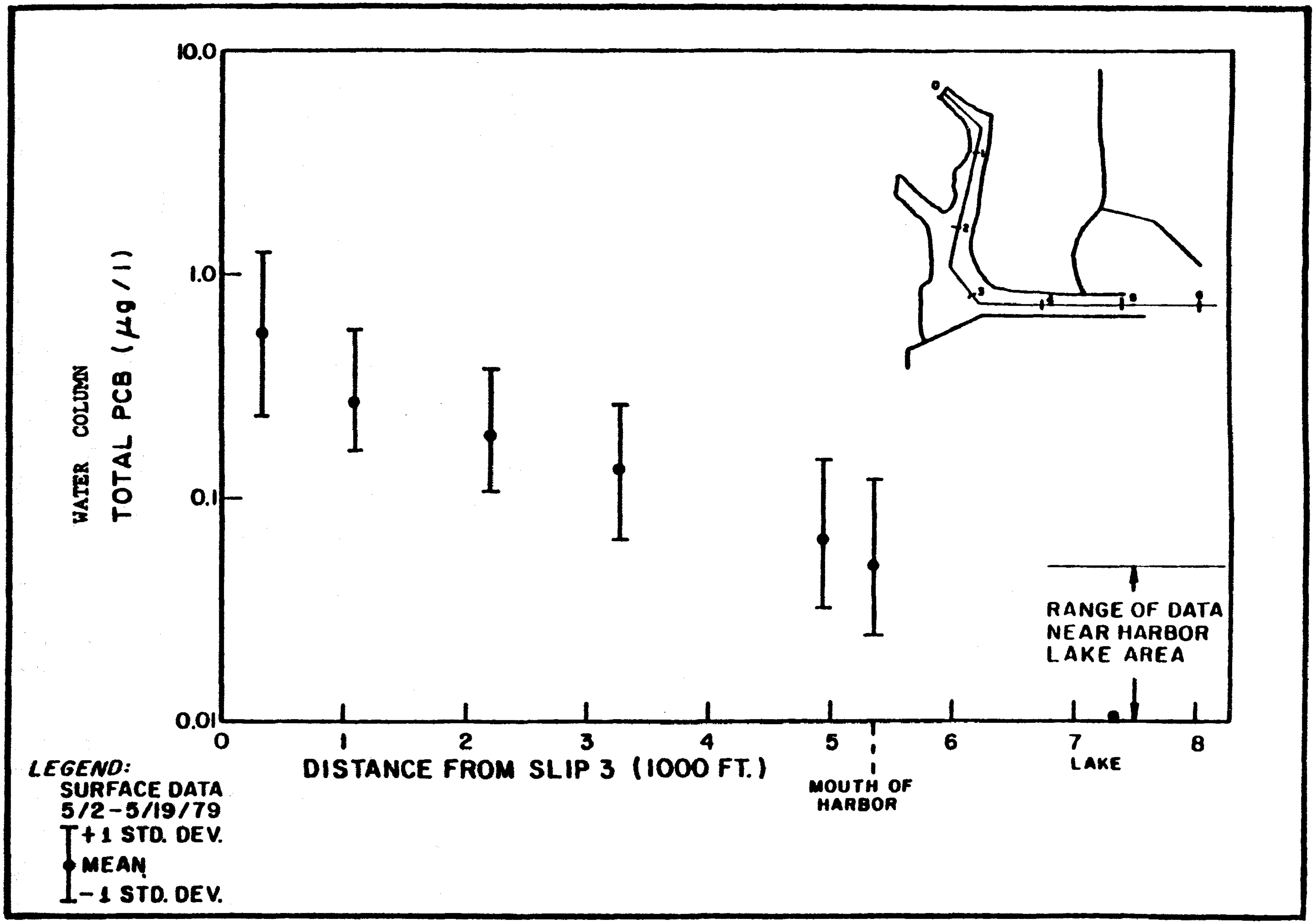


Figure 27. Total PCB concentrations along a transect through Waukegan Harbor, from daily survey data (EPA 1981).

clean-up. Under low wind conditions, materials dripping from the bridge would probably also present good clean-up prospects.

Under high wind conditions, some spreading due to the wind could be expected. Because the wind would break the drippings into small droplets, additional spreading could occur once those droplets hit the river due to river currents. Using Stokes Law and assuming a river depth of 28 feet, the time it would take various sized droplets to sink to the bottom can be calculated. A droplet 1.0 millimeter in diameter would sink to the bottom in about 32 seconds; a droplet 0.1 millimeter in diameter (just barely visible to the naked eye) would sink to the bottom in 53 minutes. These small droplets could spread some distance even under conditions of relatively low flow. Turbulent effects on dispersal are discussed below. It is not clear whether droplets smaller than 1.0 mm could be formed even by very stong winds. Droplets smaller than 0.1 mm would be extremely unlikely under any conditions.

Therefore, if a spill drips from the bridge under high wind conditions, pooling is less likely and the area of contaminated sediments could be much greater. Nonetheless, it appears likely, given low turbulence, that even this type of spill could be effectively cleaned from the River using existing dredging technology.

The analysis presented above only applies to river conditions likely during summer low flow. Flow rates in the Ohio River are usually much greater from late fall through early spring. During this time period, the Ohio is much more turbulent than during summer and may be turbulent enough to transport sediment long distances. In order to determine whether sediments could be carried appreciable distances during peak flow conditions, EPA contacted the U.S. Army Corps of Engineers, Vicksburg Waterways Experimental Station. The Corps of Engineers has a sophisticated computer model which can predict when and how far sediments will be transported. Results, however, depend on accurate characterization of baseline conditions, which are prohibitively expensive to measure, and on the precise location of the modeled spill which would be entirely arbitrary.

EPA contacted Mark Griese at the Evansville Water Treatment Plant to gain some insight into how a spill might move in the River. The EWTP regularly tests the waters of the Ohio for their suspended sediment content. Average values month by month for 1985 are provided below. Concentrations are in milligrams per liter.

Month	Concentration
January	70
February	91
March	116
April	143
May	48
June	49
July	18
August	14
September	13
October	15
November	250
December	108

While suspended sediment levels fluctuate rather broadly, peak values in late fall and early spring are not so great that they suggest massive sediment mobilization. Previous studies of the Ohio River (Finni 1986) suggest that one-half to one inch of silty sediments are deposited in the study area each year during low flow. These sediments along with very small amounts of the ancient sandy/gravelly sediments are mobilized during high flow. Therefore, it would appear that at only rarely would a spill to the River be dispersed so far downstream by turbulence that effective clean-up would be impossible. However, such an event cannot be ruled out. Sediment mobilization would depend on numerous factors which are not well known for the study area (ASCE 1975; MacKay et al. 1981)

An additional possibility in which a load of residues might be lost to the River would be a spill on the River bank which is washed in by rains. The great affinity of PCB's for soils makes substantial contamination of the River unlikely by this route. However, the PCB laden particles which do wash in would probably be carried too far downstream for clean-up to be practical. These PCB's would add incrementally to the background levels of PCB's already in the sediments over a large area in amounts that would be difficult to detect. Nonetheless, they would eventually add to the PCB burden of Ohio River fish, including the larger species consumed by man. Appendix 9 lists some existing concentrations of PCB's in Ohio River fish.

Effects on Drinking Water Supplies

Effects on drinking water supplies will depend on the amount and types of materials spilled, conditions during the spill, and on the capabilities of the plant to treat contaminated water. First, it is worth noting that the City of Waukegan Water Treatment Plant has an intake near the mouth of Waukegan Harbor. It is used whenever the main intake located well off-shore in Lake Michigan is frozen or is down for repairs or maintenance. This happens every two or three years. When the alternate intake is used, water is being drawn from Waukegan Harbor, a body of water contaminated with PCBs. After thorough study of Waukegan waters, PCBs are always impossible to detect in the finished drinking water (EPA 1981).

The Evansville Water Treatment Plant uses the same technology that is used in Waukegan. However, there is a key difference. Waukegan knows in advance when it will be drawing on contaminated supplies whereas Evansville must test the water in their laboratory day by day. Optional and somewhat expensive processes (activated carbon addition and removal) must be put on-line in order to remove PCB's to levels which can not be detected. The regular treatment process only removes the suspended fractions and would leave the dissolved fraction in the finished drinking water. In theory, PCB's might rise as high as their solubility limits in the finished water. This is likely to be between 10 and 100 ug/l (parts per billion). In practice, it is difficult to conceive of conditions under which the level would rise much above 1.0 parts per billion (Figure 27). Typical removal rates without activated carbon average 91 percent (Versar 1983 Vol. IV).

Therefore, Evansville and other riparian water supplies downstream must know of PCB contamination in the water before they can prevent all human exposure. Few of the water supplies downstream have the kind of laboratory facilities available at Evansville. Even Evansville could not prevent the first slug of PCB's from passing through to the finished drinking water because it takes time to run the analyses and put the activated carbon into use.

The possible effects of these short term low level exposures on drinking water quality are discussed in Section 5.3.

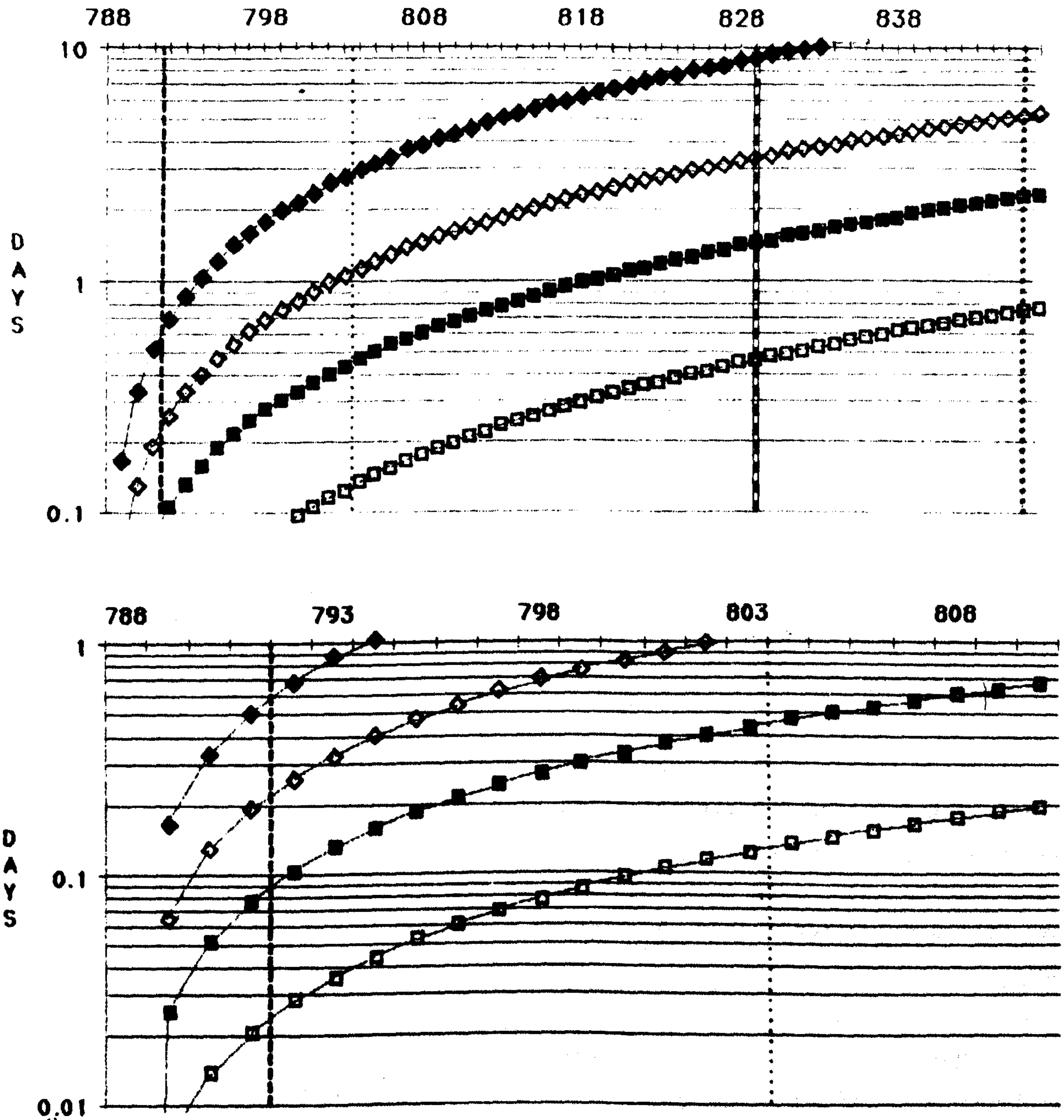
The time it takes for contamination from a spill to pass downstream to various water intakes is plotted on Figure 28 for various flow rates. As can be seen, the only water supply which might have the PCB's at its intake before notification could be made is Evansville, and there only under high flow conditions. Under such conditions, the great mass of water in the River would greatly dilute any PCB's present.

Environmental Effects

The adverse effects of PCB contamination on aquatic biota are well documented. In laboratory tests, low concentrations of PCBs exhibit acute and chronic toxicity to a variety of aquatic organisms, including algae and benthic invertebrates which are the basis of the aquatic food chain. PCBs inhibit the growth of some aquatic bacteria, and have been shown to interfere with photosynthetic mechanisms and reduce rates of cell growth and division in phytoplankton.

Chronic lethal PCB values for three species of aquatic invertebrates that have been tested range from 0.8 ppb to 4.9 ppb. Chronic values for three species of freshwater fish range from 0.2 ppb to 9.0 ppb. Acute lethal values are 10 ppb for one invertebrates species, and 2.0 ppb to 7.7 ppb for three species of fish (EPA 1980).

There is the potential for PCBs to disrupt the aquatic food chain at all trophic levels. However, due to the changes which may occur after discharge, environmental residues of PCBs do not necessarily correspond to commercial mixtures used in bioassays. There are differences in the way less chlorinated components and more chlorinated components are volatilized, become soluble, and adsorb.



TRAVEL TIME VS FLOW RATE

RIVER MILE

LEGEND

- ----- Evansville Intake
- ······ Henderson Intake
- ━━━ Mt. Vernon Intake
- ······ Uniontown Intake

FLOW RATES

- ◆ - 15,000 cfs
- ◇ - 40,000 cfs
- ■ - 100,000 cfs
- □ - 300,000 cfs

Figure 28. Time to reach various points downstream from the route 41 bridge at four flow rates.

In cases where PCB concentrations in the water and sediments are below acute or chronic toxicity levels, the bioaccumulation and biomagnification properties of PCBs can result in significant contamination of the aquatic food chain. One of the most important environmental properties of PCBs is their tendency to be bioaccumulated by aquatic organisms into their tissues to levels much higher than in the ambient water. This property results from the high solubility of PCBs in lipids and their low solubility in water. There is a further tendency for PCBs to be concentrated in animals to a higher level than levels found in their food. Once consumed, PCBs accumulate and are neither metabolized nor excreted. This phenomenon is known as biomagnification. Fish can bioaccumulate PCBs directly from water, in addition to uptake in the food, and in most cases, direct uptake is more rapid and leads to a much higher accumulation in the tissues. This uptake is initially rapid, followed by a gradual decrease in the rate of uptake, until a steady state is approached (42 FR 6532).

Bioaccumulation factors have been determined in laboratory studies for a variety of freshwater invertebrates and fish, and range from 2,700 in the phantom midge for Aroclor 1254, to 274,000 in the fathead minnow for Aroclor 1242. Results from field investigations of PCB contamination in fish have shown bioconcentration factors as high as 4,125,000 in the lake trout (EPA 1980).

Bioconcentration and biomagnification processes can result in fish PCB body burdens in the parts per million range, when PCB levels in the ambient water are in the parts per billion range. The U.S. Food and Drug administration has imposed a PCB residue tolerance limit of 2 ppm for fish involved in interstate commerce.

There are numerous reports in the literature of PCB contamination levels in fish, but few relate ambient PCB concentrations in water to fish tissue concentrations (EPA 1977). One reason for this is the difficulty in obtaining fish that have spent their entire lives in waters of the same PCB concentration. Areas of more concentrated PCB residues near discharges or in the sediments may contribute a disproportionate amount of contamination when compared to the time spent in that area.

Vieth et al. (1975) analyzed fish from Lake Michigan which were captured from waters containing 0.01 - 0.1 ppb PCBs. Some of the fish were captured near Waukegan Harbor, where over one million pounds of PCBs were discharged over a 20 year period (see discussion above). Mean PCB concentrations in the fish from the Waukegan Harbor area were 2.5 ppm for alewife, and 6.1 ppm for yellow perch.

An unknown quantity of PCBs was released into Lake Hartwell on the Savannah River prior to 1977. PCB concentrations in the water column near the discharge area were 0.04 - 0.1 ppb in 1985. PCB levels in the sediments near the discharge were as high as 47 ppm. Fish in Lake Hartwell have been monitored for PCB contamination since 1976, and although PCB levels in the fish are apparently decreasing, some of the larger fish sampled as recently as the fall of 1985 contained PCB residues as high as 100 ppm.

The effect on aquatic biota of a PCB spill into the Ohio River near the UNISON plant is difficult to determine, due to the previously mentioned uncertainties concerning changes to PCBs when they enter the environment, varying bioaccumulation and bioconcentration factors, and to what extent the spill is cleaned up. If a large spill occurs, it is possible that some fish and other aquatic organisms in the immediate vicinity will be killed due to acute effects of PCBs. Assuming a rapid response and cleanup action, however, it is doubtful that significant chronic effects on aquatic organisms would occur, and it is highly improbable that there would be any adverse impacts to the Sauerheben Wildlife Area. Since PCBs have a high affinity for organic sediments, and a very low solubility in fresh water, most PCBs which are not cleaned up would become bound to sediments (EPA 1984). The degree of binding would be dependent on the silt fraction and organic content of the sediments. These sediment-bound PCBs could contribute to food chain contamination via bioaccumulation and biomagnification processes. Bottom dwelling fish such as carp, suckers and catfish that are in direct contact with and feed within the sediments would be the most likely species to be directly affected. Benthic algae (in shallow areas) and invertebrates could accumulate PCBs from the sediments and pass them up through the food chain to higher trophic levels and affect sport fish such as bass, perch and sunfish.

5.2.2.7 National Analysts - Trucks Carrying Drums of TF-1 or TF-X

As noted earlier, the estimated annual transport distance at full capacity of trucks carrying TF-1 is 977,151 miles and of trucks carrying TF-X is 996,184 miles. An accident rate will not be calculated for trucks carrying drums because the rate of leaks caused by accidents for this type of cartage is not known. The rate of leaking due to accidents is extremely low; the vast majority of all drums involved in accidents survive without leaking.

For this analysis, the rate at which incidents (releases of all kinds) are expected to occur was calculated. Data on hazardous materials incidents (ORI 1978) indicate that there are 16.5 incidents for every million tons shipped or 68 incidents for every billion ton-miles. Based on these figures, the incident rate for TF-1 and TF-X shipments is as follows:

Annual Incident Rate

Basis	TF-1	TF-X
Based on tonnage	0.495	0.505
Based on ton-mileage	1.296	1.321

In other words, based simply on the total weight of materials shipped one would expect a releasing incident involving either TF-1 or TF-X to happen, on the average, once per year and one would expect slightly more than half of them to involve TF-X. Since these materials travel further on the average than hazardous materials in general, the releasing incident rate based on ton-mileage statistics is 162% more. One would expect on this basis about 2.6 releasing incidents per year. Of course the same fraction, 50.5%, would be TF-X.

In order to determine the nature of these releases, the HAZMAT data base (see Section 5.2.2.2) was examined for records of 55 gallon drums involved in incidents in Kentucky or Indiana between January 1, 1981, and January 22, 1986. There were 346 such incidents.

The greatest single cause of release was puncture (168 cases). The bulk of these drums were speared by careless fork-lift drivers during unloading. A few were punctured when loads shifted during sudden stops, some of which may have been unreported traffic accidents. These punctures were caused by having mixed loads of drums and machinery. Since UNISON lift trucks will not be equipped with forks (see Section 3.5) and since drums will be tightly packed on the trucks and no machinery will be present, punctures will be extremely unlikely.

Fifty-six releases were caused by bottom failures. Most of these had rusted, the remainder were either dropped during unloading or were damaged when the cargo shifted. Rusted bottoms are unlikely due to the character of TF-1 and TF-X and because drums are pressure tested before being refilled. Nonetheless, if a drum does leak on a UNISON truck, bottom failure could well be the cause.

The number of incidents involving other causes of failure are tabulated below:

Number of Incidents	Cause
32	Damaged by other freight
29	Loose fittings, valves or closures
22	Body or side failure
22	Improper blocking or bracing (cargo shifted, fell over, etc.)
13	Dropped on handling
13	Weld failure
13	Other, unspecified
12	Corrosion or rust
11	Metal fatigue
10	Defective fittings, valves or closures
9	Chime failure (broken rim)
5	Improper loading (upside down, on its side or with heavy freight on top)
4	Internal pressure
3	External heat
2	Loading/unloading
1	Friction (between containers or between container and vehicle
1	Vehicular accident
1	Failure of inner liner

The only vehicular accident occurred on August 8, 1985, in Indiana. The full contents of two drums were lost when they were damaged by other cargo.

After reviewing these incidents, EPA believes that all of them can be placed into one of three categories:

- Those which could not occur;
- Those which might occur at UNISON's unloading docks within the containment area;
- Those which might occur and be contained by the on-board containment system of UNISON's trucks (See Section 3.4).

However, this eliminates the possibility of any releases to the environment, whereas a really severe vehicular accident would surely result in some release. Since there must be some rate greater than zero at which drum contents could be expected to be lost to the environment, this analysis will assume that the single vehicular accident out of the above 346 incidents represents that rate. This is imprecise, but it will allow some measure of the release rate.

One out of 346 is a release rate of 0.00289. Multiplying this times the incident rate calculated above gives expected release rates for TF-1 and TF-X as follows:

	Annual Release Rate	
Basis	TF-1	TF-X
Based on tonnage	0.00143	0.00146
Based on ton-mileage	0.00375	0.00382
Average	0.00259	0.00264

Using the average value for the purposes of calculation one finds that there is a 94.945% chance that no TF-1 drum will leak to the environment over the twenty year life of the facility. The twenty year chance that no TF-X will leak is 94.850%. Conversely, there is a 5.055% chance of one or more TF-1 drums leaking and a 5.150% of one or more TF-X drums leaking to the environment. The subtle differences between all these values are illustrative only;

the estimates themselves have low statistical validity and could easily be overstated by a substantial margin.

5.2.2.8 Local Accident Analysis - Henderson County

In order to estimate the chance of an accident at various points along the routes to be used by UNISON, EPA utilized the resources of the Commonwealth of Kentucky. Ms. Ann Banta of the Kentucky State Police supplied the location and other statistics concerning all known accidents in Kentucky since January 1, 1980, along the proposed routes. Mr. Pierson Van Norman of the Kentucky Transportation Cabinet supplied counts of vehicles for various lengths of the route.

Vehicle counts were not available for routes 136 and 425. EPA estimated these values based on area population, land use and vehicle counts at connecting roads.

Dividing the number of accidents along each segment by the vehicle count for that segment gave an estimate of the risk involved each time some vehicle uses the road. This analysis makes no distinction among various types of vehicles and it treats cars and trucks the same.

Road utilization by UNISON's trucks depends on the type of load. Approximately 81.9% of all TF-X will come from the north. 81.9% of all TF-1 will return to the north based on EPA's model of the location of PCB transformers. All TF-2 will come from the north. About 80% of all residues were arbitrarily assumed to be traveling to Chicago. More than 80% may actually go north because Chicago has the nearest incinerator. On the other hand, if that incinerator becomes inoperable for any reason, all residue will go south. The 80:20 split in residue shipments which EPA has used in all the transportation models is an attempt to account for periodic down time at the various incinerators.

Combining this road usage with the number of trips required by the plant at full capacity gives the following breakdown on shipments:

North-South Distributon of Truck Traffic (number of trucks/yr)

Component	Common Route	Northern Route	Southern Route
TF-1	1540	1260.7	279.3
TF-X	1570	1285.3	284.7
TF-2	45	45.0	0.0
Residues	74	49.2	14.8
Total	3229	2650.2	578.8

Two types of estimates were made of the risk of local accidents:

1) An estimate of the number of accidents one should expect; and
2) An estimate of the chance of one or more accidents of any given type or along any given segment.

When the expectation is very low it is the same as the chance. However, as events become more likely the two estimates diverge because the chance of something happening can never be greater than one (100%) while the expected number of incidents can continue rising. The number of accidents that actually happen can only be zero, or one, or two or some other whole number. The expectation is an estimate of how many will occur and usually is some whole number followed by a fraction. The chance of one or more accidents is the probability of at least one accident.

Expectations are added together to combine events. Probabilities are more complicated to calculate. The methods EPA used for this analyses are described in Ullman (1972). However, a basic understanding can be reached by considering the simple case of flipping coins. The chance of getting heads on any one flip is 0.50 or 50% and the expectation is also 0.50. If one flips two coins, the expectation is 1.0 that one will be heads but the chance of at least one heads is 0.75. If one flips three coins, the expectation is that there will be 1.5 heads and the chance of at least one heads is 0.875 or 87.5%.

Appendix 10 shows both the chance and the expectation for accidents on various segments of the proposed route. The statistics are broken out by type of load as well. For example, it is very likely, if UNISON operates at capacity for twenty years, that there will be one or more accidents involving UNISON trucks in Henderson County. The chance of that happening is almost 94%. EPA's best estimate of how many accidents will occur is 2.8, which is the "expectation."

Of course, the most likely accidents would involve trucks carrying drums of TF-1 (with no PCB's) or TF-X (with an average of 2% PCB's). These drums almost always survive traffic accidents without leaking, and large leaks are exceptionally rare. The chance of concentrated PCB residues being in an accident in Henderson County is 6.16% over twenty years while the expectation is for 0.636 accidents. Recall from section 5.2.2.1 that only 29% of tanker accidents result in spills. About half of those are major spills (more than 1000 gallons).

The segment of Route 41 between Route 414 and the Indiana line includes the bridge over the Ohio River, and is of particular concern relative to a possible spill. EPA attempted to segregate accidents which might occur on the bridge or its approaches from those on other parts of the highway. However, variations in the way officers at the scene report accident locations made this impossible without going back to the original reports. However, the number of bridge accidents will certainly be less than the total reported for the segment north of Route 414. The chance of at least one accident of any type on that segment is 20.6% but the chance of a tanker accident is less than 1% and the chance of an accident involving residues is about half a percent (all of these are twenty year probability figures).

There is another way to estimate the possibility of a tanker going off the bridge into the water. Department of Transportation data (ORI 1978) indicate that trucks are immersed in water following accidents about 18 times for every trillion vehicle miles traveled. This figure cannot be used without qualification. First, it includes small ditches, ponds and streams as well as major lakes and rivers. As an estimate of losing a tanker to the Ohio it would thus overstate the chance. It is also an average figure for all truck transportation. To this extent, 18 immersions per trillion miles may understate the true risk.

Despite these ambiguities, simply multiplying the immersion risk by the twenty-year mileage figures gives numbers of some interest. The calculation produces the following expectation values:

Twenty-year Expectation of Immersion

Cargo	Expectation
TF-1	0.000352
TF-X	0.000359
TF-2	0.000013
Residues	0.000013
Total	0.000737

Based on this and assuming all immersions are to the Ohio, the twenty-year probability of losing a truck to the River would be 0.07%.

In order to compare traffic hazards along UNISON's routes through Henderson County with traffic hazards in other parts of the County, within Kentucky and Nationally, it is necessary to calculate the number of accidents per 100,000,000 vehicle miles. For each section of road the annual vehicle count was multiplied by the length in miles of that segment. These were summed to give 107,600,000 annual vehicle miles along the proposed UNISON routes. Since the average annual accident rate for all segments combined is 222.14 (see Appendix 10), there are 206 accidents per 100,000,000 vehicle miles.

This is less than the rate for Henderson County as a whole, which, at 556 per 100,000,000 vehicle miles, is the fourth highest in the State of Kentucky (Banta 1986). National averages for various types of road are listed below (Lynch and Steelman 1986):

Type of Road	Accidents/100,000,000 vehicle miles
Undivided:	
2 lanes, rural	200
2 lanes, urban	346
3 lanes, rural	228
3 lanes, urban	164
4+ lanes, rural	267
4+ lanes, urban	442
Divided, 4+ lanes:	
no access control, rural	169
no access control, urban	395
partial control, rural	93
partial control, urban	196
full control, rural	50
full control, urban	101

5.2.2.9 Local Accident Analysis - Evansville

In order to estimate the chance of an accident in Vanderburgh County at various points along Route 41, EPA requested help from the State of Indiana. Computerized traffic accident records and vehicle counts, however, are not yet available. Indiana's system is currently in a start-up phase and substantial data like the six year data base for Kentucky does not yet exist. However, the Indiana State Police were able to supply "rural" accident totals for 1983 - 1985 by township:

Vanderburgh County Route 41 Rural Accidents

Township	1983	1984	1985
Center	42	71	67
Knight	23	13	5
Perry	0	0	1
Pigeon	7	2	0
Scott	41	51	50
Total	113	137	123

Because Route 41 crosses each of Center, Knight and Pigeon townships in more than one place, there was no way to apportion these accidents to any particular length of road nor any way to combine them with the traffic count data.

Inspector James Kleeman at the Evansville Police Department supplied accident data for intersections at various points along Route 41 which cover the period from January, 1985 through March, 1986. This data is as follows:

Intersection	# Accidents
Morgan	33
Columbia	43
Virginia	52
Walnut	40
Lincoln	19
Bellemeade	12
Washington	38
Covert	25
Riverside	19
Southlane	16

Mr. Cliff Ong of the Evansville Urban Transportation Study Group supplied the following traffic counts:

Location	Annual Number of Vehicles
South of I 64	7,059,000
City Limits	7,654,000
North of Pigeon Creek	15,060,000
North of Morgan	16,652,000
North of Oak Hill	12,648,000
South of Division	13,402,000
South of Washington	9,569,000
North of Bridge	9,746,000

These data were used to estimate the risk of UNISON traffic going through Evansville. In order to account for accidents in between intersections, EPA sought Inspector Kleemen's opinion on the proportion of such accidents which would be intersection related. Inspector Kleeman stated that, based on his experience with the way Evansville Police Officers report accident locations, his best estimate for the ratio of mid-block to intersection accidents is 2%.

He added that 5% would be conservative. EPA has calculated the risk of mid-block accidents assuming they add another 5% to the number of accidents reported between the State line and Morgan Street. The vehicle count used for the mid-block accident rate calculation is the simple arithmetic average of the other counts used.

In other respects the chance and expectation calculations for Evansville were made in the same way as the Henderson calculations reported in the previous section. Results are reported in Appendix 10. However, the twenty year risk will not remain meaningful because as soon as Interstate 164 is completed, UNISON will use it instead of Route 41 through Evansville.

5.2.2.10 Other Hazardous Shipments

UNISON is only one of many companies that are involved with shipping of hazardous materials. This section describes UNISON's shipments in relation to the other hazardous materials transportation activities.

In the United States, approximately two billion tons of domestic shipments are by truck each year (DOT, 1977). About one third of all such shipments are "hazardous" according to the Department of Transportation (DOT) criteria. The criteria used by DOT to define hazardous materials are similar to those used by EPA.

At capacity, UNISON will ship a total of approximately 63,382 tons of materials per year. This will increase the amount of domestic hazardous materials being shipped by 9.7 thousandths of one percent. This is, of course, an extremely small increase. The amount by which hazardous materials shipments will increase in the vicinity of Henderson and Vanderburgh Counties can be estimated by assuming current local hazardous materials shipments are proportional to the local population. Approximately 0.09% of the United States population lives in Henderson or Vanderburgh Counties. On this basis, local hazardous materials shipments will increase by ten to eleven percent if UNISON is allowed to operate.

5.3 RISK EVALUATION

This section evaluates the risks associated with the exposure estimates developed in the previous sections (5.1 and 5.2). In evaluating the potential risks which would result if the various scenarios developed in sections 5.1 and 5.2 occurred, EPA considered the magnitude, duration, and the frequency of exposures which were estimated in these sections against the background of previous regulatory decisions and TSCA's "unreasonable risk standard."

Under the Toxic Substances Control Act (TSCA), EPA may authorize activities involving PCBs upon making a finding that no unreasonable risk of injury to human health or the environment will result from that activity. In applying the unreasonable risk standard, EPA balances the magnitude of expected exposures to humans and the environment (including considerations of the frequency and duration of exposures) and the potential effects on human health and the environment as a result of such exposures, against the benefits to society of the activity and the reasonably ascertainable economic consequences of prohibiting or otherwise restricting that activity.

In the course of regulating the manufacture, use, processing, distribution in commerce, and disposal of PCBs, EPA has previously evaluated potential exposures to PCBs in various scenarios (e.g., PCBs in the workplace, in ambient air, and in contaminated soil) and made some determinations about whether certain levels of exposure pose "unreasonable risks." Unless otherwise indicated, the previous exposure and risk assessments described in this section used 38.5 years for the duration of occupational exposure and 70 years for calculation of lifetime exposure.

Under section 6(e) of TSCA, EPA promulgated disposal regulations (codified at 40 CFR 761) which prescribe criteria for permitting PCB disposal facilities. These criteria are designed to minimize the potential for, and provide maximal protection against human and environmental exposure to, PCB releases during normal operations and/or accidents. In establishing these criteria, EPA determined that an unreasonable risk would not result if a disposal facility operates in accordance with these criteria.

Thus, the criteria for permitting disposal facilities and/or methods (specifically landfills and incinerators) are intended to require monitoring of and limits on the potential routes of PCB release. In permitting a high temperature incinerator, EPA applies process controls, (e.g., limits upon emissions from the process, requirements for destruction efficiency of the process, the requirement of emergency shutoff capability in the event of a process abnormality, and the requirement for continuous monitoring of releases and process conditions). In permitting landfills, EPA applies criteria which are closely tied to the site characteristics (considerations of soil type, geologic/hydrologic conditions such as the accessibility of the groundwater and considerations of historic flood plains, and topography) along with an evaluation of whether the landfill provides for appropriate leachate collection and treatment, barriers to public access to prevent exposure, and the prevention of mixing PCBs with other, incompatible wastes.

For alternative methods of disposal, the regulations require a level of performance equivalent to that achieved by EPA approved PCB incinerators and a demonstration that the alternative method will not present unreasonable risks to public health or the environment. In permitting an alternative method, EPA places the same types of process and site restrictions on the method as are placed upon incinerators and landfills under 40 CFR 761. EPA considered the potential for PCB releases from the normal operation of PCB disposal methods and facilities and determined that the operation of PCB disposal methods and/or facilities in accordance with the criteria specified at 40 CFR 761 would not pose an unreasonable risk of injury to human health or the environment. Therefore, determination that the disposal method or facility would result in an unreasonable risk to human health or the environment will be made only if either process or site conditions of unique environmental significance suggest that the risks from permitting the process or facility will result in significantly greater risks than those considered in establishing permitting criteria at 40 CFR 761. Such conditions include:

1. an unusually high probability of accidental releases due to the process design or handling procedures; or
2. an unusually high probability of natural disasters or other catastrophic incidents involving the facility such as earthquakes, floods, tornadoes, or airplane impacts due to the nature or location of the site.

In this evaluation of the potential risks posed by the Henderson County UNISON facility, EPA focused upon whether the proposed location of the site would result in the second of the conditions discussed above. Thus, any conclusions drawn in this section about the risks associated with siting the UNISON facility at Henderson County, Kentucky, apply only to the siting decision. When UNISON performs a demonstration of their physical separation process, EPA will make a separate determination of whether the UNISON physical separation process poses an unreasonable risk by evaluating whether the operating parameters of the process result in a level of performance equivalent to a PCB incinerator.

There is some small probability of incidents such as earthquakes and tornadoes associated with any process and/or facility location. While the Agency did not explicitly evaluate the risks associated with such incidents in establishing its disposal permitting criteria, it assumed that some probability of such incidents is present at any site. However, the frequency of such incidents is, in the overwhelming majority of cases, so low as to be insignificant to the Agency's evaluation of the risk associated with the facility's siting and operation.

As discussed in previous sections of this report, EPA evaluated the potential exposures associated with possible, though highly unlikely, catastrophic incidents as well as the exposures resulting from releases during normal facility operations at UNISON's proposed Henderson County, Kentucky facility. Our evaluation of potential exposure, and the probability of each scenario occurring, indicates that there is no extraordinary characteristic of the Henderson County site which will result in a greater than average probability of accidental release, or unusally high exposures in the event of a release. Therefore, the risk of exposure and injury to the population and the environment of Henderson County does not differ from the risks implicitly considered in developing the Agency's general permitting criteria. Consequently, the Agency concludes, based upon available information, that operation of the UNISON treatment process at Henderson County, Kentucky, will not result in an unreasonable risk of injury to human health or the environment.

The following sections compare the potential exposures at the Henderson facility to (1) the exposures which the Agency determined do, and do not, pose unreasonable risks in its previous regulatory decisions on PCBs, (2) a PCB risk assessment prepared by the Agency for its Superfund program, and (3) more common risks to which the U.S. population is exposed in everyday life. Although TF-1 components have been less extensively studied than PCBs, available public health studies have not indicated any significant public health problems associated with exposures at the levels reported in this document.

5.3.1 Comparative risks associated with air emissions from ordinary operations.

As discussed in section 5.1.1, the expected exposure to PCBs at the nearest off-site receptor via air emissions during ordinary operation of the UNISON facility are several orders of magnitude lower than the PCB levels established as re-entry guidelines for indoor, workplace air concentrations following a PCB transformer fire (0.5 mg/m^3). Furthermore, these expected exposures are several orders of magnitude lower than annual exposures associated with activities which the Agency determined do not pose unreasonable risks in establishing limits on manufacturing processes which inadvertently generate PCBs. Exposure scenarios considered in evaluating the risks to workers in such manufacturing facilities included inhalation exposures to workers downwind of leaking equipment, and inhalation exposure to mineral oil mist and to spray paint mist. These exposures were assumed to occur 40 hours per week and found not to pose an unreasonable risk assuming that those exposures occurred for 38.5 years.

Potential PCB inhalation exposures to individuals in the Henderson County population are also several orders of magnitude lower than exposures found not to pose unreasonable risk to populations near manufacturing facilities which inadvertently generate PCBs. The amount of PCBs to which the people in the census tract closest to the UNISON facility would be exposed in one year, is equal to the magnitude of yearly exposure to each individual living downwind of a manufacturing facility with inadvertently generated PCBs in its air emissions.

In fact, the yearly exposure to populations in the census tract closest to the Henderson facility is on the same order of magnitude as the yearly exposures to current measured ambient air levels of PCBs in urban areas.

5.3.2 Comparative analysis of risks posed by exposures resulting from accidents on-site

As indicated by the discussion in sections 5.2.1.1 through 5.2.1.7, the probability of releases due to certain on-site accidents (i.e., earthquakes, flooding, tornadoes, airplane impact, failure of pollution control equipment, and fires or explosions) is rare. The probabilities of on-site accidents such as flooding, tornadoes, failure of pollution control equipment, and fires or explosions seem to be no greater at the Henderson facility than the average probability of such incidents. While probabilities of other on-site accidents (i.e., earthquakes, and airplane impacts) are slightly greater than average at the Henderson County site, these probabilities are not substantially higher than those assumed by the Agency in establishing the PCB disposal permitting criteria. Despite the improbability of catastrophic on-site accidents, we have performed a conservative evaluation of the exposures and risks associated with such accidents.

The results of these analyses indicate that, while the exposures resulting from such incidents can be greater than the exposures associated with ordinary operation of the facility, the exposures and resulting risks are lower than those the Agency has previously found do not warrant regulation because an unreasonable risk to human health or the environment will not result.

5.3.2.1 Earthquake

As stated in section 5.2.1.4, there is no possibility that an earthquake of the magnitude and character necessary to cause damage to the facility such that releases could not be contained within the immediate area of the facility could occur. The Agency can not determine that the facility will pose an unreasonable risk.

The potential risks posed by PCB contamination in soil which could result from an earthquake of lesser magnitude than discussed above are similar to the risks posed by possible soil contamination following a tornado (see 5.3.2.3, infra).

5.3.2.2 Flooding

Section 5.2.2.5 concludes that the probability of damage due to flooding (which could cause uncontrolled releases of PCBs) is much lower for the UNISON facility than for the remainder of Evansville. The proposed site is located above the five-hundred year flood plain (i.e., one flood in five hundred years may affect the site). When the Agency established criteria for PCB storage facilities at 40 CFR 761.65, EPA found that no unreasonable risk would result if the facility is sited above the 100 year flood plain. Therefore, the potential risks associated with PCB releases due to a flood well above the 500 year flood plain are not unreasonable.

5.3.2.3 Tornado

The discussion in section 5.2.2.6 indicates that even if the UNISON facility were severely damaged by one tornado, the resulting PCB release would be in the form of subsequent leaks and spills from equipment and containers tossed about by the tornado. Such leaks and spills will probably be limited to an area within a 1/4 miles radius of the facility.

Should a tornado occur, resulting in such leaks and spills, short term exposures to cleanup personnel would occur. If the site were not covered, short term exposure to surrounding populations could result. Further, workers on-site and the off-site population could be exposed to residual contamination (depending upon the cleanup level) after decontamination of the area. However, based upon the results of a risk analysis for PCBs in soil, Recommendation of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup developed by the EPA Office of Research and Development (ORD) for use in the evaluation of Superfund sites, no unreasonable risk of acute or chronic effects on human health would result.

The ORD risk assessment does not quantify allowable PCB concentrations in soil above the concentration at which the air at the soil surface becomes saturated with PCBs. The basis for this is that beyond that point there is no increase in the amount of PCBs available for inhalation exposure and, therefore, no theoretical upper limit to the allowable PCB concentration in the soil. The ORD risk assessment does not specify an upper PCB concentration for short term (10 day), on-site and off-site, inhalation exposures. That is, short-term inhalation exposure to a concentration of PCBs sufficient to saturate the air at the soil surface will not result in an unreasonable risk of acute health effects.

Long-term inhalation exposures to the area on which the leaks and spills occurred would depend upon the decontamination level. However, inhalation exposure to populations greater than 0.1 kilometer (.0625 miles) from a spill area would not pose significant risks even if the soil were only decontaminated to 90 ppm or less. By comparison, the nearest residence to the projected site is more than 1.0 kilometer from the facility and nearly 1.0 kilometers from the spill area furthest from the facility. EPA regulations would, at a minimum, require decontamination of the area to below 50 ppm PCBs. Furthermore, both

EPA and UNISON will probably apply a decontamination standard closer to non-detectable levels of PCBs. Additional measures may be required to mitigate on-site, worker exposures to residual contamination (i.e., cleanup to detectable levels, capping the spill area, protective clothing for workers, or some combination of these approaches) depending upon the size of the area contaminat and the characteristics of the soil. Therefore, releases which may result in the unlikely event of a single tornado can be controlled and subsequently decontamined to safe levels through existing cleanup methods.

Section 5.2.2.6 indicates that only a simultaneous occurrence of two tornadoes would cause damage sufficient to pose unreasonable risks, and that the probability of such a double tornado strike is estimated to be one in one-hundred million. Due to the extremely low probability of occurrence, operation of the UNISON facility in Henderson County cannot be determined to pose unreasonable risks based upon the risk associated with a double tornado strike involving the UNISON facility.

5.3.2.4 <u>Airplane crash involving the facility</u>

In section 5.2.2.7, it is estimated that the probability that an airplane accident at the facility which is of sufficient magnitude to cause damage greater than minor leaks and spills which will occur during twenty years is less than thirty in one million. Even though this is an extremely low probability of occurrence, the Agency did look at the exposures and risks which could result from such a high-velocity, high-angle impact airplane crash. For the purposes of the analysis, EPA made an even more conservative assumption than warranted by the probability estimates by assuming that one such plane crash would occur during the twenty years the UNISON facility is in operation.

5.3.2.4.1 PCB exposures at all phases of a high angle, high velocity airplane crash

Worst-case PCB exposure estimates at all phases of the plane crash, as described at section 5.2.2.7, would result in no significant lifetime cancer risk. Even if the event occurred once in twenty years, the short duration of exposure (zero minutes to 72 hours) would make the lifetime dose associated with such an event equivalent to, or less than, the dose associated with ordinary operations as discussed at section 5.3.1.

5.3.2.4.2 Exposure to soot components other than PCBs at Phase II of a high angle, high velocity airplane crash

This analysis is based on the worst-case assumption that the components of the soot would be present at the same ratios as in the soot resulting from a PCB transformer fire. EPA evaluated the comparative exposures to possible incomplete combustion products in the soot resulting from a PCB transformer fire.

Further, the potential for a fire or explosion-related incident, and the magnitude of exposures in the event of an incident, would be mitigated by the presence of trained personnel and the operating procedures at the facility. Even in the case of transformer fires where the potential risks are orders of magnitude higher than for this Henderson scenario, EPA did not require phaseout of transformers in industrial facilities or electrical substations because of the additional controls generally placed on such equipment and the presence of trained personnel. Similarly, in the event of a fuel fire which results from an airplane crash into the facility, the soot would probably be dispersed into ambient air rather than causing extensive contamination of the building. EPA also recognized the risk-mitigating conditions inherent to PCB transformer fires in outdoor settings, and excluded outdoor PCB transformers from the phaseout requirement. Given the significantly lower level of exposure associated with a fuel fire due to a plane crash at the UNISON facility, and the improbability of such an event, an unreasonable risk would not result.

5.3.2.5 Pollution Control Equipment Failure

In the unlikely event that UNISON's pollution control equipment fails, and that several employees are severely negligent within the same frame of time, it was estimated that large releases of TF-1 containing 0.002% PCBs could continue for a duration of one week. Based on the assumption that such an event would occur once a year for 20 years, and that the same people would be downwind of the facility for the duration of all twenty such incidents, EPA evaluated the exposures to people downwind of the facility. The expected lifetime exposures and risks would be several orders of magnitude lower than those which the Agency has previously found do not pose an unreasonable risk (see discussion at section 5.3.1).

5.3.2.6 Fire or Explosion Related Releases

As indicated at section 5.2.1.3, the possibility of a fire or explosion-related incident involving PCB residues would be extremely remote, if not impossible, due to expected operating procedures at the UNISON facility and the nature of the materials in the facility. Should such an incident occur, it is not likely to be of a greater magnitude or duration than is hypothesized for a potential fuel fire resulting from an airplane crash (see discussion at 5.3.2.4). Therefore, the Agency would not find that the Unison facility poses an unreasonable risk based upon the possibility of such an incident.

5.3.3 Transportation Related Incidents

It was concluded in section 5.2.2.2 that one transportation related tanker spill is expected to occur in 20 years, and that there would be a 50% chance that such a spill would involve PCB residues as opposed to TF-2. Given these probabilities, EPA evaluated potential exposures assuming that the one spill would occur in a residential area or a water supply. Of course the probabilities associated with each of these transportation scenarios is lower than the probabilit that a spill of PCBs will occur during the twenty years of UNISON's operation.

5.3.3.1 Residential Spill

EPA evaluated a worst-case scenario assuming that the largest possible amount of residues was spilled on hot pavement in a residential area. Exposure to initial concentrations of PCBs and any vapors would be limited to a maximum one hour response time (time to cover the spill area in order to mitigate inhalation exposure). In such a case, emergency response personnel would be subject to the greatest potential exposures. Assuming that emergency response personnel do not wear respirators, the resulting exposures would be less, by one to two orders of magnitude, than those found not to pose an unreasonable risk to workers in manufacturing facilities which inadvertently generate PCBs (see discussion in section 5.3.1). Further, the doses associated with exposure to cleanup personnel are lower than those associated with the 10 day acute health advisory levels established by EPA's Office of Research and Development (ORD). All other exposures to observers and surrounding populations would be one to two orders of magnitude lower than for emergency response personnel, and three or four orders of magnitude lower than those found not to pose an unreasonable risk to populations downwind of a manufacturing facility emitting PCBs at 10 ppm (at the point of emission). Available studies indicate that the levels of organic vapors within one hundred meters shortly after a large spill from a PCB residue or TF-2 tanker truck would result in eye and respiratory irritation. Direct contact with the spill material would result in skin irritation (dermatitis). Such effects from a predicted worst case spill are believed to be reversible with no long term adverse health consequences.

5.3.3.2 Spills into Water Supply

As discussed in section 5.2.2.6, it is difficult to accurately estimate the potential exposures and risks associated with transportation related spills into water supplies. It is true, however, that given the tendency of PCBs to bind to sediment, only a small percentage of the PCBs spilled will actually be carried in the water. Further, any PCBs not bound to the sediment initially can be separated out by a water treatment facility prior to entering a drinking water supply. Any dissolved PCBs would also tend to be dispersed by the flow of the river, so that individual ingestion exposure to PCBs (either through contaminated fish or through drinking water) should be mitigated.

Additionally, the possibility that a transportation accident will actually result in the release of PCB into water is mitigated by the containment of the fluids (either in drums or tanks cars). As indicated in section 5.2.2.7, even if a tank containing PCB residues overturned into the river, the tank will probably be dredged up before any appreciable release of PCBs into the water occurs.

Section 5.2.2.8 provided estimates of the probabilities that a transportation spill involving PCB residues would occur on or near the bridge (0.52%) and the probability that a truck carrying PCB residues would overturn into the Ohio River (0.07% or seven in ten thousand) in twenty years. The probability that a transportation spill involving PCB residues will contaminate water supplies is most likely somewhere between those two probabilities.

In short, while the uncertainties associated with a possible spill of PCB residues into a water supply are certainly a factor in considering the potential risks associated with the UNISON facility, these uncertainties are of no greater magnitude at the Henderson site than the generic possibilities of such incidents which were considered in developing EPA's disposal regulations. These probabilities could be compared to the one in ten thousand chance that a person living in the U.S. will suffer a fatal accident in the home.

5.3.4 Benefits of the Unison Facility

While the Agency's evaluation of the risks posed by the various scenarios discussed above show the probability of such PCB exposures and the potential risks posed by such exposures to be low enough to allow a finding of no unreasonable risk on a pure risk basis, it is important to consider the benefits of the UNISON process. The disposal of PCB residues at UNISON's proposed Henderson, Kentucky facility will reduce the overall risks posed by existing PCBs by allowing the reduction of PCB concentrations in in-service transformers while generating less PCB wastes, and at a lesser cost, than if new TF-1 were used in each retrofill operation. Further, the reduced generation of PCB wastes will leave existing incineration capacity and other permitted disposal capacity free for the safe disposal of high concentration PCB wastes.

5.3.5 General Conclusion About the Potential Risks Associated with the Proposed UNISON Facility at Henderson, Kentucky

Based upon the exposure analysis and the considerations discussed above, EPA concludes that the UNISON site at Henderson will not pose an unreasonable risk of injury to human health or the environment, assuming that the types of risk-mitigating criteria which EPA applies to PCB incinerators are found to be met by the UNISON disposal process. EPA will separately determine whether or not routine process operations pose an unreasonable risk (e.g., whether the process achieves adequate separation of PCB residues and meets restrictions on emission levels). This determination will be based on observation of, and analytical results from, an actual demonstration of the UNISON physical separation process.

6.0 SOCIOECONOMIC EFFECTS OF THE FACILITY

Construction and operation of the UNISON Transformer Recovery Center in Henderson County, Kentucky will have national as well as local economic benefits The bulk of the benefits will accrue to transformer owners. UNISON's customers will save an average of 30-40% versus the total cost of replacement of a transformer. Customers savings will range from $11,000 to $83,000 per PCB transformer. If UNISON's target service level of 5,000 units per year is met, annual savings, nationally, are likely to be in the range of $100 million.

Other potential benefits include:

- Risk reduction, since the PCB's are removed from operating transformers;
- Avoidance of long-term landfill liabilities, since reclassifying a transformer to non-PCB status eliminates disposal of a PCB filled transformer carcass at the end of its service life;
- Less disruption of service due to shorter down time;
- Full utilization of investment process offers improved transformer performance, and ability to repair the unit and reclaim material; and
- Financial flexibility, since customers can capitalize or expense the costs of service

Locally, construction and operation of the Recovery Center will contribute to the economy of Henderson County, Kentucky. Construction of the proposed project will result in an estimated $3,500,000 expenditure for equipment, labor, and installation of the facility. During operation the facility will employ 20 people initially and 30 at capacity with an annual payroll of $550,000 and $875,000, respectively. At capacity the following annual expenditures are anticipated:

Taxes	$90,000
Local Purchases	360,000
Local Services	465,000
Utilities	475,000
Total	$1,390,000

These benefits must be weighed against the environmental and public exposure effects as described in the other sections of this report.

7.0 MITIGATION

This section describes some of UNISON's efforts to reduce the chance of accidents and to lessen the impact of accidents that might occur despite precautions. It also describes efforts UNISON might make if EPA determines in its continuing study of this project that additional mitigation is required and practical.

Much of UNISON's mitigative efforts have been described in other sections of this report. Measures which would tend to reduce the chance of transportation related spills and lessen their impacts are noted in Section 3.5. UNISON's air pollution control system is described in Sections 4.1.3 and 5.2.1.2. Many of the measures to be used inside the plant cannot be discussed in detail but are noted generally in Sections 3.7 and 5.2.1.3.

Additionally, UNISON has prepared and submitted to EPA a comprehensive Spill Prevention, Control and Countermeasure Plan and a Health and Safety Plan for the facility detailing how numerous contingencies would be handled and describing equipment UNISON has to carry out the plans. They also have a leak detection program which describes how the plant will be frequently and systematically examined for signs of leakage. This program is described in the air permit application which has been submitted to KDEP.

UNISON's plans for dealing with various emergencies include isolation, containment and evacuation strategies and responsibilities of emergency coordinators. UNISON's plans call for working with local officials and emergency response personnel to make sure area emergency management teams have the equipment, training and contingency plans they might require.

7.1 ADDITIONAL MITIGATIVE MEASURES CONSIDERED BY EPA

EPA has considered requiring UNISON to take additional mitigative measures in three areas to:

- Lessen the risk to the Evansville water supply in the event of a bridge accident;

- Lessen the risk of traffic accidents generally, and;
- Lessen the long term environmental impact of leftover TF-1 when the facility is decommissioned.

These will be discussed in turn.

7.1.1 Water Supply Contamination

As noted in Section 5.2.2.6, the travel time between a spill at the Route 41 bridge and the potential appearance of PCBs at downstream water supply intakes depends on the rate of flow in the Ohio River. Flow rates range from almost undetectable, when the river is pooled, up to five or six miles per hour at flood stage. At flood stage, travel time from the bridge to the Evansville water intake could be less than one hour (Figure 28). If the Evansville Water Treatment Plant is notified within a few minutes of an accident, there will be no danger to the water. According to Mr. Mark Griese of EWTP, raw water intakes can be closed within approximately five minutes of receiving warning. Activated carbon can be brought on-line in less than two hours. More than enough reserve (stored) capacity exists to supply the city while the intakes are closed and the activated carbon is brought on-line.

However, there is no guarantee that EWTP would receive timely notification of an accident. It is unclear how long it might take under worst case conditions to identify a truck lost to the River, or how long after that it might be before downstream water users would be alerted.

In order to eliminate the risk of late notification, EPA is considering requiring that, during periods of high flow, UNISON notify EWTP each time a tanker of residues leaves the facility on its way to Chicago notify EWTP again when the tanker has safely crossed the bridge. Then, if the second notification is not received within a certain period of time, the intakes could be closed until it could be determined that PCBs had not been lost to the River.

7.1.2 Traffic Accidents

EPA is considering two types of mitigation in connection with traffic accidents. One would reduce the chance of an accident occurring and concerns risks related to transport over icy or snowy roads. The other would reduce the impact of an accident should one occur and concerns keeping innocent by-standers away from accident scenes.

The local traffic accident analysis presented in Sections 5.2.2.8 and 5.2.2.9 was based on accidents occurring in a variety of weather situations. A disproportionale number of accidents occurred during bad weather, especially ice and snow. Such conditions may make travel by UNISON trucks unreasonably dangerous and would require mitigative measures.

Of the 1403 traffic accidents studied in Henderson County, 155 (11%) occurred on snow covered roads. The northern-most two miles of U.S. 41 in Henderson County were especially likely to be the scene of snow-related accidents. Of 228 accidents along that stretch, 52 (23%) were on snowy roads. These accidents occurred only on 1.2% of the possible days. The worst of these was the morning of November 13, 1984, when, during a one hour period, there were fourteen separate accidents involving a total of forty-six vehicles either on or near the U.S. 41 bridge. Only one of these accidents was fatal.

According to Major Rick Riley of the Henderson Police Department, the bridge is watched closely by both state and local authorities during cold weather and is salted immediately when it snows. Nonetheless, sufficient resources do not exist to prevent snow from accumulating from time to time on area roads. Snows of one inch or more occur on the average about four times per year. As a mitigation measure, EPA is considering prohibiting UNISON from operating its trucks when the roads may be slick with ice or snow.

The second mitigative measure EPA is considering in connection with traffic accidents is intended to reduce the impact of possible accidents on innocent by-standers. As noted in Section 5.2.2.3, most of UNISON's transportation routes within Henderson and Vanderburgh Counties pass through urban areas. In many places, residential development lies astride the route, in other places there are busy shopping and commercial districts. If there were an accident at one of these locations and PCBs or other hazardous materials spilled onto hot pavement, there is a substantial likelihood that nearby pedestrians would be exposed to relatively high doses of vapors. Moreover, accidents in densely populated areas often attract crowds of curious on-lookers.

EPA believes it is important to minimize the exposure of such persons. EPA is considering requiring that UNISON, in its training seminars for local emergency response personnel, include an assessment of the potential for by-stander exposure and a discussion of available technical means for minimizing that exposure. EPA is further considering requiring that UNISON conduct a public information campaign designed to educate the public regarding appropriate responses to spills they may observe or be near.

7.1.3 Ultimate Fate of TF-1

When the Henderson facility is decommissioned, any TF-1 remaining in existence will cease having its original purpose. It may have some use in connection with another facility either in the United States or elsewhere. It may be used simply as a transformer dielectric fluid. It may also have no practical use and require disposal.

This last possibility is of concern to EPA. As a liquid, current law (RCRA, Section 3004(c)) does not allow TF-1 to be landfilled. However, it could be adsorbed on some sorbant and containerized. In this form it could be landfilled.

Under Kentucky law, adsorbed TF-1 would fall into the category of special or industrial waste. As such, it could not be landfilled without a special permit. Current Kentucky policy strongly discourages landfilling of adsorbed solvents. However, under special circumstances, it might be allowed. Moreover nothing in Kentucky law could prevent TF-1 from being landfilled elsewhere.

Although regulations in effect at the time would govern TF-1 disposal and these regulations may be stricter than those in force now, EPA need not rely on anticipated developments in the law. EPA can condition UNISON's permit with limitations on land disposal of TF-1.

8.0 PUBLIC INVOLVEMENT

The purpose of this section of the report is to describe the actions taken to date to inform and involve the public regarding this project. Actions initiated by UNISON, the Henderson County Board of Zoning Adjustment, the State of Kentucky, and EPA are presented.

8.1 ACTIONS BY UNISON

The following is a list of activities in which UNISON/Union Carbide personnel have participated in efforts to inform the public about the proposed project.

Date	Activity
August 6, 1985	Presentation to the Henderson Economic Development Council.
August 7, 1985	Presentation to media representatives.
August 22, 1985	Presentation to Henderson Rotary Club. Presentation to Henderson Downtown Merchants Association. Presentation to Henderson Industrial Association.
August 27, 1985	Participated in WSON radio call-in talk show.
August 27, 1985	Presentation to Henderson Lions Club.
August 28, 1985 to September 1, 1985 (4 sessions)	Participated in Henderson County Board of Zoning Adjustment public hearing. Made presentation and answered questions.
August 29, 1985	Presentation to Evansville Sertoma Club.
September 10, 1986	Presentation to Business and Professional Women's Club.
September 20, 1985	Participated in Henderson County Board of Zoning Adjustment public meeting.
October 16, 1985	Participated in Henderson County Board of Zoning Adjustment public meeting.

October 17, 1985	Press conference announcing UNISON's decision to locate at the Riverport Industrial Park.
December 2, 1985	Attended U.S. EPA, Region IV public meeting.
December 13, 1985	Attended Kentucky Department of Environmental Protection public meeting on the air construction permit.
December 19, 1985	Ground Breaking Ceremony.
March 12, 1986	Presentation to Kentucky Environmental Quality Commission.
April 29, 1986	Presentation to Henderson County Lions Club.

8.2 ACTIONS BY THE HENDERSON COUNTY BOARD OF ZONING ADJUSTMENT

The only major local permit required for this project was given by the Henderson County Board of Zoning Adjustment. Prior to issuance of this permit, the Board held public hearings in four sessions from August 28 to September 1, 1985. Additional public meetings were held by the Board on September 20, 1985, and October 16, 1985.

8.3 ACTIONS BY THE KENTUCKY ENVIRONMENTAL PROTECTION CABINET

A Public Hearing was held on the state air construction permit on December 13, 1985 in Henderson, Kentucky. Several hours of testimony were received.

8.4 ACTIONS BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

On December 2, 1985, a public meeting was held by the EPA in Henderson, Kentucky, to learn public concerns so that they could be used as a guide for development of the Scope of Work for this report. EPA has also solicited and received written comments on the proposed project. The following is a summary of the issues raised at this hearing and in correspondence.

- Characteristics and Effects of TF-1: UNISON's use of Confidential Business Information procedures to maintain secrecy concerning the constituents of TF-1 was a great concern to many speakers. A strong belief was expressed that the lack of disclosures was preventing the public in the local area from fully understanding the risks associated with the plant.

- Risks of Contamination of Public Water Supply Systems: Several comments were made expressing concerns about the contamination of drinking water supplies downstream from the plant site. Fear was expressed about PCB's entering the Ohio River from the plant site and from a transportation accident on the Ohio River Bridge. Several municipal officials expressed concern over the potential need for alternate sources of water supply.

- Risks Associated with Transportation: Many speakers raised the issue of the safety of major transportation routes in the area and the possibility of a tanker truck accident. A spill of PCB's or TF-1 along a high density population area was of concern. Other speakers argued that extensive transportation of PCB's and other hazardous materials was already occurring in the area with no significant adverse effects.

- Proximity of New Madrid Earthquake Zone: The possibility of an earthquake along the New Madrid fault line leading to a plant accident was a serious concern to several commentators. Liquefaction of the area soils and the potential consequences were raised as an issue.

- Other Concerns with Accidents: There was concern for accidents other than those associated with transportation and earthquakes. Fires, faulty equipment, on-site spills, normal maintenance and operating procedures were all seen as potential causes of accidents.

- Emergency Clean-up and Response Procedures: The suitability of notification procedures in case of on- or off-site accidents, the ability of local fire departments to respond to emergency situations, the existence of appropriate spill clean-up plans and financial responsibility in case of accidents were raised.

- Risks Associated with Normal Plant Operation: The major public concerns associated with normal plant operations included toxic air emissions and impacts to ground and surface waters from incidental spills.

- Construction of the Plant Before Completion of An Assessment: Several speakers expressed concern that UNISON was about to proceed with construction of the facility before the agency determined if there would be any unreasonable risks. Several speakers believed it would be very difficult to deny a permit to operate once a 10 million dollar facility was in place.

- Applicability of the Resource Conservation and Recovery Act (RCRA): Several speakers requested the agency to apply RCRA as a tool to stop construction of the plant and to insure safer operating procedures. There was a great deal of confusion as to why RCRA had not previously been applied to the regulation of PCB's. The applicability of RCRA to TF-1 was also addressed.

- Alternatives to the Proposed Henderson Project: Several alternatives were available for both plant processes and location. The existence of more proven processes and the perceived greater safety of a mobile rather than a fixed facility were discussed. Many commentators also expressed concern about the facility being so close to a major river. Location alternatives in a more isolated area were favored by many. Safety factors regarding the proximity of the facility to the local airport were also mentioned as were the benefits of locating near an existing PCB incinerator.

- Benefits to the Local Economy: Some speakers expressed the view that the facility would be good for the local economy by providing jobs and an increased tax base. Other speakers argued that the increased number of new jobs would not be significant to the local economy.

- Risks Associated With PCB's: The fact that PCB's are not a proven carcinogen was raised at the hearing. Some speakers argued that the relative risk of PCB's was not that great when compared to other common hazardous substances.

- Risks Associated With Dioxins and Dibenzofurans: Concern was expressed about potential danger from dioxins and dibenzofurans that could be formed by heating PCB's during normal plant operations or in case of fire.

- Appropriate Mitigative Measures: Some speakers expressed the hope that the study would recommend appropriate measures which could be taken to insure plant safety.

- Concern for Wildlife Areas: Speakers questioned the potential impact of the project on sensitive wildlife habitats in the area.

A mailing list was prepared for this project consisting of local public officials in the project area and all citizens who either attended EPA's public meeting or wrote us about the project. A copy of the issues raised at the public meeting and other materials were sent to everyone on the mailing list along with a copy of the scope of work for this Public Health and Environmental Exposure Assessment. Four repositories have been set up in the project area containing copies of public hearing transcripts, permit applications, and related material from EPA's project files.

9.0 PROPOSED EPA ACTION

Based upon a review of UNISON's permit application and the material presented in this document, EPA has made a preliminary determination that operation of the proposed facility at the UNISON site in Henderson will not pose an unreasonable risk of injury to human health or the environment. This determination is made based on the imposition of certain Conditions of Authorization which are listed below. If these conditions of authorization are violated, TSCA prescribes a civil penalty system with fines of up to $25,000 per day per violation.

EPA has also authorized the initiation of the test demonstration in late August. This test will determine whether the process operations achieve adequate separation of PCB residues and meet required emission levels. EPA's final decision on authorization of plant operation will be based on the results of the test demonstration as well as the comments received on this Draft Public Health and Environmental Exposure Assessment.

The Draft Conditions of Authorization are as follows:

1. Advance Notification: A non-confidential written notice, to be received by the addressee no less than thirty days, and no more than one hundred eighty days prior to the conduct of a permitted PCB disposal activity, shall be provided to: the appropriate EPA Regional PCB Coordinator, the appropriate State Agency, and appropriate local town/city/county government official(s). The content of the notice shall be at a minimum:

    (1) The nature of the PCB disposal activity.

    (2) The exact location(s), such as street address of a facility (or, if there is no street address, plant site location with a telephone contact such that exact location(s) may be determined by telephone inquiry).

    (3) The exact time(s) and date(s) the treatment will take place. When changes in these time(s) and date(s) are expected, these changes must be made immediately by telephone to the appropriate officials (as indicated above) and followed by written notification of the changes such that the revised times shall still be at least thirty days following receipt of the written notificaiton.

2. Other Permits/Approvals: Permittee must obtain all necessary environmental approvals and/or permits from the appropriate Federal, State and local agencies prior to the treatment of PCBs at any site.

3. Limitation of Treatment Matrix: System will be permitted to treat only the type of material successfully demonstrated to EPA.

4. Limitation of Matrix PCB Concentration: PCB concentration of the fluid mixture in the process vessel is limited to the highest levels successfully treated during the process demonstration.

Prior to treatment, samples of the treatment matrix (feedstock) must be obtained and analyzed by the Permittee using gas chromatography procedures specified in EPA approved procedures outlined in the following documents:

"Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans", EPA Contract No. 68-02-3938, April 16, 1985:

"Recommended Analytical Requirements for PCB Data Generated On Site During Non-Thermal PCB Destruction Tests", USEPA, December 12, 1985 (Draft);

"Quality Assurance and Quality Control Procedures for Demonstrating PCB Destruction in Filing for PCB Disposal Permit", USEPA, June 28, 1983 (Draft); and

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans: QAMS-005/80, Office of Research and Development,

5. Quality Control: A sample of treated material must be drawn, and analyzed in duplicate by gas chromatography for the concentration of PCBs after the treatment at the site where the PCB disposal process is being used. If the concentration of PCBs in the treated sample is 2 ppm or greater, the treated material must be reprocessed and reanalyzed to show less than 2 ppm per peak before the next batch is treated.

6. Processing Time Limitation: If the quality control testing, as described in Condition (5), reveals that the PCBs have not been adequately removed after repeated processing (not to exceed three times the estimated theoretical time necessary for complete reaction), the facility shall cease operation. The facility operator must notify the PCB Disposal Site Coordinator in EPA Region IV immediately and file a written report with that region within seven (7) days. The facility shall not resume operation until the problem has been corrected to the satisfaction of the appropriate EPA region.

7. Operations Log/Recordkeeping: Provisions must be made to assure that the following process elements are suitably monitored and recorded for each batch processed, such that materials harmful to health or the environment are not inadvertently released:

a. name, address, and telephone number of the disposal unit operator and supervisor;

b. the name and business address of the person or firm whose PCB-containing material is being processed;

c. the location, manufacturer, rated capacity and identification (serial) number of the transformer, heat transfer system or hydraulic system, as appropriate;

d. the date the PCB material is received by Permittee, the date(s) processed, and the date returned to the custody of the owner (if applicable);

e. estimated quantity and quality of feed material charged into the reactor;

f. estimated quantity and quality of treated materials and wastes produced;

g. date, time and duration of treatment per batch or system;

h. a copy of the gas chromatrograph and/or other records from tests conducted to determine the final concentration of the treated material;

i. estimated quantity and quality of wastes produced; the method of disposal and location of the disposal facility for each waste should be documented; and

j. temperature of reaction in at least one-half hour intervals.

Disposal recordkeeping documents must be compiled within 60 days of the testing date, must be kept at one centralized location, and must be made available for inspection by authorized representatives of the EPA. Such documents shall be maintained for at least five years. Permittee must also maintain the records required by 40 CFR 761.180(f). If Permittee or its authorized agents terminate business, these records or their copies must be submitted to the Regional Administrator, Region IV.

8. PCB Releases: In the event Permittee or an authorized facility operator of the disposal facility unit believes, or has reason to believe, that a release has or might have occurred, the facility operator must inform EPA Region IV by telephone immediately.

A written report describing the incident must be submitted by the close of business of the next regular business day following the incident. No PCBs may be processed in that facility until the release problem has been corrected to the satisfaction of the EPA Region IV.

9. PCB Spills: Any spills of PCBs or other fluids at the facility site or related to transportation of materials offsite shall be promptly controlled and cleaned up as provided in the Permittee's spill prevention plan, and in accordance with the PCB spill cleanup procedures of EPA Region IV. In addition,

a written report describing the spill, operations involved, cleanup actions and changes in operation to prevent such spills in the future must be submitted to EPA Region IV within seven (7) business days.

PCB spills must be reported in accordance with the PCB spill reporting requirements prescribed under §311 of the Clean Water Act for discharges to navigable waters and under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) for discharges to other media.

10. Safety and Health: Permittee must take all necessary precautionary measures to insure that operation of the disposal facility is in compliance with the applicable safety and health standards, as required by Federal, State and local regulations and ordinances.

11. Facility Security: The disposal facility shall be secured (e.g., fence, alarm system, etc.) to restrict public access to the area. Any bodily injury occurring as a result of the PCB disposal process must be reported to the PCB Disposal Site Coordinator in EPA Region IV the next regular business day.

12. Reporting of PCB Incidents: Any reports required by conditions (6), (8), (9), and (11) are to be submitted by telephone to the appropriate regional PCB Disposal Site Coordinator within the time frame specified. In addition, Permittee shall file written reports with the Regional Administrator of EPA Region IV and the Director of the Office of Toxic Substances within the time frame specified in the aforementioned conditions.

13. Personnel Training: Permittee shall be responsible for ensuring that personnel directly involved with the handling or disposal of PCB-contaminated fluid using the disposal process are demonstrably familiar with the general requirements of this approval. At a minimum, this must include:

a. the type of materials which may be treated using the PCB disposal process, and the upper limit of PCB contamination which may be treated;

b. basic recordkeeping requirements under this approval and the location of records;

c. notification requirements;

d. waste disposal requirements for process and by-product wastes generated during the operation of the PCB disposal process; and

e. reporting requirements.

In this regard, Permittee must maintain on-site during the operation of its separation facility, a copy of this approval; the spill prevention and cleanup plan; and sampling and analytical procedures used to determine PCB concentrations in untreated and treated materials.

14. PCB Transport Limitation: Untreated PCB fluids may not be transported off-site of the disposal facility. Process equipment (i.e., reactors, pump hoses, etc.) must be decontaminated in accordance with procedures described in Permittee's permit application and test plan, prior to transporting off-site. PCB-contaminated equipment must be transported in accordance with 40 CFR Section 761.40 and the U. S. Department of Transportation (USDOT) requirements of Title 49, CFR Part 172, including placarding and labelling all PCBs.

15. Process and Pollution Control Maintenance and Inspection: Procedures must be followed in accordance with information provided in permit application/demonstration plan, including periodic replacement of pollution abatement parts (e.g., filters).

16. PCB Waste Disposal Requirements: All wastes generated by the PCB disposal process other than the successfully cleaned material, (e.g., filter media, sludges, water or other effluents) must be disposed of as if it contains the original PCB feedstock concentration. EPA will consider amending this condition only after such waste has been fully characterized to determine all components, and gas chromatography analysis of the waste demonstrates that the PCB concentration is below 2 ppm.

17. Financial Assurance: Permittee shall incorporate financial assurance of closure and liability coverage provisions into its closure plan. These provisions must be equivalent to those specified in 40 CFR Part 264, Subpart H of the Resource Conservation and Recovery Act (RCRA), and provide funds for:

a. proper closure of the PCB disposal units, and

b. compensating others for bodily injury and property damage caused by accidents arising from operations of the disposal units.

18. Notification Requirements for New Facilities: Permittee must notify the Regional Administrator in writing of any plans for new facilities at the site. The Regional Administrator will then determine the appropriate procedures for consideration of an operating permit for the proposed facilities.

19. Notice of Modifications: No major modifications may be made to the unit design, as described in the application and demonstration plan for this approval without written approval of the Regional Administrator. For the purpose of this approval, "major modification" shall be defined as any change to capacity, design, efficiency, waste type, or any other changes affecting overall performance or environmental impacts.

20. PCB Regulations Requirements: Permittee shall comply with all applicable requirements of the Federal PCB Regulation, 40 CFR Part 761, in the operation of the facility. Particular note shall be given to:

a. 40 CFR Section 761.65 - storage for disposal;

b. 40 CFR Section 761.79 - decontamination; and

c. 40 CFR Section 761.180 - records and monitoring.

21. Permit Severability: The conditions of this approval are severable, and if any provision of this approval of any application of any provision is held invalid, the remainder of this approval shall not be affected thereby.

22. Permit Expiration/Renewal: Approvals are effective for a three-year period. For a renewal approval, EPA may require additional information and/or testing of the PCB disposal process. In order to continue the effectiveness of an approval pending EPA action on reissuance, the Permittee must submit a renewal request letter to EPA at least 90 days, but not more than 180 days, prior to the expiration date of this approval.

23. Annual Quality Control Monitoring: Permittee shall conduct annual monitoring of the facility for PCBs, separation efficiencies, and mass emission rates for TF-1 and PCBs. If limits specified in the conditions of approval are not complied with, U. S. EPA must be notified within one day of receipt of the test report, and Permittee shall cease separation of PCBs. Otherwise test results shall be incorporated into the annual report. If no disposal operations were conducted during the year of an anniversary of this permit, the first disposal operation in the following year after the anniversary shall be monitored as required under this condition.

24. Disposal of Cleaned TF-1: Permittee shall not dispose of cleaned material (TF-1) other than by marketing the material for further use in commerce or by disposing of the material at an approved RCRA hazardous waste disposal facility or approved PCB incinerator. Should the constituents of TF-1 be fully evaluated for inclusion on the RCRA hazardous waste list, these constituents shall then be disposed of in accordance with any applicable regulations.

25. Accident Reporting: Permittee shall utilize a method (radio, telephone, etc.) of communicating between tanker trucks carrying TF-2 or PCB residues and the separation facility. The drivers of each truck shall notify a responsible party at the separation facility immediately prior to and immediately following crossing the U.S. 41 bridge. UNISON shall maintain records of such communications. UNISON shall immediately investigate failure to communicate successful crossing of the U.S. 41 bridge. Should an accident occur on the bridge or should the vehicle not be located, the permittee shall immediately notify the Evansville Water Treatment Plant and the Henderson County Sheriff's Department.

26. Transport Limitations: Permittee shall assure that no TF-2 or PCB tanker trucks cross the U. S. Highway 41 bridge during periods when ice, snow, or other severe weather conditions are causing hazardous driving conditions.

27. Emergency Training: Permittee shall at their sole expense furnish to the applicable police, fire and emergency response agencies of the city and County of Henderson and the City of Evansville, such special training as is necessary to combat emergency or disaster situations which might reasonably be anticipated at the subject property and along transportation routes in these jurisdictions.

28. Safety Procedures and Equipment: Permittee shall follow safety procedures as outlined in their operating manual. Permittee shall have and maintain safety equipment at the separation facility as described in their permit application and operating manual. Permittee shall notify EPA of any proposed modifications to these operation procedures or changes in safety equipment.

29. Monitoring Requirements: Permittee shall meet the baseline environmental monitoring requirements of Henderson County and the operational monitoring of the Commonwealth of Kentucky. Copies of environmental monitoring reports shall be provided to EPA Region IV at the same time as provided to the County and Commonwealth.

30. Process Limitations: Permittee shall not process greater amounts of contaminated TF-1 (TF-X) than allowed in the State air permit.

31. Closure Plan: Permittee shall notify EPA in the event the facility is to discontinue operation for an extended period (greater than three months). Permittee shall notify EPA of any plans for closure and submit a proposed plan of such closure 60 days in advance to EPA for approval.

32. Facility Access: The Permittee shall allow EPA inspectors access to the facility and all reports, documents, or other materials required of this facility by EPA, the Commonwealth and Henderson County at any time with or without prior notification.

10.0 LIST OF PREPARERS

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APPENDICES

APPENDIX 1

TOXIC SUBSTANCES CONTROL ACT

Section 6(e)

(e) POLYCHLORINATED BIPHENYLS.—(1) Within six months after the effective date of this Act the Administrator shall promulgate rules to—

(A) prescribe methods for the disposal of polychlorinated biphenyls, and

(B) require polychlorinated biphenyls to be marked with clear and adequate warnings, and instructions with respect to their processing, distribution in commerce, use, or disposal or with respect to any combination of such activities.

Requirements prescribed by rules under this paragraph shall be consistent with the requirements of paragraphs (2) and (3).

(2)(A) Except as provided under subparagraph (B), effective one year after the effective date of this Act no person may manufacture, process, or distribute in commerce or use any polychlorinated biphenyl in any manner other than in a totally enclosed manner.

(B) The Administrator may by rule authorize the manufacture, processing, distribution in commerce or use (or any combination of such activities) of any polychlorinated biphenyl in a manner other than in a totally enclosed manner if the Administrator finds that such manufacture, processing, distribution in commerce, or use (or combination of such activities) will not present an unreasonable risk of injury to health or the environment.

(C) For the purposes of this paragraph, the term "totally enclosed manner" means any manner which will ensure that any exposure of human beings or the environment by the polychlorinated biphenyl will be insignificant as determined by the Administrator by rule.

(3)(A) Except as provided in subparagraphs (B) and (C)—

(i) no person may manufacture any polychlorinated biphenyl after two years after the effective date of this Act, and

(ii) no person may process or distribute in commerce any polychlorinated biphenyl after two and one-half years after such date.

(B) Any person may petition the Administrator for an exemption from the requirements of subparagraph (A), and the Administrator may grant by rule such an exemption if the Administrator finds that—

(i) an unreasonable risk of injury to health or environment would not result, and

(ii) good faith efforts have been made to develop a chemical substance which does not present an unreasonable risk of injury to health or the environment and which may be substituted for such polychlorinated biphenyl.

An exemption granted under this subparagraph shall be subject to such terms and conditions as the Administrator may prescribe and shall be in effect for such period (but not more than one year from the date it is granted) as the Administrator may prescribe.

(C) Subparagraph (A) shall not apply to the distribution in commerce of any polychlorinated biphenyl if such polychlorinated biphenyl was sold for purposes other than resale before two and one half years after the date of enactment of this Act.

(4) Any rule under paragraph (1), (2)(B), or (3)(B) shall be promulgated in accordance with paragraphs (2), (3), and (4) of subsection (c).

(5) This subsection does not limit the authority of the Administrator, under any other provision of this Act or any other Federal law, to take action respecting any polychlorinated biphenyl.

PART 761—POLYCHLORINATED BIPHENYLS (PCBs) MANUFACTURING, PROCESSING, DISTRIBUTION IN COMMERCE, AND USE PROHIBITIONS

AUTHORITY: Secs. 6, 8, and 12, Toxic Substances Control Act, 15 U.S.C. 2605, 2607, and 2611.

Subpart A—General

§ 761.1 Applicability.

(a) This part establishes prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB Items.

(b) This part applies to all persons who manufacture, process, distribute in commerce, use, or dispose of PCBs or PCB Items. Substances that are regulated by this rule include, but are not limited to, dielectric fluids, contaminated solvents, oils, waste oils, heat transfer fluids, hydraulic fluids, paints, sludges, slurries, dredge spoils, soils, materials contaminated as a result of spills, and other chemical substances or combination of substances, including impurities and byproducts and any byproduct, intermediate or impurity manufactured at any point in a process. Most of the provisions of this part apply to PCBs only if PCBs are present in concentrations above a specified level. For example, Subpart D applies generally to materials at concentrations of 50 parts per million (ppm) and above. Also certain provisions of Subpart B apply to PCBs inadvertently generated in manufacturing processes at concentrations specified in the definition of "PCB" under § 761.3. No provision specifying a PCB concentration may be avoided as a result of any dilution, unless otherwise specifically provided.

(c) Definitions of the terms used in these regulations are in Subpart A. The basic requirements applicable to disposal and marking of PCBs and PCB Items are set forth in Subpart D—Disposal of PCBs and PCB Items and in Subpart C—Marking of PCBs and PCB Items. Prohibitions applicable to PCB activities are set forth in Subpart B—Manufacture, Processing, Distribution in Commerce, and Use of PCBs and PCB Items. Subpart B also includes authorizations from the prohibitions. Subparts C and D set forth the specific requirements for disposal and marking of PCBs and PCB Items.

(d) Section 15 of the Toxic Substances Control Act (TSCA) states that failure to comply with these regulations is unlawful. Section 16 imposes liability for civil penalties upon any person who violates these regulations, and the Administrator can establish appropriate remedies for any violations subject to any limitations included in section 16 of TSCA. Section 16 also subjects a person to criminal prosecution for a violation which is knowing or willful. In addition, section 17 authorizes Federal district courts to enjoin activities prohibited by these regulations, compel the taking of actions required by these regulations, and issue orders to seize PCBs and PCB Items manufactured, processed or distributed in violation of these regulations.

(e) These regulations do not preempt other more stringent Federal statutes and regulations.

(f) Unless and until superseded by any new more stringent regulations issued under EPA authorities, or any permits or any pretreatment requirements issued by EPA, a state or local government that affect release of PCBs to any particular medium:

(1) Persons who inadvertently manufacture or import PCBs generated as unintentional impurities in excluded manufacturing processes, as defined in

§ 761.3, are exempt from the requirements of Subpart B of this part, provided that such persons comply with Subpart J of this part, as applicable.

(2) Persons who process, distribute in commerce, or use products containing PCBs generated in excluded manufacturing processes defined in § 761.3 are exempt from the requirements of Subpart B provided that such persons comply with Subpart J of this part, as applicable.

(3) Persons who process, distribute in commerce, or use products containing recycled PCBs defined in § 761.3, are exempt from the requirements of Subpart B of this part, provided that such persons comply with Subpart J of this part, as applicable.

(Sec. 6, Pub. L. 94-469, 90 Stat. 2020 (15 U.S.C. 2605))

[44 FR 31542, May 31, 1979, as amended at 49 FR 28189, July 10, 1984]

§ 761.3 Definitions.

For the purpose of this part:

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"Commerce" means trade, traffic, transportation, or other commerce:

(1) Between a place in a State and any place outside of such State, or

(2) Which affects trade, traffic, transportation, or commerce described in paragraph (1) of this definition.

"Disposal" means intentionally or accidentally to discard, throw away, or otherwise complete or terminate the useful life of PCBs and PCB Items. Disposal includes spills, leaks, and other uncontrolled discharges of PCBs as well as actions related to containing, transporting, destroying, degrading, decontaminating, or confining PCBs and PCB Items.

"Distribute in commerce" and "Distribution in Commerce" when used to describe an action taken with respect to a chemical substance, mixture, or article containing a substance or mixture means to sell, or the sale of, the substance, mixture, or article in commerce; to introduce or deliver for introduction into commerce, or the introduction or delivery for introduction into commerce of the substance, mixture, or article; or to hold or the holding of, the substance, mixture, or article after its introduction into commerce.

"Excluded manufacturing process" means a manufacturing process in which quantities of PCBs, as determined in accordance with the definition of inadvertently generated PCBs, calculated as defined, and from which releases to products, air, and water meet the requirements of paragraphs (1) through (5) of this definition, or the importation of products containing PCBs as unintentional impurities, which products meet the requirements of paragraph (1) and (2) of this definition.

(1) The concentration of inadvertently generated PCBs in products leaving any manufacturing site or imported into the United States must have an annual average of less than 25 ppm, with a 50 ppm maximum.

(2) The concentration of inadvertently generated PCBs in the components of detergent bars leaving the manufacturing site or imported into the United States must be less than 5 ppm.

(3) The release of inadvertently generated PCBs at the point at which emissions are vented to ambient air must be less than 10 ppm.

(4) The amount of inadvertently generated PCBs added to water discharged from a manufacturing site must be less than 100 micrograms per resolvable gas chromatographic peak per liter of water discharged.

(5) Disposal of any other process wastes above concentrations of 50 ppm PCB must be in accordance with Subpart D of this part.

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"PCB" and "PCBs" means any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance. Refer to § 761.1(b) for applicable concentrations of PCBs. PCB and PCBs as contained in PCB items are defined in § 761.3. For any purposes under this part, inadvertently generated non-Aroclor PCBs are defined as the total PCBs calculated following division of the quantity of monochlorinated biphenyls by 50 and dichlorinated biphenyls by 5.

"PCB Article" means any manufactured article, other than a PCB Container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. "PCB Article" includes capacitors, transformers, electric motors, pumps, pipes and any other manufactured item (1) which is formed to a specific shape or design during manufacture, (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use, and (3) which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the PCB Article.

"PCB Article Container" means any package, can, bottle, bag, barrel, drum, tank, or other device used to contain PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs.

"PCB Container" means any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.

"PCB Equipment" means any manufactured item, other than a PCB Container or a PCB Article Container, which contains a PCB Article or other PCB Equipment, and includes microwave ovens, electronic equipment, and fluorescent light ballasts and fixtures.

"PCB Item" is defined as any PCB Article, PCB Article Container, PCB Container, or PCB Equipment, that deliberately or unintentionally contains or has a part of it any PCB or PCBs.

"PCB Transformer" means any transformer that contains 500 ppm PCB or greater.

"PCB-Contaminated Electrical Equipment" means any electrical equipment, including but not limited to transformers (including those used in railway locomotives and self-propelled cars), capacitors, circuit breakers, reclosers, voltage regulators, switches (including sectionalizers and motor starters), electromagnets, and cable, that contain 50 ppm or greater PCB, but less than 500 ppm PCB. Oil-filled electrical equipment other than circuit breakers, reclosers, and cable whose PCB concentration is unknown must be assumed to be PCB-Contaminated Electrical Equipment. (See §761.30 (a) and (h) for provisions permitting reclassification of electrical equipment containing 500 ppm or greater PCBs to PCB-Contaminated Electrical Equipment).

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"Recycled PCBs" are defined as those intentionally manufactured PCBs which appear in the processing of paper products or asphalt roofing materials as PCB-contaminated raw materials and which meet the requirements of (1) through (5) of this definition.

(1) The concentration of Aroclor PCBs in paper products leaving any manufacturing site or imported into the United States must have an annual average of less than 25 ppm with a 50 ppm maximum.

(2) There are no detectable concentrations of Aroclor PCBs in asphalt roofing materials.

(3) The release of Aroclor PCBs at the point at which emissions are vented to ambient air must be less than 10 ppm.

(4) The amount of Aroclor PCBs added to water discharged from a processing site must at all times be less than 3 micrograms per liter ($\mu g/l$) for total Aroclors (roughly 3 parts per billion (3 ppb)).

(5) Disposal of any other process wastes above concentrations of 50 ppm PCB must be in accordance with Subpart D of this part.

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"Storage for disposal" means temporary storage of PCBs that have been designated for disposal.

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Subpart B—Manufacturing, Processing, Distribution in Commerce, and Use of PCBs and PCB Items

§ 761.20 Prohibitions.

Except as authorized in § 761.30, the activities listed in paragraphs (a) and (d) of this section are prohibited pursuant to section 6(e)(2) of TSCA. The requirements set forth in paragraphs (b) and (c) of this section concerning export and import of PCBs for purposes of disposal and PCB Items for purposes of disposal are established pursuant to section 6(e)(1) of TSCA. Subject to any exemptions granted pursuant to section 6(e)(3)(B) of TSCA, the activities listed in paragraphs (b) and (c) of this section are prohibited pursuant to section (6)(e)(3)(A) of TSCA. In addition, the Administrator hereby finds, under the authority of section 12(a)(2) of TSCA, that the manufacture, processing, and distribution in commerce of PCBs at concentrations of 50 ppm or greater and PCB Items with PCB concentrations of 50 ppm or greater present an unreasonable risk of injury to health within the United States. This finding is based upon the well-documented human health and environmental hazard of PCB exposure, the high probability of human and environmental exposure to PCBs and PCB Items from manufacturing, processing, or distribution activities; the potential hazard of PCB exposure posed by the transportation of PCBs or PCB Items within the United States; and the evidence that contamination of the environment by PCBs is spread far beyond the areas where they are used. In addition, the Administrator hereby finds, for purposes of section 6(e)(2)(C) of

TSCA, that any exposure of human beings or the environment to PCBs, as measured or detected by any scientifically acceptable analytical method, may be significant, depending on such factors as the quantity of PCBs involved in the exposure, the likelihood of exposure to humans and the environment, and the effect of exposure. For purposes of determining which PCB Items are totally enclosed, pursuant to section 6(e)(2)(C) of TSCA, since exposure to such Items may be significant, the Administrator further finds that a totally enclosed manner is a manner which results in no exposure to humans or the environment to PCBs. The following activities are considered totally enclosed: distribution in commerce of intact, nonleaking electrical equipment such as transformers (including transformers used in railway locomotives and self-propelled cars), capacitors, electromagnets, voltage regulators, switches (including sectionalizers and motor starters), circuit breakers, reclosers, and cable that contain PCBs at any concentration and processing and distribution in commerce of PCB Equipment containing an intact, nonleaking PCB Capacitor. See paragraph (c)(1) of this section for provisions allowing the distribution in commerce of PCBs and PCB Items.

(a) No person may use any PCB, or any PCB Item regardless of concentration, in any manner other than in a totally enclosed manner within the United States unless authorized under § 761.30, except that an authorization is not required to use those PCBs or PCB Items resulting from an excluded manufacturing process or recycled PCBs defined in § 761.3, provided all applicable conditions of § 761.1(f) are met.

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§ 761.30 Authorizations.

The following non-totally enclosed PCB activities are authorized pursuant to section 6(e)(2)(B) of TSCA:

(a) *Use in and servicing of transformers (other than railroad transformers).* PCBs at any concentration may be used in transformers (other than transformers for railroad locomotives and self-propelled railroad cars) and may be used for purposes of servicing including rebuilding these transformers for the remainder of their useful lives, subject to the following conditions:

(1) *Use conditions.* (i) After October 1, 1985, the use and storage for reuse of PCB Transformers that pose an exposure risk to food or feed is prohibited.

(ii) A visual inspection of each PCB Transformer (as defined in the definition of "PCB Transformer" under § 761.3) in use or stored for reuse shall be performed at least once every three months. These inspections may take place any time during the three month periods: January-March, April-June, July-September, and October-December as long as there is a minimum of 30 days between inspections. The visual inspection must include investigation for any leak of dielectric fluid on or around the transformer. The extent of the visual inspections will depend on the physical constraints of each transformer installation and should not require an electrical shutdown of the transformer being inspected.

(iii) If a PCB Transformer is found to have a leak which results in any quantity of PCBs running off or about to run off the external surface of the transformer, then the transformer must be repaired or replaced to eliminate the source of the leak. In all cases any leaking material must be cleaned up and properly disposed of according to disposal requirements of § 761.60. Cleanup of the released PCBs must be initiated as soon as possible, but in no case later than 48 hours of its discovery. Until appropriate action is completed, any active leak of PCBs must be contained to prevent exposure of humans or the environment and inspected daily to verify containment of the leak. Trenches, dikes, buckets, and pans are examples of proper containment measures.

(iv) Records of inspection and maintenance history shall be maintained at least 3 years after disposing of the transformer and shall be made available for inspection, upon request, by EPA. Such records shall contain the following information for each PCB Transformer:

(A) Its location.

(B) The date of each visual inspection and the date that a leak was discovered, if different from the inspection date.

(C) The person performing the inspection.

(D) The location of any leak(s).

(E) An estimate of the amount of dielectric fluid released from any leak.

(F) The date of any cleanup, containment, repair, or replacement.

(G) A description of any cleanup, containment, or repair performed.

(H) The results of any containment and daily inspection required for uncorrected active leaks.

(v) A reduced visual inspection frequency of at least once every 12 months applies to PCB Transformers that utilize either of the following risk reduction measures. These inspections may take place any time during the calendar year as long as there is a minimum of 180 days between inspections.

(A) A PCB Transformer which has impervious, undrained, secondary containment capacity of at least 100 percent of the total dielectric fluid volume of all transformers so contained, or

(B) A PCB Transformer which has been tested and found to contain less than 60,000 ppm PCBs (after three months of inservice use if the transformer has been serviced for purposes of reducing the PCB concentration).

(vi) An increased visual inspection frequency of at least once every week applies to any PCB Transformer in use or stored for reuse which poses an exposure risk to food or feed. The user of a PCB Transformer posing an exposure risk to food or feed is responsible for the inspection, recordkeeping, and maintenance requirements under this section until the user notifies the owner that the transformer may pose an exposure risk to food or feed. Following such notification, it is the owner's ultimate responsibility to determine whether the PCB Transformer poses an exposure risk to food or feed.

(2) *Servicing conditions.* (i) Transformers classified as PCB-Contaminated Electrical Equipment (as defined in the definition of "PCB-Contaminated Electrical Equipment" under § 761.3) may be serviced (including rebuilding) only with dielectric fluid containing less than 500 ppm PCB.

(ii) Any servicing (including rebuilding) of PCB Transformers (as defined in the definition of "PCB Transformer" under § 761.3) that requires the removal of the transformer coil from the transformer casing is prohibited. PCB Transformers may be serviced (including topping off) with dielectric fluid at any PCB concentration.

(iii) PCBs removed during any servicing activity must be captured and either reused as dielectric fluid or disposed of in accordance with the requirements of § 761.60. PCBs from PCB Transformers must not be mixed with or added to dielectric fluid from PCB-Contaminated Electrical Equipment.

(iv) Regardless of its PCB concentration, dielectric fluids containing less than 500 ppm PCB that are mixed with fluids that contain 500 ppm or greater PCB must not be used as dielectric fluid in any electrical equipment. The entire mixture of dielectric fluid must be considered to be greater than 500 ppm PCB and must be disposed of in an incinerator that meets the requirements in § 761.70.

(v) A PCB Transformer may be converted to PCB-Contaminated Electrical Equipment or to a non-PCB Transformer and a transformer that is classified as PCB-Contaminated Electrical Equipment may be reclassified to a non-PCB Transformer by draining, refilling and/or otherwise servicing the transformer. In order to reclassify, the transformer's dielectric fluid must contain less than 500 ppm PCB (for conversion to PCB-Contaminated Electrical Equipment) or less than 50 ppm PCB (for conversion to a non-PCB Transformer) after a minimum of three months of in-service use subsequent to the last servicing conducted for the purpose of reducing the PCB concentration in the transformer. In-service means that the transformer is used electrically under loaded conditions that raise the temperature of the dielectric fluid to at least 50° Centigrade. The Assistant Administrator may grant, without further rulemaking, approval for the use of alternative methods that simulate the loaded conditions of in-service use. All PCBs removed from transformers for purposes of reducing PCB concentrations are subject to the disposal requirements of § 761.60.

(vi) Any dielectric fluid containing 50 ppm or greater PCB used for servicing transformers must be stored in accordance with the storage for disposal requirements of § 761.65.

(vii) Processing and distribution in commerce of PCBs for purposes of servicing transformers is permitted only for persons who are granted an exemption under TSCA 6(e)(3)(B).

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Subpart D—Storage and Disposal

NOTE: This subpart does not require removal of PCBs and PCB Items from service and disposal earlier than would normally be the case. However, when PCBs and PCB Items are removed from service and disposed of, disposal must be undertaken in accordance with these regulations. PCBs (including soils and debris) and PCB Items which have been placed in a disposal site are considered to be "in service" for purposes of the applicability of this subpart. This subpart does not require PCBs and PCB Items landfilled prior to February 17, 1978 to be removed for disposal. However, if such PCBs or PCB Items are removed from the disposal site, they must be disposed of in accordance with this subpart. Other subparts are directed to the manufacture, processing, distribution in commerce, and use of PCBs and may result in some cases in disposal at an earlier date than would otherwise occur.

§ 761.60 Disposal requirements.

(a) *PCBs.* (1) Except as provided in paragraphs (a) (2), (3), (4), and (5) of this section, PCBs at concentrations of 50 ppm or greater must be disposed of in an incinerator which complies with § 761.70.

(2) Mineral oil dielectric fluid from PCB-Contaminated Electrical Equipment containing a PCB concentration of 50 ppm or greater, but less than 500 ppm, must be disposed of in one of the following:

(i) In an incinerator that complies with § 761.70;

(ii) In a chemical waste landfill that complies with § 761.75 if information is provided to the owner or operator of the chemical waste landfill that shows that the mineral oil dielectric fluid does not exceed 500 ppm PCB and is not an ignitable waste as described in § 761.75(b) (8) (iii);

(iii) In a high efficiency boiler provided that:

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(iv) In a facility that is approved in accordance with § 761.60(e). For the purpose of burning mineral oil dielectric fluid, an applicant under § 761.60(e) must show that his combustion process destroys PCBs as efficiently as does a high efficiency boiler, as defined in paragraph (b)(2)(iii) of this section, or a § 761.70 approved incinerator.

(3) Liquids, other than mineral oil dielectric fluid, containing a PCB concentration of 50 ppm or greater, but less than 500 ppm, shall be disposed of:

(i) In an incinerator which complies with § 761.70;

(ii) In a chemical waste landfill which complies with § 761.75 if information is provided to the owner or operator of the chemical waste landfill that shows that the waste does not exceed 500 ppm PCB and is not an ignitable waste as described in § 761.75(b)(8)(iii);

(iii) In a high efficiency boiler provided that.

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(iv) In a facility that is approved in accordance with § 761.60(e). For the purpose of burning liquids, other than mineral oil dielectric fluid, containing 50 ppm or greater PCB, but less than 500 ppm PCB, an applicant under § 761.60(e) must show that his combustion process destroys PCBs as efficiently as does a high efficiency boiler, as defined in § 761.60(a)(2)(iii), or a § 761.70 incinerator.

(4) Any non-liquid PCBs at concentrations of 50 ppm or greater in the form of contaminated soil, rags, or other debris shall be disposed of:

(i) In an incinerator which complies with § 761.70; or

(ii) In a chemical waste landfill which complies with § 761.75.

NOTE: Except as provided in § 761.75(b)(8)(ii), liquid PCBs shall not be processed into non-liquid forms to circumvent the high temperature incineration requirements of § 761.60(a).

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(b) *PCB Articles*—(1) *Transformers.* (i) PCB Transformers shall be disposed of in accordance with either of the following:

(A) In an incinerator that complies with § 761.70; or

(B) In a chemical waste landfill which complies with § 761.75; *Provided,* That the transformer is first drained of all free flowing liquid, filled with solvent, allowed to stand for at least 18 hours, and then drained thoroughly. PCB liquids that are removed shall be disposed of in accordance with paragraph (a) of this section. Solvents may include kerosene, xylene, toluene and other solvents in which PCBs are readily soluble. Precautionary measures should be taken, however, that the solvent flushing procedure is conducted in accordance with applicable safety and health standards as required by Federal or State regulations.

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(4) *PCB-Contaminated Electrical Equipment.* All PCB-Contaminated Electrical Equipment except capacitors shall be disposed of by draining all free flowing liquid from the electrical equipment and disposing of the liquid in accordance with paragraph (a)(2) or (3) of this section. The disposal of the drained electrical equipment is not regulated by this rule. Capacitors that contain between 50 and 500 ppm PCBs shall be disposed of in an incinerator that complies with § 761.70 or in a chemical waste landfill that complies with § 761.75.

(5) *Other PCB Articles.* (i) PCB articles with concentrations at 50 ppm or greater must be disposed of:

(A) In an incinerator that complies with § 761.70; or

(B) In a chemical waste landfill that complies with § 761.75, provided that all free-flowing liquid PCBs have been thoroughly drained from any articles before the articles are placed in the chemical waste landfill and that the drained liquids are disposed of in an incinerator that complies with § 761.70.

(ii) PCB Articles with a PCB concentration between 50 and 500 ppm must be disposed of by draining all free flowing liquid from the article and disposing of the liquid in accordance with paragraph (a)(2) or (3) of this section. The disposal of the drained article is not regulated by this rule.

(6) *Storage of PCB Articles.* Except for a PCB Article described in paragraph (b)(2)(ii) of this section and hydraulic machines that comply with the municipal solid waste disposal provisions described in paragraph (b)(3) of this section, any PCB Article, with PCB concentrations at 50 ppm or greater, shall be stored in accordance with § 761.65 prior to disposal.

(c) *PCB Containers.* (1) Unless decontaminated in compliance with § 761.79 or as provided in paragraph (c)(2) of this section, a PCB container with PCB concentrations at 50 ppm or greater shall be disposed of:

(i) In an incinerator which complies with § 761.70, or

(ii) In a chemical waste landfill that complies with § 761.75; provided that if there are PCBs in a liquid state, the PCB Container shall first be drained and the PCB liquid disposed of in accordance with paragraph (a) of this section.

(2) Any PCB Container used to contain only PCBs at a concentration less than 500 ppm shall be disposed of as municipal solid wastes; provided that if the PCBs are in a liquid state, the PCB Container shall first be drained and the PCB liquid shall be disposed of in accordance with paragraph (a) of this section.

(3) Prior to disposal, a PCB container with PCB concentrations at 50 ppm or greater shall be stored in a facility which complies with § 761.65.

(d) *Spills.* (1) Spills and other uncontrolled discharges of PCBs at concentrations of 50 ppm or greater constitute the disposal of PCBs.

(2) PCBs resulting from the clean-up and removal of spills, leaks, or other uncontrolled discharges, must be stored and disposed of in accordance with paragraph (a) of this section.

(3) These regulations do not exempt any person from any actions or liability under other statutory authorities, including but not limited to the Clean Water Act, the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

(e) Any person who is required to incinerate any PCBs and PCB Items under this subpart and who can demonstrate that an alternative method of destroying PCBs and PCB Items exists and that this alternative method can achieve a level of performance equivalent to § 761.70 incinerators or high efficiency boilers as provided in paragraph (a)(2)(iv) and (a)(3)(iv) of this section, may submit a written request to either the Regional Administrator or the Assistant Administrator for Pesticides and Toxic Substances for an exemption from the incineration requirements of § 761.70 or § 761.60. Requests for approval of alternate methods that will be operated in more than one region must be submitted to the Assistant Administrator for Pesticides and Toxic Substances except for research and development involving less than 500 pounds of PCB material (see paragraph (i)(2) of this section). Requests for approval of alternate methods that will be operated in only one region must be submitted to the appropriate Regional Administrator. The applicant must show that his method of destroying PCBs will not present an unreasonable risk of injury to health or the environment. On the basis of such information and any available information, the Regional Administrator or Assistant Administrator for Pesticides and Toxic Substances may, in his discretion, approve the use of the alternate method if he finds that the alternate disposal method provides PCB destruction equivalent to disposal in a § 761.70 incinerator or a § 761.60 high efficiency boiler and will not present an unreasonable risk of injury to health or the environment. Any approval must be stated in writing and may contain such conditions and provisions as the Regional Administrator or Assistant Administrator for Pesticides and Toxic Substances deems appropriate. The person to whom such waiver is issued must comply with all limitations contained in such determination.

(f)(1) Each operator of a chemical waste landfill, incinerator, or alternative to incineration approved under paragraph (e) of this section shall give the following written notices to the state and local governments within whose jurisdiction the disposal facility is located:

(i) Notice at least thirty (30) days before a facility is first used for disposal of PCBs required by these regulations; and

(ii) At the request of any state or local government, annual notice of the quantities and general description of PCBs disposed of during the year. This annual notice shall be given no more than thirty (30) days after the end of the year covered.

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(2) Any person who disposes of PCBs under a paragraph (a)(5)(iii) of this section incineration or chemical waste landfilling waiver shall give written notice at least thirty (30) days prior to conducting the disposal activities to the state and local governments within whose jurisdiction the disposal is to take place.

(g) *Testing procedures.* (1) Owners or users of mineral oil dielectric fluid electrical equipment may use the following procedures to determine the concentration of PCBs in the dielectric fluid:

(i) Dielectric fluid removed from mineral oil dielectric fluid electrical equipment may be collected in a common container, provided that no other chemical substances or mixtures are added to the container. This common container option does not permit dilution of the collected oil. Mineral oil that is assumed or known to contain at least 50 ppm PCBs must not be mixed with mineral oil that is known or assumed to contain less than 50 ppm PCBs to reduce the concentration of PCBs in the common container. If dielectric fluid from untested, oil-filled circuit breakers, reclosers, or cable is collected in a common container with dielectric fluid from other oil-filled electrical equipment, the entire contents of the container must be treated as PCBs at a concentration of at least 50 ppm, unless all of the fluid from the other oil-filled electrical equipment has been tested and shown to contain less than 50 ppm PCBs.

(ii) For purposes of complying with the marking and disposal requirements, representative samples may be taken from either the common containers or the individual electrical equipment to determine the PCB concentration, except that if any PCBs at a concentration of 500 ppm or greater have been added to the container or equipment then the total container contents must be considered as having a PCB concentration of 500 ppm or greater for purposes of complying with the disposal requirements of this subpart. For purposes of this subparagraph, representative samples of mineral oil dielectric fluid are either samples taken in accordance with American Society of Testing and Materials method D-923 or samples taken from a container that has been thoroughly mixed in a manner such that any PCBs in the container are uniformly distributed throughout the liquid in the container.

(2) Owners or users of waste oil may use the following procedures to determine the PCB concentration of waste oil:

(i) Waste oil from more than one source may be collected in a common container, provided that no other chemical substances or mixtures, such as non-waste oils, are added to the container.

(ii) For purposes of complying with the marking and disposal requirements, representative samples may be taken from either the common containers or the individual electrical equipment to determine the PCB concentration. *Except,* That if any PCBs at a concentration of 500 ppm or greater have been added to the container or equipment then the total container contents must be considered as having a PCB concentration of 500 ppm or greater for purposes of complying with the disposal requirements of this Subpart. For purposes of this paragraph, representative samples of mineral oil dielectric fluid are either samples taken in accordance with American Society of Testing and Materials method D-923-81 or samples taken from a container that has been thoroughly mixed in a manner such that any PCBs in the container are uniformly distributed throughout the liquid in the container.

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§ 761.65 Storage for disposal.

This section applies to the storage for disposal of PCBs at concentrations of 50 ppm or greater and PCB Items with PCB concentrations of 50 ppm or greater.

(a) Any PCB Article or PCB Container stored for disposal before January 1, 1983, shall be removed from storage and disposed of as required by this part before January 1, 1984. Any PCB Article or PCB Container stored for disposal after January 1, 1983, shall be removed from storage and disposed of as required by Subpart D of this part within one year from the date when it was first placed into storage.

§ 761.70 Incineration.

This section applies to facilities used to incinerate PCBs required to be incinerated by this part.

(a) *Liquid PCBs.* An incinerator used for incinerating PCBs shall be approved by an EPA Regional Administrator or the Assistant Administrator for Pesticides and Toxic Substances pursuant to paragraph (d) of this section. Requests for approval of incinerators to be used in more than one region must be submitted to the Assistant Administrator for Pesticides and Toxic Substances, except for research and development involving less than 500 pounds of PCB material (see § 761.60(i)(2)). Requests for approval of incinerators to be used in only one region must be submitted to the appropriate Regional Administrator. The incinerator shall meet all of the requirements specified in paragraph (a) (1) through (9) of this section, unless a waiver from these requirements is obtained pursuant to paragraph (d)(5) of this section. In addition, the incinerator shall meet any other requirements which may be prescribed pursuant to paragraph (d)(4) of this section.

(1) Combustion criteria shall be either of the following:

(i) Maintenance of the introduced liquids for a 2-second dwell time at 1200°C(±100°C) and 3 percent excess oxygen in the stack gas; or

(ii) Maintenance of the introduced liquids for a 1½ second dwell time at 1600°C(±100°C) and 2 percent excess oxygen in the stack gas.

(2) Combustion efficiency shall be at least 99.9 percent computed as follows:

Combustion efficiency = $C_{CO_2}/C_{CO_2} + C_{CO} \times 100$

where

C_{CO_2} = Concentration of carbon dioxide.
C_{CO} = Concentration of carbon monoxide.

§ 761.79 Decontamination.

(a) Any PCB Container to be decontaminated shall be decontaminated by flushing the internal surfaces of the container three times with a solvent containing less than 50 ppm PCB. The solubility of PCBs in the solvent must be five percent or more by weight. Each rinse shall use a volume of the normal diluent equal to approximately ten (10) percent of the PCB Container capacity. The solvent may be reused for decontamination until it contains 50 ppm PCB. The solvent shall then be disposed of as a PCB in accordance with § 761.60(a). Non-liquid PCBs resulting from the decontamination procedures shall be disposed of in accordance with the provisions of § 761.60(a)(4).

(b) Movable equipment used in storage areas shall be decontaminated by swabbing surfaces that have contacted PCBs with a solvent meeting the criteria of paragraph (a) of this section.

NOTE: Precautionary measures should be taken to ensure that the solvent meets safety and health standards as required by applicable Federal regulations.

[44 FR 31542, May 31, 1979. Redesignated at 47 FR 19527, May 6, 1982]

TSCA COMPLIANCE PROGRAM POLICY NO. 6-PCB-2

Distillation, Solvent Extraction, Filtration, and other Physical Separation Methods for PCBs

TSCA Section: 6(e)

ISSUE:

Does the physical separation of PCBs from liquids and solids require EPA approval?

The physical separation of PCBs from liquids and solids requires an approval if the use or disposal of these liquids and solids avoids, or is alternative to, the disposal requirements that would have applied to the original material before separation. An approval is required for physical separation activities that can be construed to be part of, or an initiation of a disposal activity. However, an approval is not required for physical separation activities which process PCBs during authorized servicing activities and reuse the processed materials in equipment authorized for continued use in the PCB rules.

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DISCUSSION:

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The following example of the use of a physical separation technique is applicable. Capacitors must be disposed of by incineration or by an approved alternate method equivalent to incineration (40 CFR 761.70). It is theoretically possible to develop a capacitor disposal method the first step of which is to separate the PCBs from the solid materials (e.g., solvent extraction). The separation process, requires specific prior approval by the Regional Administrator or Assistant Administrator for Pesticides and Toxic Substances under section 761.60(e) since it is part of the disposal method but is not authorized under section 761.60. If such a method were successful in completely removing all detectable PCBs from the solids, the PCB-free solid materials could later be salvaged without subsequent treatment or EPA approval. Although the PCBs removed from the solid materials and any unprocessed materials require incineration, it is also theoretically possible to obtain approval to use a physical separation technique to remove PCBs from the liquid materials in a similar manner.

In contrast, a permit is not required to service electrical equipment for purposes of reducing PCB concentration. Physical separation techniques can be used to service PCB-containing electrical equipment as long as the processed materials are ultimately returned to electrical equipment regulated under the PCB rule. This type of servicing is authorized under 40 CFR 761.30(a). Filtering PCBs from the dielectric fluid of transformers and returning that fluid to the transformer is an example of this type of activity. Because the processed liquids and solids are returned or reused in regulated equipment, EPA controls the ultimate disposition of all the processed materials and no disposal requirements are circumvented.

Without an EPA disposal approval, processed liquids and solids that formerly contained PCBs must be treated as if they still contain PCBs and may not be distributed in commerce without an exemption under section 6(e)(3)(B) of the Toxic Substances Control Act (TSCA). Therefore, it is possible to physically separate PCBs from liquids and solids without EPA approval as long as these liquids and solids are treated (used, stored, disposed of, etc) as if they still contain their original PCB concentration. The PCB residue which results from physical separation activities, as well as any materials not eventually reused in regulated electrical equipment, must be disposed of in a manner which complies with section 761.60.

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TSCA COMPLIANCE PROGRAM POLICY No. 6-PCB-3

Residual PCBs in Processed Liquids and Solids

TSCA Section: 6(e)

ISSUE:

Are PCBs at concentrations less than 50 ppm in liquids and solids that have been physically separated from higher concentration PCB materials regulated for the purpose of disposal?

POLICY:

PCBs at concentrations less than 50 ppm in liquids and solids that have been physically separated from higher concentration PCB materials are regulated as if they still contain the original PCB concentrations.

DISCUSSION:

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A separator who is servicing electrical equipment may dispose of the "heavy" PCB fraction according to 40 CFR 761.60 and return the "light" fraction to the electrical equipment, in which case all materials are controlled by the PCB regulation. In the alternative (if he intends to produce a light fraction which will not be disposed of according to the PCB rule or reused in electrical equipment), the separator must obtain a disposal approval from either the Assistant Administrator for Pesticides and Toxic Substances or a Regional Administrator under 40 CFR 761.60(e). Only after the light fraction has been shown to contain no detectable PCBs, however, can the activity be approved by EPA as a disposal activity and considered an unregulated material.

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 261

[OPTS-211017; FRL 2962-1]

Hazardous Waste; Polychlorinated Biphenyls (PCBs); Response to Citizens' Petitions

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Response to Citizens' Petitions.

SUMMARY: This notice responds to citizens' petitions submitted by Citizens for Healthy Progress and Valley Watch under section 21 of the Toxic Substances Control Act (TSCA) (15 U.S.C. 2620) and section 7004 of the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6974).

Each TSCA petition is a request that EPA exercise authority under TSCA section 5(e) to prevent the construction of a PCB disposal facility in Henderson, Kentucky, pending the development of additional information regarding the health and environmental effects arising from the operation of the proposed facility. An application for an approval under TSCA section 6(e) for this proposed PCB disposal facility is pending before EPA Region IV.

As explained in Unit II, EPA is denying the TSCA requests of both petitions on two grounds: (1) EPA cannot amend TSCA, as requested by Citizens for Healthy Progress; and (2) EPA does not have the authority under section 5(e) of TSCA to issue a proposed order to prevent construction of a proposed facility when a proposed process does not involve either a "new chemical substance" or a "significant new use" of a substance.

In addition, Valley Watch has petitioned for rulemaking under RCRA, seeking regulation of the Henderson facility and, if possible, seeking to halt construction and operation. EPA regulations issued under RCRA impose additional notice and comment procedures which are applicable only to RCRA section 7004 petitions. These regulations require EPA to publish a tentative decison to grant or deny the petition, to solicit public comment on that tentative decision, and then, to issue and publish its final decision.

In this notice, EPA has tentatively decided to deny the Valley Watch petition under RCRA. The Agency solicits public comment on this tentative denial; interested persons may also request an informal public hearing regarding this tentative decision.

However, the Agency notes that it intends to list wastes containing PCBs as hazardous wastes under RCRA, thereby subjecting PCB waste management facilities to RCRA regulation.

ADDRESSES: Copies of the petitions and all related information are located in: Document Control Office (TS-793), Office of Toxic Substances, Environmental Protection Agency, Rm. E-107, 401 M St., SW., Washington, DC 20460.

They are available for review and copying from 8 a.m. to 4 p.m. Monday through Friday, except legal holidays.

Comments on EPA's Tentative Decisions under RCRA and any requests for an informal public meeting under RCRA should be in writing and sent to: Francine Jacoff, Waste Identification Branch (WH-562B), Office of Solid Waste, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460.

DATES: Comments on EPA's Tentative Decision under RCRA and any written requests for an informal public hearing under RCRA should be sent to the above address by April 25, 1986.

FOR FURTHER INFORMATION (TSCA PETITIONS) CONTACT: Edward Klein, Director, TSCA Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, Rm. E-543, 401 M St., SW., Washington, DC 20460, Toll Free: (800-424-9065). In Washington, DC: (554-1404), Outside the USA: (Operator-202-554-1404).

SUPPLEMENTARY INFORMATION:

I. Background

A. Summary of Petitions

On November 20, 1985, Citizens for Healthy Progress (CHP) petitioned the EPA under section 21 of TSCA to take action under section 5(e) of TSCA to halt construction of a planned PCB disposal facility in Henderson, Kentucky. The petitioner asserts that the Agency lacks sufficient information at this time to make a decision on the safety of the facility and that construction of the facility should not be allowed to occur until such information is available for the Agency to evaluate. The petitioner argues that the fact that funds have been expended for construction of a costly facility could bias the Agency's decision to permit or not permit the facility in favor of the applicant and could, therefore, place the public at unreasonable risk.

The CHP petition specifically requests that the Agency "amend an order" under TSCA section 5(e) by adding language to paragraph (1)(A) of the TSCA section 5(e) which would, among other things, enable the Administrator to issue a "proposed order" to prohibit the construction or completion of a facility such as the one planned for Henderson, Kentucky, pending the development of information.

On December 9, 1985, Valley Watch (VW) petitioned the EPA under section 21 of TSCA to take action similar to that requested on November 20, 1985, by Citizens for Healthy Progress. Valley Watch petitioned EPA under section 5(e), to issue either a "proposed order" or an injunction which would prohibit the commencement of construction of the Henderson facility pending the development of additional information. Specifically, VW argues that the authority to enjoin the construction of the Henderson, Kentucky, facility is "inherent" in the authority reposed in the Administrator by TSCA section 5(e) to prohibit or limit activities involving a new chemical substance pending the development of information. The Valley Watch petition is premised upon the belief that the Agency lacks information with respect to the health and environmental risks posed by the proposed PCB disposal facility, the processes to be employed in the facility, and the chemicals to be used and manufactured in the facility. In particular, the identity of and possible risks associated with the material known as "TF-1" appears to be at the heart of VW's concern that insufficient information is available regarding the proposed disposal facility. VW asserts that construction of the Henderson facility should not occur until such time as this information is available and has been subjected to reasoned evaluation by the Agency.

In addition, Valley Watch petitioned for the issuance of a regulation under section 7004(a) of RCRA (42 U.S.C. 6974(a)). The petition did not request any specific rules or cite specific provisions of RCRA as possible authority for rulemaking but generally sought regulation of the PCB facility in Henderson under RCRA and, if possible, a ban on construction and operation. The basis for the petition is that there is insufficient information available to the Agency to evaluate health and environmental effects from the activities at the facility. The Agency is treating the RCRA request as a petition seeking rulemaking under Subtitle C of RCRA (Hazardous Waste Management).

B. TSCA Section 21

Section 21 of the Toxic Substances Control Act (TSCA) provides that any person may petition the Administrator of EPA to initiate a proceeding for the issuance of rules under section 4 (rules requiring chemical testing), section 6 (rules imposing substantive controls on chemicals), or section 8 (information-gathering rules). Also, section 21 authorizes a petitioner to request the issuance, amendment, or repeal of orders under section 5(e) (orders affecting chemicals involved in premanufacture notification) or section 6(b)(2) (orders affecting quality control procedures). Section 21(b)(3) requires that EPA grant or deny citizens' petitions within 90 days of the filing of the petitions (15 U.S.C. 2620(b)(3)).

If the Administrator grants a section 21 petition, the Agency must promptly commence an appropriate proceeding. If the Administrator denies the petition, the reasons for denial must be published in the Federal Register.

If EPA denies the petition, or fails to grant or deny the petition within 90 days of the filing date, the petitioners may commence a civil action in a Federal district court to compel the Agency to initiate the requested action. This suit must be filed within 60 days of the denial, or within 60 days of the expiration of the 90-day period if the Agency fails to grant or deny the petition within that period (15 U.S.C. 2620(b)(4)).

In the case of a section 21 petition which requests an order which can be issued under section 5(e), EPA may issue such an order if EPA determines that information is insufficient to evaluate a subject chemical, and that in the absence of sufficient information, the chemical may present an unreasonable risk or, may cause substantial or significant human or environmental exposure (15 U.S.C. 2604(e)(1)(A)).

C. RCRA Regulations Governing Citizens' Petitions

EPA regulations set out a process for addressing petitions for rulemaking under RCRA Subtitle C at 40 CFR 260.20. They provide that the Administrator is to issue for publication in the Federal Register a tentative decision to grant or deny a petition and solicit public comment on the tentative decision. That notice may take the form of an advance notice of proposed rulemaking, a proposed rule, or a tentative decision to deny the petition. Upon written request of any interested person, the Administrator may, at his discretion, hold an informal public hearing to consider oral comments on the tentative decision. A person requesting a public hearing must state the issues to be raised and explain why written comments would not suffice to communicate the person's views. The Administrator may, in any event, decide to hold an informal public hearing on his own initiative. After evaluating all public comments, EPA is to make a final decision by issuing for publication in the Federal Register a regulatory amendment or a final denial of the petition.

This notice contains EPA's tentative decision on the RCRA petition. A subsequent Federal Register notice will announce the Agency's final decision.

II. Response to TSCA Petitions

The Citizens for Healthy Progress and Valley Watch petitions are motivated by concerns that allowing the construction of the Henderson PCB disposal facility might bias the Agency's ultimate permitting decision in favor of the applicant. EPA addresses these concerns in Unit III. However, in requesting relief from EPA under TSCA section 21, the petitioners rely exclusively upon the remedies set forth in TSCA section 5(e). Therefore, the decision to grant or deny petitioners' requests depends upon whether CHP and VW have presented circumstances which suggest the proper application of section 5(e) authority. EPA must deny all of petitioners' TSCA requests because of congressionally mandated limitations on the applicability of section 5(e) authority. This unit sets forth the reasons for these denials.

A. Request To Amend TSCA Section 5(e)

While phrased as a request to "amend an order," the Citizens for Healthy Progress in effect ask EPA to amend TSCA section 5(e) by adding to paragraph (1)(A) of section 5(e) language which would enable the Administrator to initiate necessary legal proceedings to prohibit construction of a facility intended primarily for activities involving a substance which EPA can subject to a proposed order.

EPA denies the CHP petition, because EPA cannot amend TSCA. Any such request should be addressed to Congress, rather than this Agency.

B. Requests for Issuance of Proposed Order

The Valley Watch petition requests that EPA issue a TSCA section 5(e) proposed order or injunction which would prohibit construction of the Henderson PCB disposal facility until sufficient information is developed regarding the health and environmental effects associated with the facility. Likewise, the Citizens for Healthy Progress petition could be construed to request the same relief.

When construed in this manner, both the CHP and VW petitions must be denied because the petitioners have not alleged circumstances which would trigger the availability of either a proposed order or an injunction under section 5(e).

The "proposed order" provision of section 5(e) does not apply to all chemical substances; rather, the provision applies only to those chemical substances with respect to which notice is required by section 5(a). Section 5(a) requires persons who intend to manufacture or import a "new chemical substance," (or, who intend to manufacture, import, or process a chemical substance in a "significant new use") to notify EPA at least 90 days before any such activity begins (15 U.S.C. 2604(a)(1)). TSCA defines a "new chemical substance" in section 3(9) as a substance not included on the inventory compiled under section 8(b).

It is true that under TSCA section 5(a)(2), EPA has authority to designate uses of chemical substances as "significant new uses." But, such a designation must be undertaken through rulemaking after EPA has considered the statutory factors enumerated in section 5(a)(2). In this instance, however, the components of TF-1 are not "new chemical substances." Nor are these components subject to any "significant new use" rules.

EPA understands that the petitioners are unaware of the precise nature of the material identified as TF-1. This circumstance arises from the claim to business confidentiality asserted by Union Carbide under TSCA section 14 with regard to the composition of TF-1. Nevertheless, EPA is aware of the identity of the TF-1 components, and there is available to EPA a considerable amount of information regarding the effects of the TF-1 components. The PCB disposal permitting process (described in Unit III) enables the EPA to consider comprehensively the possible health and environmental effects presented by the proposed Henderson PCB disposal facility, including the effects of TF-1.

EPA has determined that the substances comprising TF-1 are contained on the section 8(b) inventory of exisiting chemical substances. Thus, TF-1 is not composed of "new chemical substances" subject to section 5(a)(1)(A) premanufacture notification. Likewise, the use of TF-1 components as organic solvents or dielectric fluids is not currently subject to a rule designating such uses as "significant new uses," and thus, would not give rise to section 5(a)(1)(B) significant new use notification. Because TF-1 and its components are not subject to any section 5(a) notification requirements, TF-1 cannot be the subject of a proposed order under section 5(e)(1) or an injunction under section 5(e)(2). TSCA section 5 affords EPA the opportunity to screen new substances for their health and environmental effects prior to their being manufactured and introduced into commerce, but it does not extend to other chemical substances (such as those comprising TF-1) unless a designated "significant new use" is involved.

However, the CHP and VW petitions do raise an issue of significance in the PCB disposal permitting program: whether construction of a PCB disposal facility should be prohibited during the pendency of the permitting review for a disposal process.

While the petitioners did not specifically request that the PCB disposal permitting process be altered, the Agency believes that the construction issue merits consideration in this response. EPA has concluded that the existing permitting process, which allows construction of a facility prior to the granting of an approval, provides the best assurance that a PCB disposal process will in fact achieve safe and effective disposal of PCBs. As an essential part of the permitting process, EPA requires that PCB disposal facilities be demonstrated to meet EPA's regulatory requirements. Necessarily, a facility must be constructed before it can be demonstrated.

To aid in understanding EPA's conclusion that the existing permitting process should not be altered, EPA has included below a description of the PCB disposal permitting process.

III. The PCB Disposal Permitting Program Under TSCA

A. The Application and Review Process

EPA, under section 6(e) of TSCA, issued regulations in the Federal Register of May 31, 1979 (44 FR 31514) governing the disposal of PCBs and PCB Items. These regulations, codified at 40 CFR 761.60 et seq., contain requirements for the disposal of PCBs and PCB Items and detailed specifications that must be met by incinerators, high efficiency boilers, landfills, and alternative methods of disposal in order to be approved by EPA for the disposal of PCBs and PCB Items. For example, 40 CFR 761.70 requires that incinerators used for incinerating PCBs be approved by EPA and meet specific standards for dwell time, temperature, excess oxygen, and combustion efficiency. In practical terms, these incineration standards mean that PCB incinerators must achieve a destruction efficiency for PCBs of 99.9999 percent. The owner operator of a proposed facility is required by EPA to submit an application which contains information on the location of the incinerator, a detailed description of the incinerator, including general site plans and design drawings, engineering reports on the anticipated performance of the incinerator, the availability of sampling and monitoring equipment and facilities, estimates of waste volumes expected to be incinerated, any local, State, or other Federal permits or approvals, and schedules and plans for complying with the approval requirements (e.g., the trial burn requirement) (40 CFR 761.70(d)(1)).

The owner or operator is also required to subject the incinerator to a trial burn and to submit to EPA a full plan for conducting the trial burn. EPA requires trial burns to monitor destruction efficiency and safe operation prior to full permitting and commercial operation. Monitoring data and results from the trial burn are analyzed by EPA to insure that the applicant meets the regulatory requirements regarding destruction efficiency and safety (40 CFR 761.70(d)(2)).

EPA engineers and scientists review the material provided in the application and the results of trial burns and make determinations on whether the incinerator meets the regulatory requirements for effective and safe destruction of PCBs (40 CFR 761.70(d)(4)).

The proposed PCB disposal facility which is the subject of the Citizens for Healthly Progress petition and the Valley Watch petition is what EPA terms an alternative method for PCB destruction. Alternative methods of PCB destruction include, but are not limited to, catalytic dehydrochlorination, chlorolysis, plasma arc, ozonation, catalyzed oxidation, and microbiological and sodium-catalyzed decomposition of the PCB molecules.

Methods for decontamination of PCB-contaminated materials by concentration and removal of the PCBs also are considered alternative methods of PCB destruction. The planned Henderson, Kentucky facility is an example of an alternative method, employing a physical separation technique the particulars of which are protected by a claim to business confidentiality asserted by Union Carbide under TSCA section 14.

The proposed PCB disposal facility in Henderson, Kentucky would house material and personnel necessary to accomplish the physical separation of PCBs from a solvent (which also serves as a temporary dielectric fluid). The solvent (hereafter referred to as TF-1) is then intended to be recycled for future use and the PCBs will be shipped to an EPA-approved PCB incinerator for final destruction.

For such an alternative method of PCB destruction, EPA requires that this method achieve a "level of performance" or "destruction efficiency" equal to or greater than high temperature incineration (40 CFR 761.60(e)). For physical separation processes, the requirement of 99.9999 percent PCB destruction efficiency translates into a requirement of complete separation of the PCBs from the solvent. The person proposing such an alternative disposal process must demonstrate that after separation has occurred, there are no PCBs present in the solvent above the practical limits of detection. This is demonstrated by chemical analysis of the solvent after separation has occurred. EPA requires that the solvent contain less than 2 parts per million (ppm) PCBs, which is the lowest level of PCBs which is practically detectable or measurable in the solvent. Further, EPA requires that the process operate in a manner which will not present unreasonable risk to public health or the environment.

In the first phase of the permitting procedure for alternative methods of destruction, EPA requires the submission of an application. The applicant must provide complete information on the proposed process, including:

1. A description of the project organization including persons responsible for obtaining permits, the project manager, facility manager, and safety officer.

2. A description of waste intended to be treated in the unit, including the type of waste to be destroyed (liquid or solid), the proposed total waste and PCB feed rates, and the matrix and composition of the waste including major and minor constituents, and PCB content.

3. A process engineering description including process flow diagram, and narrative description of the system, description of the theoretical basis for the destruction process, layout diagrams and descriptions of the plant or mobile unit; detailed engineering drawings, intended location of the facility and intended location when in storage.

4. A narrative description of the waste feed system, description of waste preparation, and estimate of waste volume.

5. A description of the automatic waste feed cutoff system when process conditions exceed normal bounds, a description of the procedures to shut off the waste feed line and whole process in the event of an equipment malfunction.

6. A narrative description of the destruction system (e.g., description of chemical reactions, stoichiometry, reagents, catalysts, process design capacity), and a list of products and by-products and their concentrations.

7. A description of the pollution control system for process effluents (air emissions, liquid effluents, sludge, solid waste, etc.), design parameters, and important operating parameters of the pollution control system and how they will be monitored.

8. A summary of process operating parameters which lists target values as well as upper and lower boundaries for all measured operating parameters, instrument settings and control equipment parameters.

9. A sampling and monitoring program to monitor process operation and to verify PCB destruction is equivalent to or greater than 99.9999 percent.

10. Sampling procedures including an explanation of the apparatus, calibration procedures, and maintenance procedures.

11. Analytical procedures (e.g., methods, instruments, etc.).

12. Monitoring procedures (methods, instruments, etc.).

13. A spill prevention control and countermeasure plan.

14. A safety plan.

15. A training plan.

16. A demonstration test plan.

17. Test data or engineering performance calculations.

18. Copies of other required permits/approvals.

19. Schedule for operation.

20. A quality assurance plan.

21. A copy of the plant or facility operational plan.

22. A closure plan for the facility.

A full description of what EPA requires of applicants for approval to dispose of PCBs is contained in "Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans" (April 16, 1985).

Once EPA has received and evaluated the information contained in the application, a demonstration test of the effectiveness and safety of the disposal process is scheduled. However, if technical information contained in an application (or in an applicant's demonstration test plan) indicates to EPA that a process cannot achieve safe and effective PCB disposal, the demonstration test will not be scheduled, and the application proceeds no further. Thus, there is conducted a phased review of a proposed alternative disposal process.

At the process demonstration test, EPA completes an audit of plant operations, an audit of the laboratory which will be routinely conducting analyses of process samples, and takes samples to verify independently the effectiveness of the process. EPA ensures that the process is operating in the manner described in the application, that the process is as effective as high temperature incineration in destroying PCBs (i.e., that the process meets the 99.9999 percent PCB destruction requirement), and that it is being operated in a manner that does not present unreasonable risks to public health or the environment. The process demonstration test is critical to EPA's evaluation of applications for approval to dispose of PCBs under TSCA. EPA will deny a permit if the applicant cannot successfully demonstrate a process.

Since EPA Headquarters began reviewing applications in March of 1983 for mobile and alternative methods of PCB destruction, EPA Headquarters has received 11 complete applications. Demonstrations have been completed by the 11 applicants, and EPA has granted permits to operate to 7 of the applicants. Four of the eleven applicants that have filed complete applications and have held demonstrations have been denied permits based on EPA's determination that the process does not meet the required level of PCB destruction, or that it presents unreasonable risks to public health or the environment. Simply put, the PCB destruction equivalency criterion and the unreasonable risk standard which govern the review of alternative disposal processes assure an objective permit review that is insulated from concerns for the applicant's financial commitments.

EPA agrees with the general premise that a proposed PCB disposal facility should not be permitted under TSCA until there has been conducted a reasoned evaluation of the health and environmental effects posed by the operation of such a facility. The Agency believes that a reasoned evaluation requires that there is sufficient information available concerning the proposed disposal process and the substances involved in the process. A particularly valuable information element is actual data on the effectiveness of the alternative process as demonstrated.

The description of the PCB permitting process set forth above (and in much greater detail in "Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans" (April 16, 1985)), underscores EPA's commitment to conducting a thorough and reasoned evaluation. Indeed, the TSCA permitting process for PCB disposal requires a great deal of information on proposed PCB disposal facilities and requires that the facilities meet standards for safety and destruction efficiency prior to EPA permitting.

B. Benefits of Existing Permitting Process

It is true that prohibiting the construction of a disposal facility before the permitting evaluation has been completed might avoid wasteful expenditures on ineffective disposal processes, and might also avoid any appearance of bias in the permitting review process. But, the Agency believes that these concerns are outweighed by the value of obtaining actual data to assess the safety and effectiveness of PCB disposal processes. Such data are particularly valuable in the case of a proposed alternative method of disposal.

The approval process for alternative disposal methods was designed to encourage new PCB disposal technologies which could be demonstrated to be as effective as incineration in their ability to destroy or remove PCBs. Incineration capacity is scarce, and the alternative technologies hold out the greatest prospects for assuring an adequate capacity for safe, yet cost-effective disposal. While EPA requires a demonstration test in the case of a proposed PCB incinerator, the reasons for requiring a demonstration are much more compelling when an alternative disposal process is proposed. Unlike an incinerator, for which the design and operation conditions required to accomplish PCB destruction are well established, the design and operation parameters for an alternative process are not always amenable to being prescribed by this Agency in advance of actual demonstration. Because of the innovative nature of these technologies, it is essential that the safety and efficacy of these processes be thoroughly demonstrated to the Agency prior to the issuance of a permit. The existing permit review process assures that the Agency can evaluate a disposal facility on the basis of actual operations on a commercial scale, rather than relying upon mere "paper proof," theoretical yields, and the like.

Moreover, it is demonstrably wrong that the mere expenditure of funds for the construction of a PCB disposal facility influences the Agency's decision to permit or not permit a facility in favor of the applicant. Rather, the efficacy of PCB destruction and the "unreasonable risk" determination are the crucial considerations in the TSCA PCB permitting decision. The PCB disposal regulations contain objective destruction criteria for evaluating the efficacy of a disposal process, and these criteria, combined with the process test demonstration, assure a thorough and unbiased evaluation. But, as a practical matter, construction of a facility is necessary under the TSCA permitting process before EPA can hold a demonstration and then make a determination whether the facility meets the regulatory requirements for disposal of PCBs.

The current permitting process allows EPA personnel to be on site at the trial demonstration, and to take samples to verify destruction effectiveness and process safety. The Agency believes that this process is the optimal mechanism for assuring that the operation of a process does not present unreasonable risks to public health or the environment.

The existing permitting process may encourage the commitment of considerable resources to the construction and demonstration of TSCA disposal facilities, but EPA believes that this review procedure best accomplishes the Agency's mandate to protect human health and the environment, without unduly impeding innovation. Moreover, the record of EPA denials of proposed disposal processes shows that the permitting process is not swayed by factors irrelevant to the regulatory standards governing approvals. For these reasons, EPA would deny any request that the Agency alter its PCB disposal permitting program to prohibit construction of a facility before an approval is issued. EPA believes that the existing permitting process represents a reasonable exercise of the discretion granted EPA by Congress to prescribe disposal methods for PCBs under TSCA section 6(e)(1)(A).

IV. Response to RCRA Petition

The VW petition seeks the issuance of a regulation under RCRA which would prohibit the construction and operation of the Henderson facility. The Agency has tentatively decided that VW's petition for rulemaking under RCRA should be denied.

RCRA hazardous waste regulations do not currently apply to the Henderson facility. EPA regulates the generation, transportation, treatment, storage, and disposal (management) of hazardous wastes under Subtitle C of RCRA. However, the management requirements apply only to substances "identified" or "listed" by regulation as hazardous wastes. (See RCRA section 3001, 42 U.S.C. 6921; 40 CFR Part 261.) Therefore, until a waste is identified or listed as hazardous in a final regulation, the management requirements of EPA's regulations do not apply. Neither the wastes coming to the Henderson facility nor any wastes generated in the PCB disposal process have been listed as hazardous or exhibit a characteristic of hazardous waste (i.e., ignitability, corrosivity, reactivity, or extraction procedure (EP) toxicity), based upon the tests performed by Union Carbide and other information available to EPA.

Petitioners have requested that EPA promulgate RCRA regulations covering the Henderson facility, arguing that there is insufficient information to determine the health and environmental risks from the facility. The petition does not provide any information on the risks of managing the wastes at the Henderson facility.

Under RCRA section 1004(5) (42 U.S.C. 6903(5)), a hazardous waste means a solid waste which because of its quantity, concentration, or physical, chemical, or infectious characteristics may: (1) Cause or significantly contribute to serious irreversible illness or an increase in mortality, or (2) pose a substantial present or potential hazard to health or the environment when improperly managed. To identify or list such hazardous wastes and thereby subject their management to RCRA standards, EPA must possess or obtain information on the hazardous nature of the substances or evidence of substantial risk if mismanaged. The Agency generally conducts an industry-wide study to identify the different wastes which are generated, how they are managed, and the potentially hazardous constituents in these wastes. The Agency then gathers and evaluates any toxicity data available on the wastes and their hazardous constituents.

EPA must make a decision to list or not list a waste based upon its consideration of several factors set forth in the RCRA regulations (40 CFR 261.11(a)(3)). These factors include the nature of the toxicity, the concentration of the toxic constituent, the potential for degradation into non-harmful constituents, the degree of bioaccumulation in ecosystems, the persistence of the toxic constituent (or degradation product), the potential for the toxic constituent or degradation product to migrate into the environment, and the plausible types of improper management to which the waste could be subjected. Should this analysis suggest that listing is appropriate, the listing must be accomplished through rulemaking proceedings which require the publishing of the proposed listing rule, the opportunity for public comment on the proposed rule, the consideration of comments received on the proposed rule, and the promulgation of a final listing rule.

EPA has information on both PCBs and TF-1 (and its constituents) and intends to propose listing wastes containing PCBs as hazardous wastes. After opportunity for comment and consideration of any comments, EPA may promulgate the rule listing wastes containing PCBs as hazardous wastes. The Agency, in fact, tentatively decided to propose this listing before the VW petition was received. (The primary reason for deciding to regulate wastes containing PCBs under RCRA was a desire to regulate all hazardous wastes under the RCRA program, but not any concern that these wastes were not being properly managed under TSCA regulations.) Also, EPA is now investigating several of the constituents of TF-1 to determine their toxicity and whether they should also be listed.

If EPA lists wastes containing PCBs as RCRA hazardous wastes (as intended), the Henderson facility probably will be brought under RCRA jurisdiction at that time. Whether the Henderson facility will be regulated under RCRA depends on whether the PCR waste listing covers the wastes processed at the facility. Based on EPA's very tentative plans, the PCB waste listing regulation would include the wastes managed by the Henderson facility. However, RCRA requirements will not apply to the facility until the Agency lists PCBs as a hazardous waste. Since listing of PCBs has not yet occurred, EPA cannot now speculate as to which particular management standards will apply to the activities at the Henderson facility.

Because the Henderson facility is not now subject to RCRA jurisdiction, neither RCRA nor the RCRA regulations prohibit construction or operation. EPA could ban operation by regulation in response to this petition only if EPA found that wastes containing PCB or constitutents of TF-1 were currently within RCRA jurisdiction.

While RCRA and the RCRA regulations require a permit before construction may commence, this restriction applies only to waste management facilities that are constructed after a final listing regulation has been issued for wastes being managed at the facility (RCRA section 3005(a), 42 U.S.C. 6925(a); see also 40 CFR 270.10(f)). Should the Henderson facility ultimately receive a TSCA section 6(e) approval to dispose of PCBs, it would likely be constructed and operating by the time the Agency lists wastes containing PCBs as hazardous wastes under RCRA. Thus, the construction or operation of the Henderson facility would not be banned by this provision of RCRA. Rather, at such time as listing occurs, the Henderson plant would likely be subject to RCRA management standards necessary to protect human health and the environment for existing facilities (i.e., the "interim status" management standards) (see 40 CFR Part 265). To continue operation, the facility would later be required to obtain a final RCRA permit. Such a permit may require compliance with management standards more stringent than interim status standards (see 40 CFR Part 264).

For the above reasons, the Agency has tentatively decided to deny Valley Watch's RCRA petition seeking the issuance of a RCRA regulation.

EPA requests comment on all aspects of this tentative decision under RCRA. (Note, however, that the decisions to deny the TSCA section 21 petitions are final Agency decisions). After consideration of comments on its tentative RCRA decision, EPA will make a final decision, and will issue it for publication in the Federal Register.

V. Official Record for the Petition

The following documents constitute the record for this action:

1. Citizen's for Healthy Progress Petition to the Environmental Protection Agency, dated November 15, 1985.
2. Valley Watch Petition to the Environmental Protection Agency, dated December 2, 1985.
3. USEPA, "Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans," dated April 16, 1985.
4. Union Carbide Corporation, Public Information Copy of Permit Application for PCB Destruction Unit, dated November 21, 1984 (document available at OPTS Document Control Office, Room E-107, Environmental Protection Agency, 401 M Street SW., Washington, DC).
5. Union Carbide, Permit for PCB Destruction (complete application), dated November 21, 1984 (confidential business information contained in this document not available for public viewing, but document filed for record at OPTS Document Control Office, Room E-201, Environmental Protection Agency, 401 M Street SW., Washington, DC).
6. Official rulemaking record from "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions Rule" published in the Federal Register of May 31, 1979 (44 FR 31514).
7. Official rulemaking record from "Polychlorinated Biphenyls (PCBs): Disposal and Making Final Regulation" published in the Federal Register on February 17, 1978 (43 FR 7150).
8. USEPA, Polychlorinated Biphenyls (PCBs); Procedural Amendment of the Approval Authority for PCB Disposal Facilities and Guidance for Obtaining Approval (48 FR 13181, March 30, 1983).
9. USEPA, document dated January 8, 1986, summarizing data reflecting number of firms applying the PCB disposal approvals, number of firms conducting demonstrations, and number of firms granted approvals.

APPENDIX 2. NIOSH RECOMMENDATIONS FOR PCB STANDARDS

I. RECOMMENDATIONS FOR A POLYCHLORINATED BIPHENYLS (PCBs) STANDARD

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to polychlorinated biphenyls (PCBs) in the workplace be controlled by adherence to the following sections. The standard is designed to protect the health and provide for the safety of employees for up to a 10-hour workday, 40-hour workweek, over a normal working lifetime. The standard is measurable by techniques that are valid, reproducible, and available to industry and governmental agencies. Compliance with the standard should substantially reduce any risk of reproductive or tumorigenic effects of PCBs and prevent other adverse effects of exposure in the workplace. Employees should regard the recommended workplace environmental limit as the upper boundary for exposure and make every effort to keep exposure as low as possible.

Evidence indicates adverse reproductive and tumorigenic effects in experimental animals exposed to certain commercial PCB preparations. Currently available information is not adequate to demonstrate that other commercial PCB preparations do not have these effects. Should sufficient information become available to indicate that the standard offers greater or lesser protection from some chlorobiphenyl isomers or commercial preparations than is needed, it will be considered for revision.

The Toxic Substances Control Act of 1976 (Public Law 94-469) required the US Environmental Protection Agency (EPA) to prescribe marking and disposal regulations for PCBs by July 1, 1977 (Federal Register 42:26563-77, May 24, 1977). By this Act, the manufacture, processing, distribution in commerce, or use of PCBs in any but totally enclosed systems is to be banned, effective 1 year after the date of its enactment, October 11, 1976. Two years after the enactment date PCB manufacture is to be banned, and processing and distribution in commerce are to be banned 2.5 years from that date. However, the Act allows the Administrator of EPA to rule otherwise if he finds that manufacture, processing, distribution in commerce, or use in other than totally enclosed systems will not present an unreasonable risk of injury to health or to the environment. The Act does not affect use of equipment already containing PCBs in totally enclosed systems, so that a potential for occupational exposure to PCBs will continue to exist for many years as a consequence of their transportation, installation, use, and disposal. The part of the Act specific for PCBs is presented in Figure I-1.

"PCBs" are defined for this recommended standard as commercial preparations of chlorinated biphenyl compounds, including those preparations which may be described as single isomers or classes of isomers, such as Decachlorodiphenyl. Biphenyl and its monochlorinated derivatives occurring in commercial preparations of PCBs shall be measured along with the polychlorinated derivatives, and shall be treated in this standard as the polychlorinated components of the preparations. "Occupational exposure to PCBs," is defined as working with PCBs or with equipment containing PCBs that can become airborne or that can spill or splash on the skin or into the eyes, or the handling of any solid products that may result in exposure to PCBs by skin contact or by inhalation. The term "PCB work area" is defined as an area where there is occupational exposure to PCBs. In areas where no occupational exposure to PCBs occurs, but where PCBs are present in equipment in the workplace, adherence is required only to Section 8(a).

Section 1 - Environmental (Workplace Air)

(a) Concentration

Occupational exposure to polychlorinated biphenyls (PCBs) shall be controlled so that no worker is exposed to PCBs at a concentration greater than 1.0 microgram total PCBs per cubic meter of air (1.0 µg/cu m), determined as a time-weighted average (TWA) concentration, for up to a 10-hour workday, 40-hour workweek.

(b) Sampling and Analysis

The recommended TWA occupational exposure limit for PCBs has been determined to be the lowest reliably detectable limit by the sampling and analytical methods recommended in this document. Environmental samples shall be collected and analyzed as described in Appendices I and II, or by any methods shown to be at least equivalent in accuracy, precision, and sensitivity to the methods specified.

Section 2 - Medical

Medical surveillance shall be made available to all employees subject to occupational exposure to PCBs.

(a) Preplacement or initial medical examinations for workers shall include:

(1) Comprehensive medical and work histories with special emphasis on hepatic function, skin condition, and reproductive history.

(2) Comprehensive physical examination with particular attention to the skin and to hepatic function including determinations of serum glutamic-oxaloacetic transaminase (SGOT) and serum glutamic-pyruvic transaminase (SGPT) activities. The responsible physician may also wish to obtain measurements of serum triglyceride concentrations or of other indices of fat metabolism.

(3) A judgment of the employee's ability to use positive pressure respirators.

(b) During examinations, applicants or employees having medical conditions that could be directly or indirectly aggravated by exposure to polychlorinated biphenyls or formulations containing polychlorinated biphenyls shall be counseled on the increased risk of impairment of their health that might result from working with these substances.

(c) Women in the work force who are of child-bearing age shall be advised of the potential adverse effects of PCBs on the unborn child. Those who bear children while working with PCBs shall be counseled concerning the advisability of nursing their babies.

(d) Initial medical examinations shall be made available to all workers as soon as practicable after promulgation of a standard based on these recommendations.

(e) Periodic examinations shall be made available at least annually and include: (1) interim medical and work histories, and (2) physical examinations as outlined in paragraphs (a)(1) and (a)(2) of this section.

(f) If evidence of adverse effects of exposure to PCBs is suspected or confirmed, appropriate medical care shall be made available to the affected worker(s).

(g) Pertinent medical records shall be maintained for all employees exposed to PCBs in the workplace. Such medical records shall be maintained for the period of employment plus 30 years. These records shall be made available to the designated medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, of the employer, and of the employee or former employee.

Section 3 - Labeling and Posting

All labels and warning signs shall be printed both in English and in the predominant language of non-English-reading workers. Illiterate workers and workers reading languages other than those used on labels and posted signs shall be otherwise informed regarding hazardous areas and shall be informed of the instructions printed on labels and signs.

(a) Labeling

The following warning label shall be affixed in a readily visible location on PCB-processing or other equipment, and on PCB-storage tanks or containers:

POLYCHLORINATED BIPHENYLS
(PCBs)

DANGER! CONTAINS POLYCHLORINATED BIPHENYLS
CANCER SUSPECT AGENT

Use only with adequate ventilation.
Do not get in eyes, or on skin or clothing.

First Aid: In case of skin or eye contact, flush with running water.

(b) Posting

Warning placards shall be affixed in readily visible locations in or near PCB work areas. The information contained thereon shall be arranged as in the following example.

POLYCHLORINATED BIPHENYLS
(PCBs)

DANGER!

CANCER SUSPECT AGENT

AUTHORIZED PERSONNEL ONLY

Do not enter unless area is adequately ventilated.
Do not get in eyes, or on skin or clothing.

First Aid: In case of skin or eye contact, flush with running water.

Section 4 - Personal Protective Equipment and Clothing

(a) Protective Clothing

In any operation where workers may come into direct contact with PCBs, protective clothing impervious to PCBs shall be worn. Gloves, boots, overshoes, and bib-type aprons that cover boot tops shall be provided when necessary. Protective apparel shall be made of materials which most effectively prevent skin contact with PCBs where it is most likely to occur. Employers shall ensure that all personal protective clothing is inspected regularly for defects and that it is in a clean and satisfactory condition.

(b) Eye Protection

Chemical safety goggles, face shields (8-inch minimum) with goggles, or safety glasses with side shields shall be provided by employers and shall be worn during any operation in which PCBs are present. If liquid or solid PCBs contact the eyes, the eyes shall be irrigated immediately with large quantities of water and then examined by a physician or other responsible medical personnel. (A drop of vegetable oil on the eye has been found to reduce the resultant irritation.) Eye protection shall be in accordance with 29 CFR 1910.133 and ANSI Z 87.1-1968.

(c) Respiratory Protection

(1) Engineering controls shall be used when needed to keep concentrations of airborne PCBs at or below the recommended TWA occupational exposure limit. The only conditions under which compliance with the permissible exposure limit may be achieved by the use of respirators are:

(A) During the time necessary to install or test the required engineering controls.

(B) For nonroutine maintenance or repair activities.

(C) During emergencies when concentrations of airborne PCBs may exceed the permissible limit.

(2) When the use of respirators is permitted by paragraph c(1) of this section, respirators shall be selected and used in accordance with the following requirements:

(A) The employer shall establish and enforce a respiratory protection program meeting the requirements of 29 CFR 1910.134.

(B) The employer shall provide respirators in accordance with Table I-1 and shall ensure that employees properly use the respirators provided. The respirators shall be those approved by NIOSH or the Mining Enforcement and Safety Administration. The standard for approval is specified in 30 CFR 11. The employer shall ensure that respirators are properly cleaned, maintained, and stored when not in use.

TABLE I-1

RESPIRATOR SELECTION GUIDE

Concentration of PCBs	Respirator Type Approved under Provisions of 30 CFR 11
Greater than 1.0 µg/cu m or Emergency (entry into area of unknown concentration)	(1) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. (2) Combination Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

Section 5 - Informing Employees of Hazards from PCBs

(a) All new and present employees in any area in which PCBs are used shall be informed of the hazards, relevant symptoms, and effects of overexposure to PCBs, and the precautions to be observed for safe use and handling of these materials.

(b) All employees involved with the manufacture, use, transport, or storage of PCBs shall be informed that PCBs have been found to induce tumors in experimental animals after repeated oral ingestion and that because of these findings it is concluded that PCBs are potential human carcinogens; employees shall also be informed that adverse reproductive effects may result from occupational exposure to PCBs.

(c) The employer shall institute a continuing education program, conducted by instructors qualified by experience or training, to ensure that all employees occupationally exposed to PCBs have current knowledge of job hazards, proper maintenance and cleanup methods, and proper use of protective clothing and equipment, including respirators. The instructions shall include a general description of the medical surveillance program and of the advantages to the employee of participation. Special attention shall be given to women in the workplace. They shall be made aware of the potential adverse effects of PCBs on the unborn child, and of the known transport of PCBs to breast milk. Elements of the program shall also include:

Emergency procedures and drills;
Instruction in handling spills and leaks;
Decontamination procedures;
Firefighting equipment location and use;
First-aid procedures, equipment location, and use;
Rescue procedures;
Confined space entry procedures;
Low warning (odor) properties of PCBs.

(d) The information explaining the hazards of working with PCBs shall be kept on file and be readily accessible to workers at all places of employment where PCBs are manufactured, used, stored, or transported. Required information shall be recorded on the "Material Safety Data Sheet" shown in Appendix III, or similar form approved by the Occupational Safety and Health Administration, US Department of Labor.

Section 6 - Work Practices and Engineering Controls

(a) Regulated Areas

Access to PCB work areas shall be regulated and limited to authorized persons. A daily roster shall be kept of persons entering such areas.

(b) Handling of PCBs and General Work Practices

(1) Operating instructions shall be formulated and posted where PCBs are handled or used.

(2) Transportation and use of PCBs shall comply with all applicable local, state, and federal regulations.

(3) PCBs shall be stored in tightly closed containers in well-ventilated areas.

(4) When PCB storage containers are being moved, or when they are not in use and are disconnected, valve protection covers shall be in place. Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.

(5) Storage facilities shall be designed to contain spills completely within surrounding dikes and to prevent contamination of workroom air.

(6) Ventilation switches and emergency respiratory equipment shall be located outside storage areas in readily accessible locations which will remain minimally contaminated with PCBs in an emergency.

(7) Process valves and pumps shall be readily accessible and shall not be located in pits or congested areas.

(8) Containers and systems shall be handled and opened with care. Approved protective clothing as specified in Section 4 shall be worn

by employees engaged in opening, connecting, and disconnecting PCB containers and systems. Adequate ventilation shall be provided to minimize exposures of such employees to airborne PCBs.

(9) PCB-operating and storage equipment and systems shall be inspected daily for signs of leaks. All equipment, including valves, fittings, and connections shall be checked for leaks immediately after PCBs are introduced therein.

(10) When a leak is found, it shall be repaired or otherwise corrected immediately. Work shall resume normally only after necessary repair or replacement has been completed, the area has been ventilated, and the concentration of PCBs has been determined by monitoring to be at or below the recommended TWA concentration limit.

(c) Control of Airborne PCBs

(1) Suitable engineering controls, designed to maintain exposure to airborne PCBs at or below the limit prescribed in Section 1(a), shall be used. Complete enclosure of processes is the recommended method for control of PCB exposure. Local exhaust ventilation may also be effective, used alone or in combination with process enclosure. When a local exhaust ventilation system is used, it shall be so designed and operated as to prevent accumulation or recirculation of airborne PCBs in the workplace environment and to effectively remove PCBs from the breathing zones of employees. Exhaust ventilation systems discharging to outside air must conform to applicable local, state, and federal regulations and must not constitute a hazard to employees or to the general population. Before maintenance work on control equipment begins, the generation of airborne PCBs shall be eliminated to the extent feasible.

Enclosures, exhaust hoods, and ductwork shall be kept in good repair so that designed airflows are maintained. Airflow at each hood shall be measured at least semiannually and preferably monthly. Continuous airflow indicators are recommended, such as water or oil manometers properly mounted at the juncture of fume hood and duct throat (marked to indicate acceptable airflow). A log shall be kept showing design airflow and the results of semiannual airflow measurements.

(2) Forced-draft ventilation systems shall be equipped with remote manual controls and shall be designed to shut off automatically in the event of a fire in the PCB work area.

(d) Special Work Areas

(1) PCB Hazard Areas

A hazard area shall be considered as any space having physical characteristics and containing sources of PCBs, such as transformers, that could result in PCB concentrations in excess of the recommended airborne PCB exposure limit. Exits shall be plainly marked, conveniently located, and open outwardly into areas which will remain minimally contaminated in an emergency.

(2) Confined or Enclosed Spaces

Entry into confined or enclosed spaces, such as tanks, pits, process vessels, and tank cars where there is limited egress, shall be controlled by a permit system. Permits shall be signed by an authorized representative of the employer and shall certify that appropriate measures have been taken to prevent adverse effects on the worker's health as a result of his or her entry into such space.

Confined or enclosed spaces which have contained PCBs shall be thoroughly ventilated to assure an adequate supply of oxygen, tested for PCBs and other contaminants, and inspected for compliance with these requirements prior to each entry. Adequate ventilation shall be maintained while workers are in such spaces. Leakage of PCBs into such confined or enclosed spaces while work is in progress shall be prevented by disconnecting and blanking the PCB supply lines. Each individual entering such confined or enclosed space shall be furnished with appropriate personal protective equipment and clothing and be connected by a lifeline harness to a standby worker stationed outside of the space. The standby worker shall also be equipped for entry with approved personal protective equipment and clothing and have contact with a third person. The standby person shall maintain communication (visual, voice, signal line, telephone, radio, or other suitable means) with the employee inside the confined or enclosed space.

(e) Emergency Procedures

For all PCB work areas where there is a potential for the occurrence of emergencies, employers shall take all necessary steps to ensure that employees are instructed in, and follow, the procedures specified below as well as any others appropriate to the specific operation or process.

(1) If PCBs leak or are spilled, the following steps shall be taken:

(A) All nonessential personnel shall be evacuated from the leak or spill area.

(B) The area of the leak of spill shall be adequately ventilated to prevent the accumulation of vapors.

(C) If the PCBs are in liquid form, they shall be collected for reclamation or sorbed in vermiculite, dry sand, earth, or similar nonreactive material.

(2) Personnel entering the spill or leak area shall be furnished with appropriate personal protective equipment and clothing. All other personnel shall be prohibited from entering the area.

(3) Only personnel trained in the emergency procedures and protected against the attendant hazards shall shut off sources of PCBs, clean up spills, control and repair leaks, and fight fires, in areas where PCBs are used.

(4) All wastes and residues containing PCBs shall be collected in PCB-resistant containers and appropriately disposed of (Federal Register 42:26563-77, May 24, 1977).

(5) Safety showers, eyewash fountains, and washroom facilities shall be provided, maintained in working condition, and located so as to be readily accessible to workers in all areas where the occurrence of skin or eye contact with PCBs is likely. If liquid or solid PCBs are splashed or spilled on an employee, contaminated clothing shall be removed promptly and the skin washed thoroughly with soap and water for at least 15 minutes. Eyes shall be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A drop of vegetable oil may be applied to the eye to relieve the irritating effect of PCBs.

Section 7 - Sanitation Practices

(a) Employees occupationally exposed to PCBs shall be provided with separate lockers or other storage facilities for street clothes and for work clothes.

(b) Employees occupationally exposed to PCBs shall not wear work clothing away from their place of employment.

(c) Employees occupationally exposed to PCBs shall be provided clean work clothing daily, and cleaning establishments shall be informed as to the hazards of handling PCBs and proper disposal procedures for PCB-contaminated waste water.

(d) Facilities for shower baths shall be provided for employees occupationally exposed to PCBs. Workers should shower before changing into street clothes.

(e) Employees exposed to PCBs shall be advised to wash their hands and exposed skin before eating, drinking, smoking or using toilet facilities during the work shift.

(f) Food, drink, or smoking materials shall not be permitted in areas where PCBs are handled, processed, or stored.

Section 8 - Monitoring and Recordkeeping Requirements

(a) Monitoring

(1) As soon as practicable after the promulgation of a standard based on these recommendations, each employer who manufactures, processes, handles, stores or otherwise uses PCBs shall determine by an industrial hygiene survey whether occupational exposure to PCBs may occur. Surveys shall be repeated at least once every year and within 30 days of any process change likely to result in occupational exposure to PCBs. Records of these surveys, including the basis for any conclusion that there

may be no occupational exposure to PCBs, shall be retained until the next survey has been completed.

(2) If occupational exposure to PCBs is determined to be possible, a program of personal monitoring shall be instituted to measure or permit calculation of the exposures of all employees.

(A) In all personal monitoring, samples representative of the employees' breathing zones shall be collected.

(B) For each TWA concentration determination, a sufficient number of samples shall be taken to characterize each employee's exposure during each work shift. Variations in work and production schedules and in employees' locations and job functions shall be considered in choosing sampling times, locations, and frequencies.

(C) Each operation in each work area shall be sampled at least once every 3 months.

(3) If an employee is found to be exposed to PCBs in excess of the recommended TWA concentration limit, control measures shall be initiated, the employee shall be notified of the exposure and of the control measures being implemented to correct the situation, and the employee shall be monitored every 30 days. Such monitoring shall continue until two such consecutive determinations indicate that the employee's exposure no longer exceeds the recommended TWA concentration limit. Routine monitoring may then be resumed.

(b) Recordkeeping

Environmental monitoring records shall be maintained for at least 30 years after the employee's last occupational exposure to PCBs. These records shall include the dates and times of measurements, job function and location of employees within the worksite, methods of sampling and analysis used, types of respiratory protection in use at the time of sampling, TWA concentrations found, and identification of exposed employees. Each employee shall be able to obtain information on his or her own environmental exposures. Daily rosters of authorized persons who enter regulated areas shall be retained for 30 years. Environmental monitoring records and entry rosters shall be made available to designated representatives of the Secretary of Labor and of the Secretary of Health, Education, and Welfare.

Pertinent medical records for each employee shall be retained for 30 years after the employee's last occupational exposure to PCBs. Records of environmental exposures applicable to an employee should be included in that employee's medical records. These medical records shall be made available to the designated medical representatives of the Secretary of Labor, of the Secretary of Health, Education, and Welfare, of the employer, and of the employee or former employee.

APPENDIX 3. EPA GENERAL PERMIT CONDITIONS
HCBZA CONDITIONAL USE PERMIT

APPENDIX 3. EPA GENERAL PERMIT CONDITIONS

The following items are typical conditions of approval included in alternate PCBs disposal permits issued by OTS:

1. <u>Advance Notification</u>: A non-confidential written notice, to be received by the addressee no less than thirty days, and no more than one hundred eighty days, prior to the conduct of a permitted PCB disposal activity, shall be provided to: the appropriate EPA Regional PCB Coordinator, the appropriate State Agency, and appropriate local town/city/county government official(s). The content of the notice shall be at a minimum:

(1) The nature of the PCB disposal activity.

(2) The exact location(s), such as street address of a facility (or, if there is no street address, plant site location with a telephone contact such that exact location(s) may be determined by telephone inquiry).

(3) The exact time(s) and date(s) the treatment will take place. When changes in these time(s) and date(s) are expected, these changes must be made immediately by telephone to the appropriate officals (as indicated above) and followed by written notification of the changes such that the revised times shall still be at least thirty days following receipt of the written notification.

2. <u>Other Permits/Approvals</u>: Permittee must obtain all necessary environmental approvals and/or permits from the appropriate Federal, State and local agencies prior to the treatment of PCBs at any site.

3. <u>Limitation of Treatment Matrix</u>: System will be permitted to treat only the type of material successfully demonstrated to EPA.

4. <u>Limitation of Matrix PCB Concentration</u>: PCB concentration of the fluid mixture in the process is limited to the highest levels successfully treated during the process demonstration:

Prior to treatment, samples of the treatment matrix (feedstock) must be obtained and analyzed by the Permittee using gas chromatography procedures specified in EPA approved procedures outlined in the following documents:

"Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans", EPA Contract No. 68-02-3938, April 16, 1985;

"Recommended Analytical Requirements for PCB Data Generated on Site During Non-Thermal PCB Destruction Tests", USEPA, December 12, 1985 (Draft);

"Quality Assurance and Quality Control Procedures for Demonstrating PCB Destruction in Filing for PCB Disposal Permit", USEPA, June 28, 1983 (Draft); and

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans:, QAMS-005/80, Office of Research and Development, USEPA, December 29, 1980.

5. Quality Control: A sample of treated material must be drawn, and analyzed in duplicate by gas chromatography for the concentration of PCBs after the treatment at the site where the PCB disposal process is being used. If the concentration of PCBs in the treated sample is 2 ppm or greater the treated material must be reprocessed and reanalyzed to show less than 2 ppm per peak before the next batch is treated.

6. Processing Time Limitation: If the quality control testing, as described in Condition (5), reveals that the PCBs have not been adequately removed after repeated processing (not to exceed three times the estimated theoretical time necessary for complete reaction), the affected unit shall cease operation. The facility operator must notify the PCB Disposal Site Coordinator in the appropriate EPA region immediately and file a written report with that region within seven (7) days. The affected unit shall not resume operation until the problem has been corrected to the satisfaction of the appropriate EPA region.

7. Operations Log/Recordkeeping: Provisions must be made to assure that the following process elements are suitable monitored and recorded for each batch processed, such that materials harmful to health or the environment are not inadvertently released:

a. name, address, and telephone number of the disposal unit operator and supervisor;

b. the name and business address of the person or firm whose PCB-containing material is being processed:

c. the location, manufacturer, rated capacity and identification (serial) number of the transformer, heat transfer system or hydraulic system, as appropriate;

d. the date the PCB materials are received by Permittee, the date(s) processed, and the date returned to the custody of the owner (if applicable);

e. estimated quantity and quality of feed material charged into the reactor;

f. estimated quantity and quality of treated materials and wastes produced;

g. date, time and duration of treatment per batch or system;

h. a copy of the gas chromatograph and/or other records from tests conducted to determine the final concentration of the treated material;

i. estimated quantity and quality of wastes produced, the method of disposal and location of the disposal facility for each waste should be documented; and

j. temperature of reaction in at least one-half hour intervals.

Disposal recordkeeping documents must be compiled within 60 days of the testing date, must be kept at one centralized location, and must be made available for inspection by authorized representatives of the EPA. Such documents shall be maintained for at least five years. Permittee must also maintain the records required by 40 CFR 761.180(f). If Permittee or its authorized agents terminate business, these records or their copies must be submitted to the Director of the Office of Toxic Substances.

In addition, Permittee must maintain, aboard the mobile unit, a record of the PCB disposal services performed by the unit during the previous month. These records must be available for inspection by authorized representatives of EPA.

8. PCB Releases: In the event Permittee or an authorized facility operator of the disposal facility/mobile unit believes, or has reason to believe, that a release has or might have occurred, the facility operator must inform the appropriate EPA region by telephone immediately.

A written report describing the incident must be submitted by the close of business on the next regular business day following the incident. No PCBs may be processed in that facility until the release problem has been corrected to the satisfaction of the appropriate EPA region.

9. PCB Spills: Any spills of PCBs or other fluids shall be promptly controlled and cleaned up as provided in the Permittee's spill prevention plan, and in accordance with the PCB spill cleanup procedures of the appropriate EPA region. In addition, a written report describing the spill, operations involved, cleanup actions and changes in operation to prevent such spills in the future must be submitted to the appropriate EPA region within seven (7) business days.

PCB spills must be reported in accordance with the PCB spill reporting requirements prescribed under §311 of the Clean Water Act for discharges to navigable waters and under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) for discharges to other media.

10. Safety and Health: Permittee must take all necessary precautionary measures to unsure that operation of the disposal facility/mobile unit(s) is in compliance with the applicable safety and health standards, as required by Federal, State and local regulations and ordinances.

11. Facility Security: The disposal facility/mobile unit shall be secured (e.g., fence, alarm system, etc.) at each commercial site to restrict public access to the area. Any bodily injury occurring as a result of the PCB disposal process must be reported to the PCB Disposal Site Coordinator in the appropriate EPA region by the next regular business day.

12. Reporting of PCB Incidents: Any reports required by Conditions (6), (8), (9), and (11) are to be submitted by telephone to the appropriate regional PCB Disposal Site Coordinator within the time frame specified. In addition, Permittee shall file written reports with the Regional Administrator of the appropriate EPA region, and the Director of the Office of Toxic Substances within the time frame specified in the aforementioned conditions.

13. Personnel Training: Permittee shall be responsible for ensuring that personnel directly involved with the handling or disposal of PCB-contaminated fluid using the disposal process are demonstrably familiar with the general requirements of this approval. At a minimum, this must include:

a. the type of materials which may be treated using the PCB disposal process, and the upper limit of PCB contamination which may be treated;

b. basic recordkeeping requirements under this approval and the location of records;

c. notification requirements;

d. waste disposal requirements for process and by-product wastes generated during the operation of the PCB disposal process; and

e. reporting requirements.

In this regard, Permittee must maintain on-site during the operation of its mobile unit a copy of this approval; the spill prevention and cleanup plan; and sampling and analytical procedures used to determine PCB concentrations in untreated and treated materials.

14. PCB Transport Limitation: Untreated PCB fluids may not be transported off-site on the disposal facility/mobile unit. Process equipment (i.e., reactors, pump's hoses, etc.) on the mobile unit must be decontaminated in accordance with procedures described in Permittee's permit application and test plan, prior to transporting off-site. PCB-contaminated equipment must be transported in accordance with 40 CFR Section 761.40 and the U.S. Department of Transportation (USDOT) requirements of Title 49, CFR part 172, including placarding the mobile facility and labelling all PCBs.

15. Process and Pollution Control Maintenance and Inspection: Procedures must be followed in accordance with information provided in permit application/demonstration plan, including periodic replacement of pollution abatement parts (e.g. filters).

16. PCB Waste Disposal Requirements: All wastes generated by the PCB disposal process other than the successfully cleaned material, (i.e., filter media, sludges, water or other effluents, etc.) must be disposed of as if it contains the original PCB feedstock concentration. EPA will consider amending this condition only after such waste has been fully characterized to determime all components, and gas chromatography analysis of the waste demonstrates that the PCB concentration is below 2 ppm.

17. Financial Assurance: Permittee shall incorporate financial assurance of closure and liability coverage provisions into its closure plan. These provisions must be equivalent to those specified in 40 CFR Part 264, Subpart H of the Resource Conservation and Recovery Act (RCRA), and provide funds for:

a. proper closure of the PCB disposal units, and

b. compensating others for bodily injury and property damage caused by accidents arising from operations of the mobile disposal units.

18. Notification Requirements for Duplicate Units: Permittee must file a written pre-operation report with the Director of the Office of Toxic Substances within thirty (30) days from the date of manufacture of each additional PCB disposal facility/mobile unit which is to be operated in the United States. This report shall contain the following information:

a. date of manufacture of the unit;

b. identification and/or serial number of the new facility/unit;

c. certification by an independent, registered professional engineer to the effect that the facility/unit is substantially identical to the original unit in terms of engineering design, hardware, process capacity, quality and workmanship;

d. certification by the Permittee (chief executive officer signifying that the PCB disposal facility/unit construction has been completed in such manner; and

e. a list of all substantive and nonsubstantive changes made to the design and construction of any new disposal facility/ unit which is not identical to the original unit.

19. Notice of Modifications: No major modifications may be made to the unit design, as described in the application and demonstration plan for this approval, without written approval of the Director of the Office of Toxic Substances. For the purpose of this approval, "major modification" shall be defined as any change to capacity, design, efficiency, waste type, or any other changes affecting overall performance or environmental impact.

20. PCB Regulations Requirements: Permittee shall comply with all applicable requirements of the Federal PCB Regulation, 40 CFR Part 761, in the operation of the mobile PCB disposal unit(s). Particular note shall be given to:

a. 40 CFR, section 761.65 - storage for disposal;

b. 40 CFR, section 761.79 - decontamination; and

c. 40 CFR, section 761.180 - records and monitoring.

21. Permit Severabilty: The conditions of this approval are severable, and if any provision of this approval or any application of any provision is held invalid, the remainder of this approval shall not be affected thereby.

22. Permit Expiration/Renewal: Approvals are effective for 3-year period. For a renewal approval, EPA may require additional information and/or testing of the PCB disposal process. In order to continue the effectiveness of as approval pending EPA action on reissuance, the Permittee must submit a renewal request letter to EPA at least 90 days, but not more than 180 days, prior to the expiration date of this approval.

23. Annual Quality Control Monitoring: (for an alternate thermal destruction operation) Permittee shall conduct annual monitoring of the facility for PCBs and HCl destruction and removal efficiencies, and mass emission rates for particulates, 2,3,7,8-TCDD, and 2,3,7,8-TCDF and total polychlorinated dibenzodioxin and total polychlorinated dibenzofurans. If limits specified in the conditions of approval are not complied with, U.S. EPA must be notified within one day of receipt of the test report, and Permittee shall cease commercial incineration of PCBs. Otherwise test results shall be incorporated into the annual report. If no disposal operations were conducted during the year of an anniverary of this permit, the first disposal operation in the following year after the anniversary shall be monitored as required under this condition.

BEFORE THE
HENDERSON COUNTY BOARD OF ZONING ADJUSTMENT

IN RE: THE MATTER OF THE
APPLICATION OF THE HENDERSON COUNTY
RIVERPORT AUTHORITY AND UNISON TRANSFORMER
SERVICE, INC. FOR A CONDITIONAL USE PERMIT
APPEAL NO. 146

FINDINGS OF FACT, CONCLUSIONS AND CONDITIONAL USE PERMIT

****

This cause came before the Henderson County Board of Zoning Adjustment on the application of the Henderson County Riverport Authority and Unison Transformer Service, Inc. for a conditional use permit in accordance with Article XXII, Section 22.03 of the Code of Zoning Ordinances of Henderson County, Kentucky and Chapter 100 of the Kentucky Revised Statutes to store oil above ground in excess of 500 gallons; and

The Board of Zoning Adjustment having considered the application, conducted an evidentiary hearing thereon and being otherwise fully and sufficiently advised does find and conclude as follows:

The Board of Zoning Adjustment FINDS:

1. The applicants are the Henderson County Riverport Authority, a unit of government of the County of Henderson, Commonwealth of Kentucky and Unison Transformer Service, Inc., a New York corporation wholly owned by the Union Carbide Corporation,

2. The conditional use permit is sought for a tract of land said to contain 15 acres in Henderson County, Kentucky owned by the Henderson County

Riverport Authority located on a public road designated as the Riverport Access Road.

3. The applicant, Unison Transformer Service, Inc., has an option to purchase the subject property from the Henderson County Riverport Authority and intends to do so if a conditional use permit is granted.

4. The Henderson County Riverport Authority will not operate the premises, but instead intends to sell the subject property to Unison Transformer Service, Inc.

5. Unison Transformer Service, Inc. proposes to build a plant on the subject property to engage in an enterprise which involves the removal of liquid substances from electrical transformers which contain (among other things) a chemical compound known as polychlorinated biphenols, (PCBs).

6. The Congress of the United States of America has determined that PCBs are injurious to the public health and welfare and has directed that they should be removed from the environment.

7. PCB laden materials and substances will be transported to and from the subject property by truck.

8. Unison Transformer Service, Inc. will contract with the transporters of the material and substances containing PCBs.

9. The PCB laden materials and substances exceeding 500 gallons will be stored upon the subject property in heavy duty metal drums and tanks.

10. The handling of the PCB laden materials and substances will, except for their transport to and from the plant site, take place at the plant site.

11. The proposed use of the subject property under the conditions herein imposed will not emit detrimental, obnoxious or objectionable conditions

beyond the confines of the subject property. However, unless the conditions herein imposed are strictly performed, complied with and adhered to by Union Carbide Corporation and Unison Transformer Service, Inc. there exists the potential for harm to the public health, safety and welfare which will emit beyond the confines of the subject property. For that reason the conditions herein stated should be strictly performed, complied with and adhered to by Union Carbide Corporation and Unison Transformer Service, Inc..

The Board of Zoning Adjustment CONCLUDES:

1. The subject property for which the conditional use permit is sought is presently zoned M-2, a heavy industrial district. The uses for this zone are primarily of a manufacturing, assembling and fabricating nature requiring good access by road, railroad and/or river and water access and needing special sites or public utility services. (Code of Zoning Ordinances of Henderson County, Kentucky, Article XXII).

2. Permitted uses upon the subject property are (a) any use permitted in a light industrial district; (b) manufacturing, fabrication and/or processing of any commodity; and (c) accessory buildings and uses - garages and other buildings and uses accessory to the principal use. (Code of Zoning Ordinances of Henderson County, Kentucky, Article XXII, Section 22.02).

3. Among other uses, the following uses require conditional use permits in an M-2 heavy industrial zone issued by the Board of Zoning Adjustments:

(a) Gasoline or oil storage above ground in excess of 500 gallons.

(b) The manufacturing of chemicals.

(c) Any other use which in the opinion of the Board of Zoning Adjustment would emit objectionable conditions beyond the confines of its property. (Code of Zoning Ordinances of Henderson County, Kentucky, Article XXII, Section 22.03).

4. A "conditional use" is a use which is essential to or would promote the public health, safety or welfare in one or more zones, but which would impair the integrity and character of the zone in which it is located, or in adjoining zones, unless restrictions on location, size, extent and character of performance are imposed in addition to those imposed in the Zoning Regulations. (KRS 100.111(6)).

5. A "conditional use permit" is a legal authorization to undertake a conditional use issued by the administrative official pursuant to authorization by the Board of Adjustments, consisting of two parts: (a) a statement of the factual determination by the Board of Adjustments which justifies the issuance of the permits; and (b) a statement of the specific conditions which must be set in order for the use to be permitted. (KRS 100.111(7)).

6. The Board of Zoning Adjustment concludes that the use to which Union Carbide Corporation and Unison Transformer Service, Inc. intends to put the subject property is one which is essential to or would promote the public health, safety or welfare in one or more zones, but because of the nature of the undertaking and the hazardous materials and substances which will be transported to and from, stored, processed and/or handled upon the subject property such use may reasonably be expected to impair the integrity and character of the adjoining property and cause damage and harm to the public health, safety and welfare generally unless restrictions on the character of performance of Union

Carbide Corporation and Unison Transformer Service, Inc. at the subject property herein imposed in addition to those imposed in the Zoning Regulation itself are strictly performed, complied with and adhered to by Union Carbide Corporation and Unison Transformer Service, Inc. For such reason, the conditional use permit should not issue except upon the conditions herein stated.

7. Union Carbide Corporation, the parent corporation for Unison Transformer Service, Inc., should be a record permittee with its said subsidiary and should be bound and equally responsible in all respects for the operations conducted upon the subject property by its subsidiary, Union Transformer Service, Inc. For such reason the application should be amended to reflect Union Carbide Corporation as a joint applicant with its subsidiary, Unison Transformer Service, Inc.

8. The application for a conditional use permit should be amended so as to reflect a proposed use by the applicants upon the subject property which, unless the conditions herein imposed are strictly performed, complied with and adhered to by Union Carbide Corporation and Unison Transformer Service, Inc. may cause harm to the public health, safety and welfare which will emit beyond the confines of the subject property.

<u>CONDITIONAL USE PERMIT</u>

NOW, THEREFORE, the application for conditional use permit is granted to Union Carbide Corporation and Unison Transformer Service, Inc. subiect to and upon the following specific conditions:

1. Union Carbide Corporation shall be a record permittee with its subsidiary, Unison Transformer Service, Inc., and shall in all respects be equally responsible for all operations conducted upon the subject property bv

its subsidiary, Unison Transformer Service, Inc. As evidence of its agreement to be in all respects equally rsponsible for all operations conducted upon the subject property by its subsidiary, Unison Transformer Service, Inc., Union Carbide Corporation shall present to and file with the Board of Zoning Adjustment corporate minutes stating such agreement.

2. This conditional use permit shall not be assigned to any person, firm or corporation without prior written approgal of the BZA.

3. Union Carbide Corporation and Unison Transformer Service, Inc. shall file with the Board of Zoning Adjustment and keep current an emergency response plan acceptable to the Board of Zoning Adjustment which plan shall include among other things the manner in which disaster and emergency situations at the subject property are to be handled by Union Carbide Corporation and Unison Transformer Service, Inc., the method of notice to the public generally of emergency situations and a specific plan of addressing such emergency situations so as to prevent harm to persons in and about the premises and to persons and property of the public generally. The Board of Zoning Adjustment reserves the right, from time to time, to review the emergency response plans so filed; to additions theretoom accprdmace wotj omdistru stamdards; to disapprove all or portions thereof; and to order Union Carbide Corporation and Unison Transformer Service, Inc. to cease operations at the subject property in the event it is determined that Union Carbide Corporation and Unison Transformer Service, Inc. are unable to implement and execute an acceptable emergency plan.

4. Union Carbide Corporation and Unison Transformer Service, Inc. shall file with the Board of Zoning Adjustment all permit applications and permits which are considered public information and which they make to all local, state and federal agencies regulating the enterprise being conducted upon the subject property by Union Carbide Corporation and Unison Transformer Service, Inc.

5. When received Union Carbide Corporation and Unison Transformer Service, Inc. shall file with the Board of Zoning Adjustment all notices of permit violations issued by any local, state or federal agency pertaining to operations upon the subject property and/or the transport of PCB laden materials and substances to and from the subject property. In the event of any such violations the contamination of which would pose an immediate threat of injury or damage to persons, property or the environment, Union Carbide Corporation and Unison Transformer Service, Inc. shall immediately cease operations upon the subject property until such violations are corrected and the agency issuing the notice of violation acknowledges in writing that the violation has been abated.

6. Union Carbide Corporation and Unison Transformer Service, Inc. shall file and maintain with the Board of Zoning Adjustment a current list of all transporters used by them to transport PCB laden materials and substances to and from the subject property together with documentation that all such transporters are in good standing with all regulatory agencies. In addition thereto Union Carbide Corporation and Unison Transformer Service, Inc. shall file and maintain current certificates of insurance for each such transporter. Union Carbide Corporation and Unison Transformer Service, Inc. shall be primarily responsible for all operations, actions and inactions in Henderson County, Kentucky of such transporters including, without limitation, loss, damage or harm to persons, property, and the environment.

7. Union Carbide Corporation and Unison Transformer Service, Inc. shall install approved emergency early warning systems linked to police, fire, emergency and disaster agencies of the City and County of Henderson. The early warning systems shall be approved by the applicable police, fire and emergency

agencies of the City and County of Henderson and an explanation of such system filed and maintained current with the Board of Zoning Adjustment.

8. Union Carbide Corporation and Unison Transformer Service, Inc. shall obtain prior written approval from the Board of Zoning Adjustment of all transportation routes it proposes to use for the transport of PCB laden materials and substances to and from the subject property and shall not deviate from the approved routes except upon prior written approval from the Board of Zoning Adjustment.

9. Union Carbide Corporation and Unison Transformer Service, Inc. shall submit to the Board of Zoning Adjustment for its prior approval a Federal EPA approved audit or accounting system which will set forth completely and specifically the method by which they intend to account for the nature and quantity of PCB laden materials and substances coming into and leaving the subject property. The books and records of such audit or accounting shall be open for inspection by the Board of Zoning Adjustment or its designee at all reasonable times.

10. Should any person be exposed to PCB laden materials or substances while at the subject property or be exposed to such materials or substances outside of the subject property in Henderson County, Kentucky while the same are being transported to or from the subject property, Union Carbide Corporation and Unison Transformer Service, Inc. shall upon request from a person so exposed, his or her family or treating or consulting physicians, provide to any such person making the request the name of the material and all necessary datea of such materials and substances as are received for the proper treatment of such persons.

11. Union Carbide Corporation and Unison Transformer Service, Inc. shall not maintain or store any PCB laden materials or substances outside of the plant to be erected upon the subject property.

12. Union Carbide Corporation and Unison Transformer Service, Inc. shall file with the police and fire agencies of the City and County of Henderson and State of Kentucky a complete and specific security plan which shall be approved by each such agency.

13. Union Carbide Corporation and Unison Transformer Service, Inc. shall at all reasonable times allow access to its premises for inspection by representatives of the Board of Zoning Adjustment and all police, fire and emergency response agencies of the City and County of Henderson and State of Kentucky.

14. Union Carbide Corporation and Unison Transformer Service, Inc. shall maintain at the subject property emergency response personnel adequately trained to combat all emergencies that might reasonably be expected to arise at the subject property. Such emergency response personnel shall be properly trained and equipped with all of the necessary equipment to combat any such emergency. Union Carbide Corporation and Unison Transformer Service, Inc. shall file with the Board of Zoning Adjustment and maintain current a list of their emergency response personnel and of the equipment provided to such emergency response personnel.

15. Union Carbide Corporation and Unison Transformer Service, Inc. shall at their sole expense furnish to the applicable police, fire and emergency response agencies of the City and County of Henderson and local agencies of the State of Kentucky such special training, equipment and supplies as are necessary to combat emergency or disaster situations which might reasonably be anticipated at the subject property.

16. Union Carbide Corporation and Unison Transformer Service, Inc. shall file and maintain current with the applicable police, fire and emergency agencies of the City and County of Henderson, and local state police agencies plans of all buildings on the subject property with areas designated on those plans where hazardous materials and substances might be encountered by emergency response personnel in times of emergencies.

17. Union Carbide Corporation and Unison Transformer Service, Inc. shall be responsible for removing from the environment in an EPA approved manner all PCB laden substances which are spilled within Henderson County while being transported to and from the subject property regardless of the cause of such spill.

18. The proposed plant to be erected on the subject property shall be designed and constructed in strict compliance with the requirements of all state and federal agencies having jurisdiction thereof including local, state and federal environmental agencies.

19. No commercial operations shall commence upon the subject property until Union Carbide Corporation and Unison Transformer Service, Inc. shall have obtained building and operating permits from all local, state and federal agencies, including, local, state and federal environmental agencies having jurisdiction thereof.

20. No operations shall commence upon the subject property until Union Carbide Corporation and Unison Transformer Service, Inc. shall have obtained approval from the Kentucky Airport Zoning Commission and the Henderson-Henderson County Airport Board.

21. Should the plant to be constructed upon the subject property be permanently closed and/or disapproved for operations either voluntarily or involuntarily for any reason, Union Carbide Corporation and Unison Transformer Service, Inc. shall be responsible for: the removal of all PCB laden materials and substances from the subject property; for decontaminating and restoring the plant, equipment, plant site and its environs to the conditions existing prior to commencement of operations and shall not after such time reintroduce PCB laden materials and substances to the site. All such decontamination and restoration operations shall be completed not later than one (1) year following the closure or disapproval for operations.

22. Union Carbide Corporation and Unison Transformer Service, Inc. shall fund a study to be conducted under the auspices and directions of the Board of Zoning Adjustments the purpose of which shall be to determine the present level of PCBs and other chemicals presently existing in the environment at the subject property, its environs, designated transportation routes, nearby rivers, streams, bodies of water and water courses. The Board of Zoning Adjustment shall select the person, firm or corporation to conduct this study which shall be answerable only to the Board of Zoning Adjustment. After the initial baseline study is conducted, the Union Carbide Corporation and Unison Transformer Service, Inc. shall, when requested by the Board of Zoning Adjustment, provide the necessary funds to the Board of Zoning Adjustment for follow-up studies to determine if the levels of PCBs and other chemicals in the environment at the subject property, its environs, nearby rivers, streams, bodies of water and water courses and along the transportation routes used by the applicants have increased. A significant increase in the levels of PCBs and

other chemicals traceable to the operation above the baseline levels shall constitute a violation of this conditional use permit.

23. Union Carbide Corporation and Unison Transformer Service, Inc. shall at their expense, when requested by the Board of Zoning Adjustment, provide the necessary funds for the Board of Zoning Adjustment to employ independent inspectors and auditors answerable only to the Board of Zoning Adjustment for the purpose of determining continual compliance with this conditional use permit.

24(A). Union Carbide Corporation and Unison Transformer Service, Inc. shall file and maintain with the Board of Zoning Adjustment an indemnity bond or bonds in amounts to be determined by the Board of Zoning Adjustment after a hearing for that purpose with sufficient surety thereon in the opinion of the Board of Zoning Adjustment conditioned upon the following:

> (1) That all of the conditions herein stated shall be strictly performed, complied with and adhered to by Union Carbide Corporation and Unison Transformer Service, Inc.
>
> (2) That Union Carbide Corporation and Unison Transformer Service, Inc. and their surety or sureties are bound to and shall indemnify the City and County of Henderson and all other persons, firms or corporations for all damages, losses and expenses incurred by any or all of them because of the failure or refusal of Union Carbide Corporation and/or Unison Transformer Service, Inc. to strictly perform, comply with and adhere to the conditions herein stated or arising out of the enterprise in Henderson County, Kentucky conducted by Union Carbide Corporation and Unison Transformer Service, Inc. upon the subject property for which this conditional use permit is granted.

24(B). The indemnity bond or bonds shall be in form and amounts satisfactory to the Board of Zoning Adjustment and shall provide, among other things, that the City and County of Henderson and all other persons, firms or corporations suffering damage or loss or incurring expenses caused by the operations of Union Carbide Corporation and/or Unison Transformer Service, Inc. upon the subject property or because of the failure or refusal of Union Carbide Corporation and Unison Transformer Service, Inc. to strictly perform, comply with and adhere to the conditions of this conditional use permit shall have a direct right of action against Union Carbide Corporation, Unison Transformer Service, Inc. and their surety or sureties.

24(C). The sureties upon these bonds shall be responsible insurance companies authorized to do business in the state of Kentucky and acceptable to the Board of Zoning Adjustment.

24(D). Should the surety or sureties (or any one when there is more than one) lose its or their certificate to operate in the state of Kentucky, be adjudged a bankrupt, make an assignment for the benefit of creditors or become insolvent in the opinion of the Board of Zoning Adjustment, then, and in such event, Union Carbide Corporation and Unison Transformer Service, Inc. shall secure a successor surety or sureties acceptable to the Board of Zoning Adjustment and shall cease all operations at the subject property until the successor surety is approved and accepted by the Board of Zoning Adjustment.

24(E). The indemnity bond or bonds herein required to be filed and maintained by Union Carbide Corporation and Unison Transformer Service, Inc. shall continue in force and effect for so long as Union Carbide Corporation and/or Unison Transformer Service, Inc. are conducting operations upon the subject property and for so long thereafter as the subject property, its environs, the improvements to be erected thereon, the equipment therein, and all transportation routes in Henderson County, Kentucky used for the transportation of PCB laden materials to and from the subject property remain contaminated from operations upon the subject property.

25. No commercial operations shall commence at the subject property until the conditions herein imposed shall have been strictly performed, complied with and adhered to by the applicants.

26. The conditions herein imposed are of a continuing nature and the violation of any such conditions shall be cause for the revocation of the conditional use permit herein granted.

27. The Board of Zoning Adjustment shall have the authority to enforce the provisions of this conditional use permit and to seek damages for its violation by all applicable laws, ordinances and regulations.

Issued this ___ day of _______________, 1985.

HENDERSON COUNTY BOARD OF ZONING ADJUSTMENT

By: ______________________________
Chairman

AGREED TO BY:

UNION CARBIDE CORPORATION

By: ______________________________

ATTEST:

____

UNISON TRANSFORMER SERVICE, INC.

By: ______________________________

ATTEST:

____

STATE OF KENTUCKY

COUNTY OF HENDERSON...SCT.

The foregoing was acknowledged before me by Richard Crafton, Chairman of the Henderson County Board of Zoning Adjustment on this ___ day of September, 1985.

My commission expires: ____________________

____
Notary Public

STATE OF ______________

COUNTY OF ______________...SCT.

The foregoing was acknowledged before me by ____________________ and ____________________, ____________________ and secretary of Union Carbide Corporation on this ____ day of ______________, 1985.

My commission expires: ____________________

____
Notary Public

STATE OF ______________

COUNTY OF ______________...SCT.

The foregoing was acknowledged before me by ____________________ and ____________________, ____________________ and secretary of Union Carbide Corporation on this ____ day of ______________, 1985.

My commission expires: ____________________

____
Notary Public

APPENDIX 4. EPA FIRES RULE BROCHURE

PCB Transformers and the Risk of Fire

The greatest danger from a fire usually is not the flames or the heat but the smoke and gases given off from burning substances. The burning of chemicals as toxic as PCBs (polychlorinated biphenyls) produces gases which are particularly dangerous.

Individuals may be exposed to PCB gases if a fire occurs in or near an electrical transformer which uses PCBs in its insulating fluid.

If you are the owner of a commercial building, you have a special responsibility to reduce the threat to the health of your tenants and local fire fighters that could stem from a fire in or near a PCB transformer. (A commercial building is a non-industrial building—such as an apartment house, school, meeting hall, or store—which is typically accessible to the general public.)

PCB electrical transformers were manufactured between 1929 and 1977. An estimated 77,000 PCB transformers are in use in this country today. Only about 18,000 of these are owned by utility companies. The great majority of PCB transformers belong to building owners.

U.S. Environmental Protection Agency regulations now require owners of PCB transformers to take specific actions to help ensure the public safety.

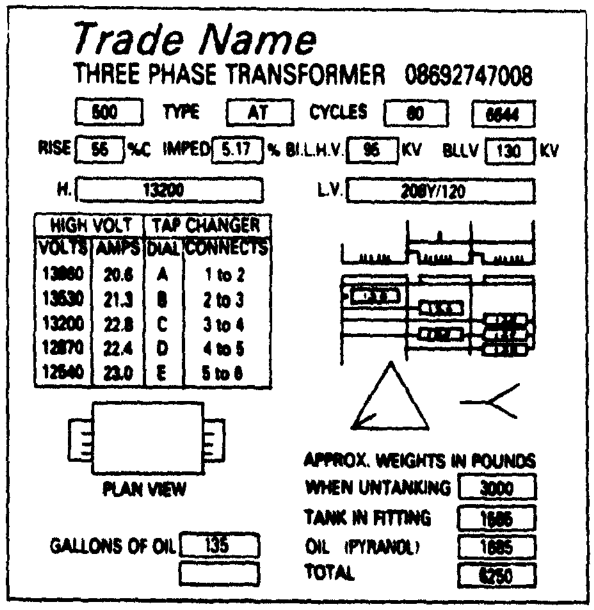
Do You Own a PCB Transformer?

As a building owner, you need to know if you own the electrical transformer(s) for your building. If you are uncertain, contact your local utility company. If the utility does not own the transformer in your building, then you do.

If you own the transformer in your building, your next step is to determine if it contains PCBs.

The tranformer will be in or near the building it serves. It may be on the roof, in the basement, in the parking lot, on an exterior wall, in a vault under the sidewalk, or in some other location close to where the power cables enter the building.

Generally, a transformer will have a nameplate attached to one side of the unit.



Since PCBs were marketed under different trade names, the nameplate on a PCB transformer may not carry the specific term "PCBs." Trade names for PCBs include:

Chlorextol	**Pyranol**
EEC-18	**Chlophen**
Kennechlor	**Pyralene**
Abestol	**Non Flammable Liquid**
No-Flamol	**Fenclor**
Aroclor	**Solvol**
Askarel	**Saf-T-Kuhl**
Inerteen	**DK**
Phenoclor	

If the nameplate says "PCBs" or any of the names on the above list, then the transformer most likely contains PCBs in concentrations of between 600,000 and 700,000 parts per million (ppm). Any transformer containing PCBs at a concentration of 500 ppm or greater is subject to the new EPA regulations listed below.

Should your transformer's nameplate not carry any of the above labels, or if the label is missing or illegible, your utility company may be able to tell you if the transformer contains PCBs. Otherwise, the only way to be certain is to have the fluid tested.

New Requirements

For some time, regulations have been in effect which govern the use, servicing, and disposal of PCB transformers. The recently issued rule described here applies to all PCB transformers in commercial buildings and establishes strict requirements for the owners of those transformers.

- Installation of PCB transformers in, or near, commercial buildings is prohibited. (Although PCBs are no longer manufactured for use in transformers, many PCB transformers are currently in storage for reuse.)
- Owners must register PCB transformers with their local fire department.
- Utility companies that own PCB transformers located in or near commercial buildings must register the transformers with building owners as well as with their fire department.
- PCB transformer areas, excluding grates and manhole covers, must be marked.
- Combustible materials cannot be stored within a PCB-transformer enclosure or within five meters (approximately 16 feet) of an unenclosed transformer.
- Owners of PCB transformers which are involved in a fire must report the incident immediately to the U.S. Coast Guard National Spill Response Center by calling 800-424-8802 toll-free. (In the Washington, DC metropolitan area, call 426-2675.)

As of October 1, 1990:

- The use of PCB units that EPA believes have a relatively high probability of electrical failure is prohibited.
- Improved electrical protection must be installed on other PCB transformers to avoid fires caused by electrical faults.

It is critically important that commercial building owners register PCB transformers with local fire departments or brigades. PCB fires pose serious risks to building occupants and fire fighters. If fire fighters and other emergency personnel know they may be dealing with PCBs, they can be prepared and equipped to deal with the fire. Both fire fighters and building owners also should be aware of the need to quickly evacuate occupants in an emergency situation, and of the need to insure that proper and adequate cleanup occurs prior to reoccupation of the building.

A Serious Health Concern

EPA's regulations covering transformers are part of a series of rules the Agency has issued in recent years to protect the public from PCBs. There are a number of adverse health effects associated with these chemicals. Tests on animals show that PCBs can harm reproduction and growth, and can cause skin lesions and tumors. When PCB dielectric fluid is partly burned—as it may be in a tranformer fire—the PCB fluid produces by-products, which include polychlorinated dibenzo**dioxin** and polychlorinated dibenzo**furans**, that are much more toxic than the PCBs themselves. Tests on rats show that furans can cause anemia and other blood problems. Dioxin is associated with a number of health risks, and has been shown to cause cancer of the liver, mouth, adrenal gland, and lungs in laboratory animals.

For More Information

If you need help in complying with the new regulation, please contact your nearest EPA Regional Office (see back cover). For more information about the transformer regulation, or other EPA rules controlling PCBs, write to the Office of Toxic Substances (TS-799), U.S. EPA, Washington, DC 20460, or call that office toll free at 800-424-9065 (in Washington, D.C., call 554-1404).

APPENDIX 5. AIR EMISSIONS, ORDINARY OPERATIONS

APPENDIX 5 Ordinary Operations Air Model.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 101 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	166.670	333.330	500.000	666.670	833.330	1000.000	1333.330	1666.670	2000.000
	- CONCENTRATION -								
337.500	0.9783E-01	0.4482E-01	0.2649E-01	0.1740E-01	0.1235E-01	0.9256E-02	0.5949E-02	0.4194E-02	0.3143E-02
315.000	0.1041E+00	0.4886E-01	0.2928E-01	0.1935E-01	0.1377E-01	0.1033E-01	0.6658E-02	0.4697E-02	0.3520E-02
292.500	0.9562E-01	0.4206E-01	0.2466E-01	0.1614E-01	0.1143E-01	0.8554E-02	0.5483E-02	0.3859E-02	0.2888E-02
270.000	0.1335E+00	0.6963E-01	0.4373E-01	0.2951E-01	0.2126E-01	0.1610E-01	0.1044E-01	0.7375E-02	0.5558E-02
247.500	0.1007E+00	0.5926E-01	0.3849E-01	0.2632E-01	0.1910E-01	0.1454E-01	0.9467E-02	0.6725E-02	0.5064E-02
225.000	0.7178E-01	0.3909E-01	0.2475E-01	0.1675E-01	0.1208E-01	0.9162E-02	0.5943E-02	0.4212E-02	0.3167E-02
202.500	0.5227E-01	0.2909E-01	0.1851E-01	0.1255E-01	0.9064E-02	0.6879E-02	0.4469E-02	0.3171E-02	0.2386E-02
180.000	0.1395E+00	0.7476E-01	0.4725E-01	0.3196E-01	0.2306E-01	0.1749E-01	0.1136E-01	0.8061E-02	0.6165E-02
157.500	0.1153E+00	0.8879E-01	0.6232E-01	0.4393E-01	0.3239E-01	0.2492E-01	0.1639E-01	0.1172E-01	0.8859E-02
135.000	0.1573E+00	0.1285E+00	0.9147E-01	0.6479E-01	0.4791E-01	0.3691E-01	0.2433E-01	0.1740E-01	0.1316E-01
112.500	0.1315E+00	0.8827E-01	0.5991E-01	0.4171E-01	0.3056E-01	0.2341E-01	0.1535E-01	0.1095E-01	0.8267E-02
90.000	0.1230E+00	0.6397E-01	0.4012E-01	0.2706E-01	0.1949E-01	0.1477E-01	0.9579E-02	0.6791E-02	0.5106E-02
67.500	0.9644E-01	0.4747E-01	0.2901E-01	0.1934E-01	0.1384E-01	0.1044E-01	0.6735E-02	0.4755E-02	0.3571E-02
45.000	0.1146E+00	0.5284E-01	0.3145E-01	0.2071E-01	0.1472E-01	0.1105E-01	0.7098E-02	0.5002E-02	0.3746E-02
22.500	0.7824E-01	0.3380E-01	0.1943E-01	0.1259E-01	0.8864E-02	0.6610E-02	0.4222E-02	0.2966E-02	0.2216E-02
0.000	0.1720E+00	0.8170E-01	0.4899E-01	0.3237E-01	0.2305E-01	0.1732E-01	0.1115E-01	0.7865E-02	0.5395E-02

APPENDIX 5 Ordinary Operations Air Model (continued).

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	2333.330	2666.670	3000.000	3333.330	3666.670	4000.000	4333.330	4666.670	[illegible]
	- CONCENTRATION -								
337.500	0.2475E-02	0.2011E-02	0.1674E-02	0.1428E-02	0.1235E-02	0.1084E-02	0.9608E-03	0.8594E-03	[illegible]
315.000	0.2774E-02	0.2255E-02	0.1878E-02	0.1603E-02	0.1387E-02	0.1218E-02	0.1080E-02	0.9665E-03	[illegible]
292.500	0.2272E-02	0.1844E-02	0.1534E-02	0.1307E-02	0.1130E-02	0.9916E-03	0.8736E-03	0.7854E-03	[illegible]
270.000	0.4392E-02	0.3579E-02	0.2986E-02	0.2553E-02	0.2214E-02	0.1947E-02	0.1729E-02	0.1548E-02	[illegible]
247.500	0.4010E-02	0.3273E-02	0.2734E-02	0.2341E-02	0.2033E-02	0.1789E-02	0.1590E-02	0.1426E-02	0.1288E-02
225.000	0.2504E-02	0.2041E-02	0.1703E-02	0.1457E-02	0.1265E-02	0.1112E-02	0.9874E-03	0.8847E-03	0.7987E-03
202.500	0.1888E-02	0.1540E-02	0.1286E-02	0.1100E-02	0.9557E-03	0.8401E-03	0.7464E-03	0.6687E-03	0.6040E-03
180.000	0.4798E-02	0.3912E-02	0.3266E-02	0.2795E-02	0.2425E-02	0.2133E-02	0.1895E-02	0.1698E-02	[illegible]
157.500	0.7041E-02	0.5764E-02	0.4827E-02	0.4144E-02	0.3606E-02	0.3180E-02	0.2831E-02	0.2541E-02	0.2298E-02
135.000	0.1047E-01	0.8574E-02	0.7182E-02	0.6169E-02	0.5370E-02	0.4737E-02	0.4218E-02	0.3788E-02	0.3426E-02
112.500	0.6562E-02	0.5365E-02	0.4489E-02	0.3850E-02	0.3348E-02	0.2950E-02	0.2625E-02	0.2355E-02	0.2129E-02
90.000	0.4036E-02	0.3289E-02	0.2744E-02	0.2347E-02	0.2036E-02	0.1791E-02	0.1590E-02	0.1424E-02	[illegible]
67.500	0.2618E-02	0.2293E-02	0.1911E-02	0.1633E-02	0.1414E-02	0.1243E-02	0.1103E-02	0.9871E-03	0.8903E-03
45.000	0.2950E-02	0.2398E-02	0.1996E-02	0.1703E-02	0.1474E-02	0.1293E-02	0.1147E-02	0.1026E-02	0.9247E-03
22.500	0.1741E-02	0.1412E-02	0.1174E-02	0.9993E-03	0.8633E-03	0.7566E-03	0.6700E-03	0.5987E-03	0.5391E-03
0.000	0.4647E-02	0.3778E-02	0.3147E-02	0.2686E-02	0.2325E-02	0.2041E-02	0.1810E-02	0.1620E-02	0.1460E-02

APPENDIX 5 Ordinary Operations Air Model (continued).

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	6666.670	8333.330	10000.000	11666.670	13333.330	15000.000	18333.330	21666.670	25000.000
				- CONCENTRATION -					
337.500	0.5016E-03	0.3604E-03	0.2754E-03	0.2198E-03	0.1811E-03	0.1526E-03	0.1152E-03	0.9124E-04	0.7485E-04
315.000	0.5651E-03	0.4068E-03	0.3114E-03	0.2488E-03	0.2052E-03	0.1731E-03	0.1310E-03	0.1040E-03	0.8549E-04
292.500	0.4574E-03	0.3284E-03	0.2509E-03	0.2002E-03	0.1649E-03	0.1389E-03	0.1049E-03	0.8315E-04	0.6821E-04
270.000	0.9100E-03	0.6574E-03	0.5047E-03	0.4040E-03	0.3337E-03	0.2817E-03	0.2146E-03	0.1703E-03	0.1402E-03
247.500	0.8410E-03	0.6090E-03	0.4684E-03	0.3753E-03	0.3103E-03	0.2621E-03	0.1995E-03	0.1590E-03	0.1310E-03
225.000	0.5206E-03	0.3764E-03	0.2892E-03	0.2316E-03	0.1914E-03	0.1616E-03	0.1228E-03	0.9754E-04	0.8059E-04
202.500	0.3940E-03	0.2850E-03	0.2190E-03	0.1754E-03	0.1449E-03	0.1224E-03	0.9302E-04	0.7407E-04	0.6103E-04
180.000	0.9992E-03	0.7223E-03	0.5546E-03	0.4440E-03	0.3667E-03	0.3096E-03	0.2351E-03	0.1871E-03	0.1540E-03
157.500	0.1509E-02	0.1097E-02	0.8466E-03	0.6797E-03	0.5629E-03	0.4762E-03	0.3636E-03	0.2906E-03	0.2399E-03
135.000	0.2253E-02	0.1638E-02	0.1264E-02	0.1015E-02	0.8410E-03	0.7116E-03	0.5436E-03	0.4346E-03	0.3589E-03
112.500	0.1395E-02	0.1012E-02	0.7800E-03	0.6256E-03	0.5176E-03	0.4376E-03	0.3335E-03	0.2662E-03	0.2195E-03
90.000	0.8370E-03	0.6045E-03	0.4639E-03	0.3711E-03	0.3064E-03	0.2586E-03	0.1962E-03	0.1561E-03	0.1284E-03
67.500	0.5785E-03	0.4171E-03	0.3196E-03	0.2555E-03	0.2109E-03	0.1779E-03	0.1348E-03	0.1072E-03	0.8812E-04
45.000	0.5992E-03	0.4311E-03	0.3299E-03	0.2635E-03	0.2173E-03	0.1832E-03	0.1386E-03	0.1101E-03	0.9041E-04
22.500	0.3480E-03	0.2494E-03	0.1902E-03	0.1516E-03	0.1248E-03	0.1051E-03	0.7915E-04	0.6263E-04	0.5133E-04
0.000	0.9473E-03	0.6819E-03	0.5219E-03	0.4169E-03	0.3438E-03	0.2899E-03	0.2193E-03	0.1741E-03	0.1436E-03

APPENDIX 5 **Ordinary Operations Air Model (concluded).**

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	33333.340	41666.672	50000.000
	- CONCENTRATION -		
337.500	0.5060E-04	0.3764E-04	0.2962E-04
315.000	0.5795E-04	0.4322E-04	0.3406E-04
292.500	0.4614E-04	0.3436E-04	0.2704E-04
270.000	0.9542E-04	0.7136E-04	0.5634E-04
247.500	0.8936E-04	0.6692E-04	0.5289E-04
225.000	0.5491E-04	0.4110E-04	0.3247E-04
202.500	0.4153E-04	0.3106E-04	0.2452E-04
180.000	0.1047E-03	0.7822E-04	0.6170E-04
157.500	0.1641E-03	0.1232E-03	0.9745E-04
135.000	0.2456E-03	0.1844E-03	0.1459E-03
112.500	0.1499E-03	0.1123E-03	0.8877E-04
90.000	0.8724E-04	0.6518E-04	0.5140E-04
67.500	0.5986E-04	0.4471E-04	0.3527E-04
45.000	0.6132E-04	0.4576E-04	0.3607E-04
22.500	0.3465E-04	0.2576E-04	0.2026E-04
0.000	0.9694E-04	0.7228E-04	0.5696E-04

APPENDIX 6. TORNADO EFFECTS

APPENDIX 6. TORNADO EFFECTS

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Weather Bureau
Technical Paper No. 29
Tornado Occurrences in the United States
Washington, D.C. 1960
pages 8-10

Because of the erratic behavior and intense forces demonstrated by tornadoes, many unbelievable and freakish occurrences have resulted during their passage. The furious winds of a tornado turn normally harmless objects into missiles of great penetrative power. Frequently, reports show that boards or even stalks of straw were driven into tree trunks, posts, and sides of buildings, huge trees were ripped from the earth and hurled hundreds of miles, persons were lifted into the air and carried for distances, and chickens were cleanly plucked of their feathers but unhurt. Other reports tell of fine dirt, stones, and bits of leaves being driven into the flesh of persons exposed to the wind, and clothes saturated with mud under similar conditions are said to be almost impossible to clean.

The terrific force and lifting power of the whirling tornadic winds are shown in the following descriptions. On April 16, 1879, a tornado at Walterboro, S.C., lifted a hickory tree, measuring 54 inches in circumference, out of the ground and moved it 10 feet up a bank; geraniums blooming in pots were found by the owner 1 mile away undamaged. At Marshall, Mo., an ice chest weighing 800 pounds was carried a distance of several miles on April 16, 1880. After the St. Louis, Mo., tornado of May 27, 1896, a 2x4-inch scantling was found protruding several feet through iron 5/8 inch thick on the Eads Bridge; wheat straws were found forced into a tree trunk to a depth of over 1 inch; and a 6x9-inch timber was driven 4 feet almost straight down into the hard ground. Following the tornado of November 10, 1915, at Great Bend, Kans., an iron water hydrant was discovered full of wooden splinters. The force of the wind at Fergus Falls, Minn., on June 22, 1919, split a huge tree, hurled an automobile into the split, and closed the opening in the tree, holding the automobile as if it were in a vise. After the tri-State tornado of March 18, 1925, a large plank several feet long was found driven horizontally into a tree trunk so firmly that the far end could support a man's weight without loosening it from the tree; at Griffin, Ind., a piece of wall-paper about 2X3 inches was observed driven edgewise into the southwest side of a box elder tree about 6 feet above ground. At Nashville, Tenn., on March 14, 1933, a 2x4-inch timber was plunged through a panel door, without causing the slightest splitting or splintering and fit the opening perfectly; another plank, measuring 1x6 inches was forced through the trunk of a sturdy tree, splitting the tree in half. On July 4, 1956, at Edison, Nebr., 1X8-inch boards were driven into the ground in a straight line as if measured and placed there.

The powerful force of the rotating winds was shown in the tornado on May 27, 1931, at Moorhead, Minn., when farm implements of heavy iron and steel were twisted beyond recognition; at Nashville, Tenn., on March 14, 1933, when a high tension tower was bent to the ground in a tangled mass without breaking loose from its concrete moorings; and on April 6, 1936, at Gainsville, Ga., when a telephone pole was so twisted it resembled a huge corkscrew but still remained upright. On June 12, 1957, a tornado at a Dallas County, Texas, airport struck a steel hanger built to withstand winds up to 120 m.p.h., and pulled the concrete piers from the ground. During the tornado of June 22, 1919, at Fergus Falls, Minn., a trunk containing clothing was carried from one house and deposited in the attic of another two blocks away, and when found was undamaged. Galvanized roofing was carried 50 miles from La Plata, Md., on November 9, 1926. On May 7, 1927, a 5-ton caterpillar tractor was turned over and rolled 500 feet at Hutchinson, Kans.; a span of steel highway bridge near Medicine Lodge, Kans., was blown downstream for 100 feet. At Gothenberg, Nebr., on June 24, 1930, two concrete blocks, weighing 2,000 pounds each, were torn from their fastenings and moved several feet. The courthouse bell, weighting nearly a ton, was carried 350 yards in the Gainesville, Ga., tornado on April 6, 1936, and portions of a huge sign which extended across a Gainesville mill were found at Easley, S.C., over 85 miles away.

Clothing and other small articles have been recovered many miles away from the scene of the storm. An unmailed letter and check which had evidently been blown from Great Bend, Kans., on November 10, 1915, were found 85 miles to the northeast. An insurance policy from a home in Marion County, Ala., was blown into Lauderdale County, a distance of 75 miles during the tornado of April 20, 1920. A picture postcard bearing an Orestes, Ind., address was recovered on April 17, 1922, at Mt. Cory, Ohio, 124 miles away, torn at one corner, but otherwise in good condition. After the tri-State tornado of March 18, 1925, a pair of trousers with $95 in the pocket was picked up 39 miles away, and a check and calling card were carried 125 miles. An old postcard which had been kept in a trunk at Gainesville, GA., was found, following the April 6, 1936, tornado, at Liberty, S.C., 80 miles distant. Pieces of stationery from Gainesville were picked up at Easley, S.C., over 85 miles away. A letter was carried 100 miles by a tornado in Pennsylvania on June 23, 1944. Various objects were reported to have been carried 90 miles from their original position at Corn., Okla., on June 8, 1951. A government bond from Kay County, Okla., was found at Williamsburg, Kans., over 100 miles away, following the April 2, 1956 storm. Another government bond and eight $100 bills were found intact many miles away in an envelope bearing an El Dorado, Kans., address, following the tornado of June 10, 1958. On April 3, 1956, a package of knitting products from a wrecked Berlin, Wis., mill was recovered undisturbed 35 miles northward; a package of papers was found 75 miles to the north-northeast and a carton of deer hides was recovered 60 miles northeastward. Debris from the Hickman Mills, Mo., tornado of May 20, 1957, was found 180 miles distant. A jar of fruit was reported to have been carried a long distance from Wilkes Barre, Pa., on August 19, 1890, and when found was undamaged, except for the porcelain lining of the cover.

There are a number of instances on record of human beings and animals being whisked up from the ground and carried through the air for varying distances. A farmer was picked up, carried 150 yards, and put down without serious injury on May 12, 1896, at Elkhorn, Nebr. During the tri-State tornado of March 18, 1925, 16 pupils were blown 150 yards into a field from a country school and none were killed. On April 9, 1947, as a man opened the door of his home near Higgins, Tex., the door was torn loose from his grip and he was picked up by the wind and carried for 200 feet over the tree tops.

On November 4, 1950, in Pennsylvania a woman was carried 30 feet; on July 6, 1954, a Harding, Minn., farmer was lifted 40 feet and dropped to the ground unhurt; at Collinsville, Ill., on May 3, 1958, a man was carried 50 feet, and another was carried 100 feet at St. Martin, Minn., on June 4, 1958. Also during the tornado at El Dorado, Kans., on June 10, 1958, a woman was sucked through a window, blown 60 feet, and beside her was found a broken record entitled "Stormy Weather." An automobile with 2 passengers was carried 100 feet and dropped right side up without injury to the passengers on April 18, 1955, near Lanark, Ill.

Railroad trains have also been damaged and derailed by the wind force during the passage of these storms. On June 22, 1919, the Great Northern Limited was traveling at about 30 to 40 m.p.h., when the tornado at Fergus Falls, Minn., struck the baggage car behind the tender, throwing 7 of the 11 coaches from the rails. The baggage car was torn from the train and set down about 30 feet from the rails at right angles. The tornado of May 27, 1931, at Moorehead, Minn., crossed the Great Northern Railroad track, striking the "Empire Builder" at right angles. One 83-ton train coach with 117 passengers was lifted from the rails, carried through the air, and laid in a ditch 80 feet away, with only one death resulting when a passenger was hurled through the window and crushed beneath the coach. Other coaches were torn loose from the engine and pulled from the rails. On September 4, 1941, freight cars loaded with coal and weighing 80,000 pounds each were overturned near Minneapolis, Minn. At Gage, Okla., a train of 82 cars was truck by a tornado on June 21, 1958; 17 of the cars were derailed and 180 feet of track torn out.

Freakish and awesome stories are frequently reported in connection with the passage of tornadoes. In the town of Peggs, Okla., only one building was left undamaged by the tornado of May 2, 1920. It was the wooden, one-story jail, and not 30 feet away a concrete building was left in utter ruin. On July 2, 1924, 8 inches of snow, which seemed to come from a funnel cloud, covered an area of 20 square feet near Wabash, Ind. Small fish, crayfish, and tiny frogs fell during a shower of rain in a tornado associated with the passage of a hurricane in Alabama on June 28, 1957. On November 10, 1915, during the Great Bend, Kans., tornado, a dresser was splintered, but its mirror was carried some distance and set down unbroken against a fence. At Fergus Falls, Minn., on June 22, 1919, a buffet was moved 2 feet from the wall without breaking a dish, although all other furniture was in splinters and the house so badly damaged, it was unsafe to enter. A similar story is told of the February 1950 tornado which scattered the roof and parts of a Shreveport, La., home over a half-mile area, but left the floor intact on which was a china closet filled with dishes, none broken. An incident of the Gainesville, Ga., storm of April 6, 1936, was told of three small boys who rushed under the front steps of their home in terror as the storm's roar approached. The house and all foundations were blown away, leaving only the front steps and the little boys frightened but unharmed. An awesome story is told about a boy who was found with a dozen splintered sticks protruding from his chest after the El Dorado, Kans., tornado of June 10, 1958.

There have been incidences of several tornadoes striking the same area within a short space of time, namely; at Austin, TX., on May 4, 1922, two at a 30-minute interval, and at Baldwyn, Miss., on March 16, 1942, two 25 minutes apart. In Ellis County, Okla., a destructive tornado occurred on April 9, 1947, and on May 31, another tornado passed over the same area. Due to the extensive destruction resulting from the first storm, further damage from the second was negligile as very little was left to destroy. The town of Codell, Kans., was struck in three successive years, 1916, 1917, and 1918, and each time on May 20 and at about the same hour of the day.

In some instances damage by tornadoes may result at treetop or housetop levels, indicating that the cloud did not completely reach the earth's surface. This characteristic was very noticeable in two great tornadoes, one at Louisville, Ky., on March 27, 1890, and the other at St. Louis, Mo., on May 27, 1896. In the majority of cases damage was confined to upper floors, and most wrecked buildings owed their destruction to the collapsing of their walls from the weight of debris of ruined upper levels. At St. Louis, nearly all trees in Lafayette Park were broken and twisted off at an elevation of about 30 feet. Reports of more recent years show the concentration of damages above the ground level in the following tornadoes:

April 16, 1954 - Ft. Valley, Ga.- $2,000 damage at rooftop level.

May 10, 1954 - East Hartland, Conn. - $1,000 damage at treetop levels.

June 20, 1954 - Grand Island, Nebr. - $3,000 damage to upper parts of higher buildings.

July 19, 1954 - Kingsland, Ark. - $1,000 damage to tops of houses.

July 12, 1955 - Terrytown, Nebr. - Damage (not estimated) to roofs and treetops.

February 25, 1956 - Cedarville, Ohio - Overhead at elevation sufficient to tear roofs from houses, damage $250,000.

July 21, 1956 - Collinsville, Okla. - Slight damage as funnel reached to 100 feet of ground.

April 22, 1957 - Kingfisher, Okla. - passed just above ground, damage $100,000.

May 12, 1957 - Carnegie, Okla. - slight damage and funnel reached to rooftop level.

June 12, 1957 - Tuscola, Ill. - slight damage at treetop level.

July 1, 1957 - Tulsa, Olka. - dipped to treetop level, damage $20,000.

August 14, 1957 - Hanson, Okla. - about 20 feet above ground, no estimate of damage.

July 29, 1958 - Worcester to Shrewsberry, Mass. - slight damage at treetop level.

APPENDIX 7. DESCRIPTION OF AIRCRAFT ACCIDENT CALCULATION

APPENDIX 7.

This appendix presents an explanation of the methods, assumptions, input data and probability model used to assess the risk of Henderson County Airport flight operations to the Unison PCB separation facility. Methods employed to assess this risk were developed by Sandia National Laboratories, a specialist in the aircraft accident probability field. Sandia has produced aircraft crash probability models for risk analyses on a variety of facilities, including weapons storage and assembly areas (U.S. Navy 1985; Smith 1983) and nuclear power generating plants (Solomon 1975).

The model used in this analysis was taken from a study conducted by the U.S. Navy to analyze the statistical probability that an aircraft operating from the St. Mary, Ga., Airport could crash into a ballistic missile assembly and storage facility at the King's Bay Nuclear Submarine Base (U.S. Navy 1985). This model was chosen due to the following similarities between the St. Marys Airport and the Henderson County Airport:

1. Both are general aviation airports.
2. There is no commercial air traffic at either airport.
3. Both are open to the public.
4. Both lack a control tower.
5. Both have only one runway.
6. Runway lengths are comparable (5000' and 4800').

While the Henderson County Airport has more flight operations per year than the St. Marys Airport, this difference is accounted for in the probability model.

The probability model used in this analysis is of the form:

$$P = A \times \left[N_T \times \frac{5(10^{-6})}{r} e^{-r/1.6} e^{-\theta/12} + N_L \times \frac{5.3(10^{-7})}{r} e^{-r/1.6} e^{-\theta/22.2} \right]$$

where

- P = The probability per year of an aircraft crash into a selected structure.
- A = The effective plant area (in square miles).
- N_T = Number of takeoffs per year.
- N_L = Number of landings per year.
- r = distance (in miles) from the end of the runway to the facility.
- θ = The angle (in degrees) between the center line of the runway and a line from the end of the runway to the facility.

The effective plant area (Cornell, 1973) is the sum of the true plant area (A_p), the shadow area (A_s), and the skid area (A_{sk}). A_p is the actual area occupied by the facility. A_s is that area covered by the shadow of a building due to an incident angle of 15°, which is the assumed aircraft impact angle (Solomon, 1975). For a rectangular building of width a and height b,

$$A_s = \frac{a \times b}{\tan 15^\circ}$$

A_{sk} accounts for an aircraft crashing in front of a building and bouncing or skidding into it. A typical skid distance of 300 feet was used (Cornell, 1973). For a building of width a, $A_{sk} = a \times 300$.

The Unison facility does not have a rectangular profile, due to the refractory column extending through the roof of the process building. Therefore, it was necessary to divide the building into 3 rectangular sections (see Figure 5.2.4.1), compute the probability of a crash into each section, then sum those probabilities to obtain overall risk. See Table 5.2.1.4 for effective plant areas for the 3 parts of the Unison facility.

N_T and N_L were based on the number of operations at the Henderson County Airport for 1985. In the Henderson County airport 10 year plan (1975 - 1985), it was estimated that there would be about 35,000 operations at the airport in 1985. However, there were only 22,000 actual operations in 1985. The new 10 year plan for the airport has not been submitted at this time, so that figure was used as a basis for determining N_T and N_L. On average, only half of the operations at the Henderson County Airport could potentially impact the Unison facility: landings towards the west and takeoffs towards the east. This results in 11,000 operations per year, with potential for impact, of which, half are assumed to be takeoffs and half are landings. Values for N_T and N_L are thus 5500 each.

The distance (r) from the east end of the runway to the Unison Facility is 1.0 miles. The angle (θ) between the centerline of the runway and a line from the Unison facility to the east end of the runway is 14°.

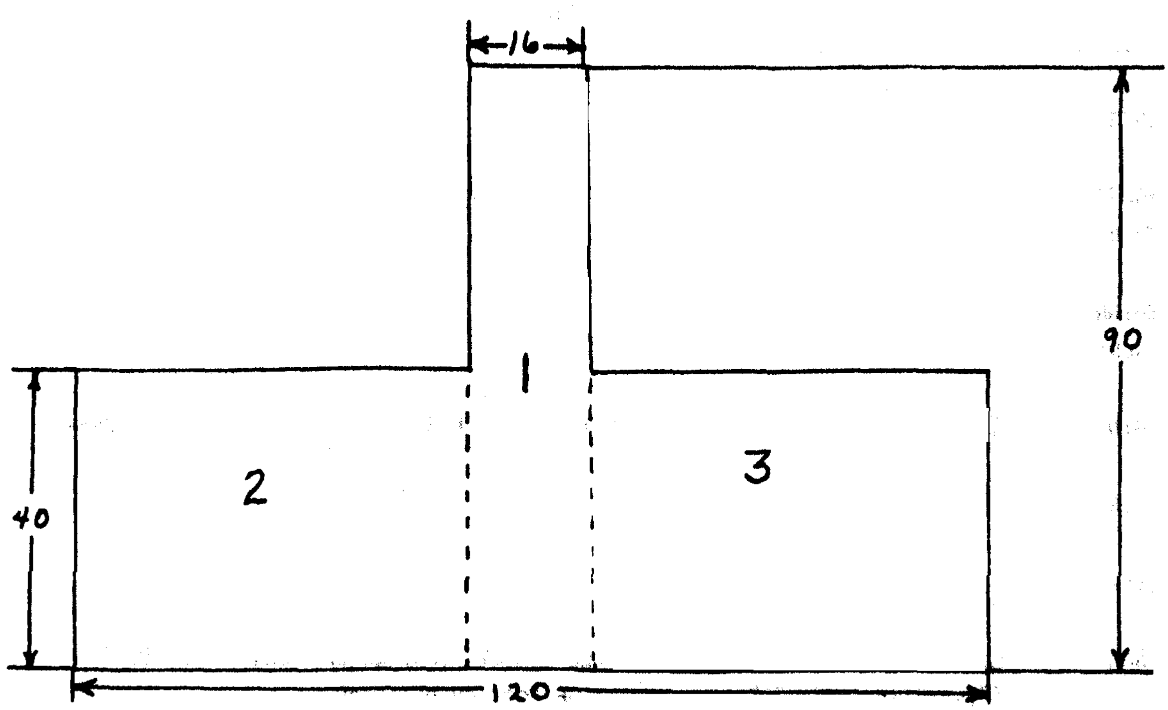
Applying the above input data to the probability model for each of the three sections of the Unison facility results in the probabilities listed in Table 5.2.4.1. The sum is 1.33×10^{-5}, which is the probability per year that an aircraft operating from the Henderson County Airport will crash into the Unison facility.

TABLE 5.2.4.1

Building Division	r	O	A	crash probability
1	1.0 mi	14°	4.22×10^{-4} mi^2	2.27×10^{-6}
2	1.0 mi	14°	1.03×10^{-3} mi^2	5.50×10^{-6}
3	1.0 mi	14°	1.03×10^{-3} mi^2	5.50×10^{-6}
		Total Crash Probability		1.33×10^{-5}

FIGURE 5.2.4.1

This is a schematic of the profile of the Unison facility relative to the direction from which a plane would approach on either takeoff or landing. The dashed lines indicate the division of the building into three rectangles for modelling purposes. All dimensions are in feet.



AIRCRAFT ACCIDENTS, ACCIDENT RATES, AND FATALITIES--
U.S. AIR CARRIER ALL OPERATIONS: 1971-1980*

Year	Number of Accidents		Aircraft Miles Flown (000)A	Accident Rate Per Million Aircraft Miles Flown		Fatalities		
	Total	Fatal		Total Accidents	Fatal Accidents	Total	Passengers	Crew and Others
1971	48	8(B)	2,660,731	0.018	0.002	203	174	29
1972	50	8	2,619,043	0.019	0.003	190	160	30
1973	43	9	2,646,669	0.016	0.003	227	200	27
1974	47	9	2,464,295	0.019	0.003	467	421	46
1975(C)	45	3	2,477,764	0.018	0.001	124	113	11
1976	28	4	2,568,113	0.011	0.002	45	39	6
1977	26	5	2,684,072	0.010	0.002	656	382	274
1978	24	6	2,742,860	0.009	0.002	163	141	22
1979(D)	32(R)	6	2,899,131	0.011	0.002	355(R)	323(R)	32
1980	20	2	3,035,600	0.007	0.001	14	11	3

(A) Nonrevenue miles of the supplemental air carriers are not reported.

(B) Includes midair collision accidents nonfatal to air carrier occupants. Number of accidents excluded from fatal accident rates (1971-2).

(C) Beginning in 1975, figures include accidents involving commercial operators of large aircraft.

(D) Beginning in 1979, figures include accidents involving deregulated all cargo carriers.

(R) Revised

* Preliminary

NOTE: Sabotage accident (9/8/74) is included in all computations except rates. In 1977, Fatalities (Other) includes 248 on aircraft of foreign registry.

SOURCE: National Transportation Safety Board.

1981-1984 data not available at time of publication by EPA.

AIRCRAFT ACCIDENTS, FATALITIES AND ACCIDENT RATES--
U.S. GENERAL AVIATION FLYING: 1971-1980

Year	Accidents		Fatalities	Aircraft Hours Flown (000)	Accident Rates 100,000 Aircraft Hours	
	Total	Fatal			Total	Fatal
1971	4,648	661	1,355	25,512	18.2	2.59
1972	4,256	695(A)	1,426(B)	26,974	15.8	2.57
1973	4,255	723(A)	1,412	29,974	14.2	2.41
1974	4,425	729(A)	1,438	31,413	14.1	2.31
1975	4,237	675(A)	1,345	32,024	13.2	2.10
1976	4,193	695	1,320	33,922	12.3	2.04
1977	4,286	702	1,436	35,792	12.0	1.96
1978R	4,494	793	1,770(B)	39,409	11.4	2.01
1979R	4,051	682	1,382	43,417	9.3	1.57
1980P	3,799	677	1,375	41,300	9.2	1.64

(A) Suicide/sabotage accidents are included in all computations except for rates (1970-1, 1972-3, 1973-2, 1974-2, 1975-2, 1976-4, 1977-1).

(B) Includes air carrier fatalities (1972-5, 1978-142) when in collision with general aviation aircraft.

SOURCE: National Transportation Safety Board.

P - Preliminary.
R - Revised.

COMPARATIVE ACCIDENT DATA: 1970 THROUGH 1979
(PASSENGER FATALITIES PER 100 MILLION PASSENGER-MILES)

YEAR	PASSENGER AUTOMOBILES AND TAXIS	BUSES	RAILROAD PASSENGER TRAINS	DOMESTIC SCHEDULED AIR TRANSPORT PLANES
1970	2.10	.19	.09	.00
1971	1.90	.19	.24	.15
1972	1.90	.19	.53	.13
1973	1.70	.24	.07	.10
1974	1.50	.21	.07	.12
1975	1.40	.15	.08	.08
1976	1.34	.17	.05	.003
1977	1.33	.13	.04(R)	.04
1978	1.30	.17	.13	.01
1979	1.31	.15	.05	.12

SOURCE: MOTOR VEHICLE (AUTOMOVILES, TAXIS, AND BUSES) AND RAILROAD PASSENGER TRAIN DATA FROM THE NATIONAL SAFETY COUNCIL. DOMESTIC SCHEDULED AIR TRANSPORT DATA FROM THE NATIONAL TRANSPORTATION SAFETY BOARD.

(R): REVISED

APPENDIX 8. EVANSVILLE GROUP QUARTERS

GROUP QUARTERS POPULATION FOR 1985

Institution/Address	Census Tract	Population
Alpha Omega Psi Lower Mt. Vernon Road	104.01	3
Bethel Sanitarium 6015 Kratzville Road	39	64
Braun's Nursing Home 909 First Avenue	26	55
Brentwood Convalescent Center 30 E. Chandler Avenue	16	28
Christ the King Rectory 3109 Bayard Park Drive	5	2
Christian Home 1615 N. Fulton Avenue	27	closed
City-County Jail Civic Center Complex	18	208
Columbia Health Care facility 1100 N. Read Street	25	25
Columbia Nursing Plaza 621 W. Columbia Street	20	128
Corpus Christi Rectory 5528 Hogue Road	104.1	2
Daughters of Charity 9400 New Harmony Road	105	20
Evansville Healthcare Center 4301 Washington Avenue	37.02	118
Evansville Protestant Home 3701 Washington Avenue	37.02	137
Evansville State Hospital 3200 Lincoln Avenue	37.01	535
Gertha's Nursing Center 617 Oakley Street	20	152
Good Samaritan Home 601 N. Boeke Road	2.02	112

Institution/Address	Census Tract	Population
Hillcrest Washington Home 2700 W. Indiana, P.O. Box 6347	30	43
Holiday Home Healthcare Community 1201 Buena Vista Road	39	202
Holy Redeemer Convent 924 W. Mill Road	39	6
Holy Redeemer Rectory 918 W. Mill Road	39	2
Holy Spirit Convent and Christ the King Convent - 1760 S. Lodge	10	4
Holy Spirit Rectory 1800 S. Lodge Avenue	10	1
Lambda Chi Alpha 213 S. Weinbach Avenue	3	47
Little Sisters of the Poor 1236 Lincoln Avenue	14	138
Mater Dei Sister's Residence 1300 Harmony Road	30	11
McCurdy Residential Center 101 S.E. First Street	18	257
Medco North 650 Fairway	33	136
Memorial High School Faculty Residence 1500 Lincoln Avenue	3	6
Memorial High School Convent 1640 Lincoln Avenue	3	8
Monastery of St. Clare 6825 Nurrenbern Road	104.02	23
Normal Life Group Homes 1016 S. Weinbach Avenue	10 Locations	70
Parkview Convalescent Center 2819 N. St. Joseph Avenue	28	95
Phi Kappa Tau 2112 Lincoln Avenue	4	18

Institution/Address	Census Tract	Population
Smith Healthcare, Inc., dba Pinehaven Nursing Home 3400 Stocker	30	93
Regina Pacis Home 3900 Washington Avenue	37.01	124
Res-Care Community Alternatives 862-A S. Green River Road	7 Locations	53
Sacred Heart Rectory 2701 W. Franklin Street	30	2
St. Agnes Convent 1626 Glendale Avenue	31	3
St. Agnes Rectory 1600 Glendale Avenue	31	2
St. Anthony Convent 718 First Avenue	19	7
St. Anthony Rectory 704 First Avenue	19	3
St. Benedict Convent 1328 Lincoln Avenue	14	9
St. Benedict Rectory 1312 Lincoln avenue	14	4
St. John Rectory 617 Bellemeade Avenue	15	1
St. Joseph Convent 618 E. Virginia Street	21	5
St. Joseph Rectory 600 E. Virginia Street	21	2
St. Mary Rectory 609 Cherry Street	16	1
St. Theresa Convent 725 Wedeking	24	4
St. Theresa Rectory 600 Herndon	24	3

Institution/Address	Census Tract	Population
St. Vincent Day Care Center 611 First Avenue	19	7
Second Chance Halfway House 3901 Kratzville Road	39	68
Seton Manor 800 St. Mary's Drive	37.01	54
Siena Hall 2735 1/2 W. Franklin Street	30	9
Sigma Alpha Epsilon 1732 Lincoln Avenue	6	5
Sigma Phi Epsilon 1332 Lincoln Avenue	14	15
Tau Kappa Epsilon 1119 Lincoln Avenue	15	15
Tau Kappa Epsilon 317 N. Wabash	28	5
University of Evansville 1700 Lincoln Avenue P.O. Box 329	3	950
Welborn Hospital Medical Center 500 S.E. Fourth Street	16	closed
Woodbridge Health Care Center 815 Second Avenue	16	56
	TOTAL (S)	4156

APPENDIX 9. OHIO RIVER PCB CONCENTRATIONS IN FISH

1983 ORSANCO OHIO RIVER FISH SURVEY
CHANNEL CATFISH FILLETS

Tag #	Site	Date Caught	L. (cm)	W. (kg)	% Fat	(ppm) PCB
62	Monongahela R.	9/7/83	47	1.13	9.30	4.46
63	Monongahela R.	9/7/83	44	0.85	0.74	1.03
64	Monongahela R.	9/7/83	34	0.31	4.20	0.95
65	Allegheny R.	9/8/83	41	0.62	12.56	2.63
70	Allegheny R.	9/8/83	37	0.39	6.74	1.11
71	Allegheny R.	9/8/83	38	0.45	5.74	0.71
56	Dashield	9/9/83	41	0.57	11.26	2.45
55	Dashield	9/9/83	44	0.65	1.78	0.97
54	Dashield	9/9/83	43	0.76	5.64	3.43
444	New Cumberland	9/20/83	41	0.62	4.96	1.68
445	New Cumberland	9/20/83	42	0.65	2.22	0.30
442	New Cumberland	9/20/83	37	0.60	6.80	1.66
212	Pike Island	9/21/83	38	0.60	6.34	1.79
213	Pike Island	9/21/83	44	0.71	6.20	2.58
214	Pike Island	9/21/83	50	1.22	11.6	2.59
16	Hannibal	8/19/83	39	0.62	0.76	0.65
19	Hannibal	8/19/83	44	0.91	5.78	1.30
33	Hannibal	8/19/83	43	0.91	10.0	2.30
400	Willow Isl.	9/22/83	44	1.11	6.36	1.90
399	Willow Isl.	9/22/83	57	2.04	11.8	3.57
395	Willow Isl.	9/22/83	55	1.79	10.48	1.34
KWP-4**	Big Sandy R.	Oct 15	43.9	.78	0.18	0.10
KWP-5	Big Sandy R.	Oct 15	31.8	0.22	0.70	0.17
KWP-6	Big Sandy R.	Oct 15*	58.4	1.90	9.02	2.05
461	Gallipolis	10/6/83	33	0.31	3.76	0.67
462	Gallipolis	10/6/83	47	1.05	16.48	1.88
463	Gallipolis	10/6/83	50	1.25	5.00	1.11
404	[illegible]					

Tag #	Site	Date Caught	L. (cm)	W. (kg)	% Fat	(ppm) PCB
199	Meldahl	9/27/83	64	2.55	8.92	3.02
200	Meldahl	9/27/83	47	1.02	6.82	1.45
201	Meldahl	9/27/83	34	0.37	8.12	0.49
JPH 5**	Licking R.	Oct 19*	48.8	1.27	1.54	0.90
JPH 6	Licking R.	Oct 19	42.2	0.80	4.06	3.43
300	McAlpine	9/29/83	53	1.03	6.28	2.55
304	McAlpine	9/29/83	41	0.55	0.82	.55
305	McAlpine	9/29/83	48	1.16	1.36	2.50
SS 4	Ohio R.	Oct 19*	58.4	2.58	7.16	1.65
SS 5	West Pt.	Oct 19	49.3	1.23	5.20	2.54
SS 6	(Mile 628)	Oct 19	45.7	1.08	6.88	2.17
DEB 4**	Green R.	Nov 22*	38.7	0.74	2.98	0.43
306	Uniontown	10/4/83	53	1.38	5.92	3.75
307	Uniontown	10/4/83	49	1.37	7.80	1.84
308*	Uniontown	10/4/83	45	0.83	1.86	.41
Spoonbill Ø	Uniontown	10/4/83	42	0.21	4.58	.22
315	Smithland	10/5/83	50	1.29	7.46	.87
316	Smithland	10/5/83	44	1.09	7.30	1.72
317	Smithland	10/5/83	39	0.73	5.06	.69

* Blue Catfish
** Flathead Catfish
Ø Whole Fish
T (Trace) - Less than 0.01 ppm.

1983 ORSANCO OHIO R[illegible] [illegible] SURVEY
CARP FILLETS

Tag #	Site	Date Caught	L. (cm)	W. (kg)	% Fat	(ppm) PCB
59	Monon[illegible] R.	9/7/83	38	0.65	0.62	0.20
60	Monong[illegible] R.	9/7/83	47	1.08	0.62	0.14
61	Monong[illegible]la R.	9/7/83	37	0.76	1.26	0.27
(Drum) 76*	Allegheny R.	9/8/83	34	0.58	3.36	0.97
72	Allegheny R.	9/8/83	39	0.74	0.74	0.18
69	Dashiel[illegible]	9/9/83	42	0.82	1.00	1.24
67	Dashiel[illegible]	9/9/83	44	1.13	0.70	1.07
57	Dashiel[illegible]	/9/83	37	0.68	0.84	0.36
431	New Cumberla[illegible]	/20/83	39	0.48	2.32	0.70
432	New Cumber[illegible]	/20/83	41	0.48	0.84	0.36
441	New Cumbe[illegible]	/20/83	43	1.08	2.32	0.71
209	Pike Is[illegible]nd	/21/83	42	0.99	2.96	.56
210	Pike Islan[illegible]	/21/83	42	0.96	3.58	0.26
211	Pike Islan[illegible]	/21/83	43	0.85	0.74	0.26
32	Hannibal	/19/83	44	1.08	2.26	0.33
34	Hannibal	/19/83	44	1.15	6.28	0.76
35	Hannibal	/19/83	43	1.05	2.36	0.45
398	Willow Isl.	9/22/83	51	1.84	3.38	0.43
394	Willow Isl.	9/22/83	46	1.45	8.28	1.15
393	Willow Isl.	9/22/83	50	1.19	1.80	.41
KWP-1	Big Sandy R.	Oct 15	55.9	2.22	6.98	0.65
KWP-2	Big Sandy R.	Oct 15*	56.6	2.25	2.42	0.34
KWP-3	Big Sandy R.	Oct 15	54.6	2.06	2.86	0.25
464	Gallipolis	10/6/83	51	2.04	8.46	1.85
460	Gallipolis	10/6/83	57	2.78	3.92	0.85
401	Belleville	10/2/83	50	1.90	7.34	1.92
402	Belleville	10/2/83	48	1.62	5.26	1.55
403	Belleville	10/2/83	46	1.22	1.24	0.23
413	Racine	10/4/83	53	2.01	9.98	2.46
414	Racine	10/4/83	55	1.90	1.54	0.63
415	Racine	10/4/83	48	1.28	1.60	0.38
194	Meldahl	9/27/83	52	1.79	1.2	0.34
195	Meldahl	9/27/83	51	1.70	0.48	0.16
198	Meldahl	9/27/83	48	1.59	0.98	0.33

Tag #	Site	Date Caught	L. (cm)	W. (kg)	% Fat	(ppm) PCB
JPH 1	Licking R.	Oct 15*	48.3	1.58	0.42	0.13
JPH 2	Licking R.	[illegible]	45.5	1.38	2.00	0.11
JPH 3*	Licking R.	Oct [illegible]	39.9	0.95	0.52	0.58
JPH 4*	Licking R.	[illegible]	36.1	0.66	0.70	0.14
301	McAlpine	[illegible]/83	56	3.11	1.06	0.42
302	McAlpine	9/[illegible]3	50	1.83	0.90	.17
303	McAlpine	9/[illegible]3	56	2.99	0.44	.12
SS 1	Ohio R.	[illegible]*	48.3	1.60	8.00	0.67
SS 2	West Pt.	[illegible]	44.7	1.13	3.64	0.28
SS 3	(Mile 628)	[illegible]	45.0	1.32	3.60	0.40
DEB 1	Green R.	[illegible]*	54.6	2.29	6.40	1.38
DEB 2	Mile 42)	Nov [illegible]	53.3	1.98	1.60	0.28
DEB 3	Mile 42)	[illegible]	46.5	1.30	1.82	0.28
309	Uniontown	10/4/83	46	1.34	0.24	.09
310	Uniontown	10/4/83	50	1.70	0.10	.07
311	Uniontown	10/4/83	51	1.62	0.16	.07
312	Smithland	10/5/83	55	2.09	0.50	.12
313	Smithland	10/5/83	56	2.14	1.66	1.78
314	Smithland	10/5/83	46	0.94	0.08	.05
RJ 1	Tenn. R.	[illegible]	55.9	2.34	3.44	0.31
RJ 2	Mile 2-5	[illegible]	39.4	.78	1.36	0.08
RJ 3**	Mile 2-5	[illegible]	39.4	0.74	1.18	0.24

T (Trace) - Less than 0.01 ppm.
* B. M. Buffalo
** River Carpsucker

APPENDIX 10. LOCAL ACCIDENT CHANCES AND EXPECTATIONS

UNISON Project, Local Traffic Accident Analysis

Kentucky Accident Data
Start of Reporting Period = 01/01/80
End of Reporting Period = 02/28/86
Years in Reporting Period = 6.1629

Indiana Accident Data
Start of Reporting Period = 01/01/85
End of Reporting Period = 03/31/86
Years in Reporting Period = 1.2457

Road Segment or Intersection	Number of Reported Accidents	Average Annual Accidents	Daily Vehicle Count	Annual Vehicle Count
Route 136	3	0.49	300	109,575
Route 425	11	16.50	2,500	913,125
Pen. Pky. So. to Co. Ln.	107	17.36	6,248	2,282,082
Pen. Pky. No. to Rt. 41	141	22.88	8,190	2,991,398
Rt. 41, Pen. Pky. to Barrett	123	19.96	20,803	7,598,296
Rt. 41, Barrett to Barker	295	47.87	35,227	12,866,662
Rt. 41, Barker to Rt. 414	368	59.71	30,783	11,243,491
Rt. 41, Rt.414 to Ind. Line	321	52.09	32,689	11,939,657
Total, Henderson County	1,369	222.14		
Southlane	16	12.84	26,684	9,746,331
Riverside	19	15.25	26,684	9,746,331
Covert	25	20.07	26,199	9,569,185
Washington	38	30.50	26,199	9,569,185
Bellemeade	12	9.63	26,199	9,569,185
Lincoln	19	15.25	36,692	13,401,753
Walnut	40	32.11	36,692	13,401,753
Virginia	52	41.74	34,628	12,647,877
Columbia	43	34.52	34,628	12,647,877
Morgan	33	26.49	45,591	16,652,113
Non-Intersection (+5%)	15	11.92	32,020	11,695,159
Total, Evansville	312	250.34		

Annual Trips	Common	North	South	Estimated Values:
TF-1	1,540	1,260.7	279.3	Traffic counts, Rt. 136
TF-X	1,570	1,285.3	284.7	and Rt. 425;
TF-2	45	45.0	0.0	Accident Rate, Evansville
Residues	74	59.2	14.8	non-intersections

Annual Accidents Expected

Road Segment or Intersection	TF-1	TF-X	TF-2	Residues	Drums	Tankers	Trucks
Route 136	0.00684	0.00697	0.00020	0.00033	0.01382	0.00053	0.01434
Route 425	0.02783	0.02837	0.00081	0.00134	0.05620	0.00215	0.05835
Pen. Pky. So. to Co. Ln.	0.00212	0.00217	0.00000	0.00011	0.00429	0.00011	0.00440
Pen. Pky. No. to Rt. 41	0.00964	0.00983	0.00034	0.00045	0.01947	0.00080	0.02027
Rt. 41, Pen. Pky. to Barrett	0.00331	0.00338	0.00012	0.00016	0.00669	0.00027	0.00696
Rt. 41, Barrett to Barker	0.00469	0.00478	0.00017	0.00022	0.00947	0.00039	0.00986
Rt. 41, Barker to Rt. 414	0.00670	0.00683	0.00024	0.00031	0.01352	0.00055	0.01407
Rt. 41, Rt. 414 to Ind. Line	0.00550	0.00561	0.00020	0.00026	0.01111	0.00045	0.01156
Total, Henderson County	0.06663	0.06793	0.00208	0.00318	0.13456	0.00526	0.1398[illegible]
Southlane	0.00166	0.00169	0.00006	0.00008	0.00336	0.00014	0.00349
Riverside	0.00197	0.00201	0.00007	0.00009	0.00398	0.00016	0.00415
Covert	0.00264	0.00270	0.00009	0.00012	0.00534	0.00022	0.00556
Washington	0.00402	0.00410	0.00014	0.00019	0.00812	0.00033	0.00845
Bellemeade	0.00127	0.00129	0.00005	0.00006	0.00256	0.00010	0.00267
Lincoln	0.00143	0.00146	0.00005	0.00007	0.00290	0.00012	0.00302
Walnut	0.00302	0.00308	0.00011	0.00014	0.00610	0.00025	0.00635
Virginia	0.00416	0.00424	0.00015	0.00020	0.00840	0.00034	0.00875
Columbia	0.00344	0.00351	0.00012	0.00016	0.00695	0.00028	0.00723
Morgan	0.00201	0.00204	0.00007	0.00009	0.00405	0.00017	0.004[illegible]
Non-Intersection (+5%)	0.00129	0.00131	0.00005	0.00006	0.00260	0.00011	0.00270
Total, Evansville	0.02691	0.02744	0.00096	0.00126	0.0543532	0.0022245	0.0565777
Total Measured	0.09355	0.09537	0.00304	0.00444	0.18892	0.00748	0.19640

Road Segment or Intersection	Accidents Expected Over Twenty Years TF-1	TF-X	TF-2	Residues	Drums	Tankers	Trucks
Route 136	0.13683	0.13949	0.00400	0.00657	0.27632	0.01057	0.28689
Route 425	0.55655	0.56739	0.01626	0.02674	1.12394	0.04301	1.16695
Pen. Pky. So. to Co. Ln.	0.04250	0.04332	0.00000	0.00225	0.08582	0.00225	0.08807
Pen. Pky. No. to Rt. 41	0.19284	0.19660	0.00688	0.00906	0.38945	0.01594	0.40539
Rt. 41, Pen. Pky. to Barrett	0.06623	0.06752	0.00236	0.00311	0.13375	0.00547	0.13922
Rt. 41, Barrett to Barker	0.09380	0.09563	0.00335	0.00440	0.18943	0.00775	0.19719
Rt. 41, Barker to Rt. 414	0.13391	0.13652	0.00478	0.00629	0.27043	0.01107	0.28149
Rt. 41, Rt.414 to Ind. Line	0.10999	0.11214	0.00393	0.00517	0.22213	0.00909	0.23123
Total, Henderson County	1.33265	1.35862	0.04156	0.06359	2.69127	0.10516	2.79643
Southlane	0.03323	0.03388	0.00119	0.00156	0.06710	0.00275	0.06985
Riverside	0.03946	0.04023	0.00141	0.00185	0.07969	0.00326	0.08295
Covert	0.05288	0.05391	0.00189	0.00248	0.10679	0.00437	0.11116
Washington	0.08038	0.08195	0.00287	0.00377	0.16232	0.00664	0.16897
Bellemeade	0.02538	0.02588	0.00091	0.00119	0.05126	0.00210	0.05336
Lincoln	0.02870	0.02926	0.00102	0.00135	0.05795	0.00237	0.06032
Walnut	0.06041	0.06159	0.00216	0.00284	0.12200	0.00499	0.12700
Virginia	0.08322	0.08484	0.00297	0.00391	0.16806	0.00688	0.17494
Columbia	0.06881	0.07016	0.00246	0.00323	0.13897	0.00569	0.14466
Morgan	0.04011	0.04089	0.00143	0.00188	0.08101	0.00332	0.08432
Non-intersection (+5%)	0.02570	0.02620	0.00092	0.00121	0.05190	0.00212	0.05403
Total, Evansville	0.53828	0.54878	0.01921	0.02528	1.08706	0.04449	1.13155
Total Measured	1.87093	1.90741	0.06078	0.08887	3.77834	0.14965	3.92799

Road Segment or Intersection	TF-1	TF-X	TF-2	Residues	Drums	Tankers	Trucks
	Chance of One or More Accidents in Any Year						
Route 136	0.00682	0.00695	0.00020	0.00033	0.01372	0.00053	0.01424
Route 425	0.02744	0.02797	0.00081	0.00134	0.05465	0.00215	0.05668
Pen. Pky. So. to Co. Ln.	0.00212	0.00216	0.00000	0.00011	0.00423	0.00011	0.00439
Pen. Pky. No. to Rt. 41	0.00960	0.00978	0.00034	0.00045	0.01928	0.00080	0.02007
Rt. 41, Pen. Pky. to Barrett	0.00331	0.00337	0.00012	0.00016	0.00667	0.00027	0.00694
Rt. 41, Barrett to Barker	0.00468	0.00477	0.00017	0.00022	0.00943	0.00039	0.00981
Rt. 41, Barker to Rt. 414	0.00667	0.00680	0.00024	0.00031	0.01343	0.00055	0.01398
Rt. 41, Rt.414 to Ind. Line	0.00548	0.00559	0.00020	0.00026	0.01105	0.00045	0.01149
Total, Henderson County	0.06446	0.06568	0.00208	0.00317	0.12590	0.00524	0.13049
Southlane	0.00166	0.00169	0.00006	0.00008	0.00335	0.00014	0.00349
Riverside	0.00197	0.00201	0.00007	0.00009	0.00398	0.00016	0.00414
Covert	0.00264	0.00269	0.00009	0.00012	0.00533	0.00022	0.00554
Washington	0.00401	0.00409	0.00014	0.00019	0.00808	0.00033	0.00841
Bellemeade	0.00127	0.00129	0.00005	0.00006	0.00256	0.00010	0.00266
Lincoln	0.00143	0.00146	0.00005	0.00007	0.00289	0.00012	0.00301
Walnut	0.00302	0.00307	0.00011	0.00014	0.00608	0.00025	0.00633
Virginia	0.00415	0.00423	0.00015	0.00020	0.00837	0.00034	0.00871
Columbia	0.00343	0.00350	0.00012	0.00016	0.00692	0.00028	0.00721
Morgan	0.00200	0.00204	0.00007	0.00009	0.00404	0.00017	0.00421
Non-Intersection (+5%)	0.00128	0.00131	0.00005	0.00006	0.00259	0.00011	0.00270
Total, Evansville	0.02656	0.02707	0.00096	0.00126	0.05290	0.00222	0.05501
Total Measured	0.08930	0.09096	0.00303	0.00443	0.17215	0.00745	0.1783[illegible]

Road Segment or Intersection	Chance of One or More Accidents in Twenty Years						
	TF-1	TF-X	TF-2	Residues	Drums	Tankers	Trucks
Route 136	0.12788	0.13020	0.00399	0.00655	0.24143	0.01052	0.24941
Route 425	0.42682	0.43300	0.01613	0.02639	0.67501	0.04209	0.68869
Pen. Pky. So. to Co. Ln.	0.04161	0.04239	0.00000	0.00225	0.08224	0.00225	0.08430
Pen. Pky. No. to Rt. 41	0.17539	0.17849	0.00686	0.00901	0.32257	0.01581	0.33328
Rt. 41, Pen. Pky. to Barrett	0.06408	0.06529	0.00236	0.00311	0.12519	0.00546	0.12997
Rt. 41, Barrett to Barker	0.08954	0.09120	0.00334	0.00440	0.17257	0.00772	0.17896
Rt. 41, Barker to Rt. 414	0.12533	0.12761	0.00477	0.00627	0.23695	0.01101	0.24535
Rt. 41, Rt.414 to Ind. Line	0.10416	0.10608	0.00392	0.00515	0.19919	0.00905	0.20644
Total, Henderson County	0.73622	0.74299	0.04071	0.06161	0.93221	0.09982	0.93897
Southlane	0.03268	0.03331	0.00119	0.00156	0.06490	0.00274	0.06747
Riverside	0.03869	0.03943	0.00141	0.00185	0.07659	0.00326	0.07960
Covert	0.05151	0.05248	0.00189	0.00248	0.10129	0.00436	0.10521
Washington	0.07723	0.07868	0.00286	0.00377	0.14983	0.00662	0.15546
Bellemeade	0.02506	0.02555	0.00091	0.00119	0.04997	0.00210	0.05196
Lincoln	0.02829	0.02883	0.00102	0.00135	0.05630	0.00237	0.05854
Walnut	0.05862	0.05973	0.00215	0.00283	0.11486	0.00498	0.11926
Virginia	0.07985	0.08134	0.00297	0.00390	0.15470	0.00685	0.16049
Columbia	0.06650	0.06775	0.00245	0.00323	0.12975	0.00567	0.13468
Morgan	0.03932	0.04007	0.00143	0.00188	0.07781	0.00331	0.08086
Non-Intersection (+5%)	0.02537	0.02586	0.00092	0.00121	0.05058	0.00212	0.05259
Total, Evansville	0.41625	0.42235	0.01903	0.02496	0.66280	0.04352	0.67747
Total Measured	0.84602	0.85154	0.05897	0.08504	0.97714	0.13899	0.98032

APPENDIX 11

SUMMARY TABLE

SUMMARY TABLE

INHALATION EXPOSURE MODELS	EXPECTED EVENTS IN TWENTY YEARS	DURATION OF EVENT	FIRST RECEPTOR / SECOND RECEPTOR / THIRD RECEPTOR / FOURTH RECEPTOR	DURATION OF EXPOSURE	NUMBER OF PERSONS NEAR RECEPTOR	TOTAL ORGANIC POLLUTANT CONCENTRATION	TOTAL PCB CONCENTRATION	METEORLOGICAL CONDITIONS PRODUCING EXPOSURE
PERMITTED[1] RELEASES	Continuous	24 Hours Per Day 365 Days Per Year	Riverport Warehouses and Docks	Yearly Average	10	82.7 ng/m³	<0.0827 µg/m³	Evansville Composite
			Henderson Community College	Yearly Average	<1000	9.45 ng/m³	<0.00945 µg/m³	Evansville Composite
			Residence Near Airport	Yearly Average	Unknown	8.40 ng/m³	<0.00840 µg/m³	Evansville Composite
			Nearest Census Tract	Yearly Average	2419	0.98 ng/m³	<0.00098 µg/m³	Evansville Composite
SPILL[5] INSIDE PLANT	Insufficient[2] Data	24 Hours	Observer Ten Meters Away	Until Wind Changes	None[3]	37.1 µg/m³	<1.98 ng/m³	Wind, 2.5 m/s Stability Class F
			Observer One Hundred Meters Away	Until Wind Changes	None[3]	5.64 µg/m³	<295 ng/m³	Wind, 2.5 m/s Stability Class F
			Observer One Kilometer Away	Until Wind Changes	<500	201 ng/m³	<10.5 µg/m³	Wind, 2.5 m/s Stability Class F
			Observer Three Kilometers Away	Until Wind Changes	<1000	16.6 ng/m³	<0.86 µg/m³	Wind, 2.5 m/s Stability Class F
POLLUTION[8] CONTROL EQUIPMENT FAILURE	Insufficient[4] Data	Seven Days	Observer Ten Meters Away	Until Wind Changes	30	not modeled	not modeled	Wind, 2.5 m/s Stability Class E
			Observer One Hundred Meters Away	Until Wind Changes	30	15.6 µg/m³	<311 µg/m³	Wind, 2.5 m/s Stability Class E
			Observer One Kilometer Away	Until Wind Changes	<500	471 ng/m³	<9.42 µg/m³	Wind, 2.5 m/s Stability Class E
			Observer Three Kilometers Away	Until Wind Changes	<1000	88.2 ng/m³	<1.76 µg/m³	Wind, 2.5 m/s Stability Class E
PLANE-CRASH[9] PART ONE INITIAL IMPACT	0.00006	Several Seconds	Observer Ten Meters Away	Zero	30	Zero	Zero	Wind, 1.0 m/s Army Stability Class 1
			Observer One Hundred Meters Away	~One Minute	30	149 µg/m³	<3.0 µg/m³	Wind, 1.0 m/s Army Stability Class 1
			Observer One Kilometer Away	~Five Minutes	<500	376 µg/m³	<7.5 µg/m³	Wind, 1.0 m/s Army Stability Class 1
			Observer Three Kilometers Away	~Fifteen Minutes	<1000	37.8 µg/m³	<756 µg/m³	Wind, 1.0 m/s Army Stability Class 1
PLANE-CRASH[6,10] PART TWO FUEL FIRE	0.00006	Five Minutes	Observer Ten Meters Away	Zero	30	Zero	Zero	Wind, 1.5 m/s Stability Class A
			Observer One Hundred Meters Away	Zero	30	Zero	Zero	Wind, 1.5 m/s Stability Class A
			Observer One Kilometer Away	~Eight Minutes	<500	496 ng/m³	374 ng/m³	Wind, 1.5 m/s Stability Class A
			Observer Three Kilometers Away	~Ten Minutes	<1000	103 ng/m³	95 ng/m³	Wind, 1.5 m/s Stability Class A

PLANE CRASH[3] PART THREE SPILL IN PLANT	0.0086	72 Hours	Observer Ten Meters Away	Until Wind Changes	None[3]	87.1 $\mu g/m^3$	<1.93 ng/m^3	Wind, 2.5 m/s Stability Class F
			Observer One Hundred Meters Away	Until Wind Changes	None[3]	5.64 $\mu g/m^3$	<298 pg/m^3	Wind, 2.5 m/s Stability Class F
			Observer One Kilometer Away	Until Wind Changes	<500	201 ng/m^3	<10.5 pg/m^3	Wind, 2.5 m/s Stability Class F
			Observer Three Kilometers Away	Until Wind Changes	<1000	16.6 ng/m^3	<0.86 pg/m^3	Wind, 2.5 m/s Stability Class F
MAXIMUM[11] RESIDUE SPILL ON HOT PAVEMENT	<<0.074	One Hour	Observer Ten Meters Away	Until Wind Changes	Emergency Response[7] Personnel	257 mg/m^3	<819 $\mu g/m^3$	Wind, 5.0 m/s [8] Stability Class D
			Observer One Hundred Meters Away	Until Wind Changes	Emergency Response[7] Personnel	20.3 mg/m^3	<64.7 $\mu g/m^3$	Wind, 5.0 m/s Stability Class D
			Observer One Kilometer Away	Until Wind Changes	<1000	4.38 mg/m^3	<14.0 $\mu g/m^3$	Wind, 2.5 m/s Stability Class F
			Observer Three Kilometers Away	Until Wind Changes	<2000	961 $\mu g/m^3$	<3.06 $\mu g/m^3$	Wind, 2.5 m/s Stability Class F
LARGE[12] RESIDUE SPILL ON HOT PAVEMENT	<0.074	One Hour	Observer Ten Meters Away	Until Wind Changes	Emergency Response[7] Personnel	35.5 mg/m^3	<113 $\mu g/m^3$	Wind, 5.0 m/s Stability Class D
			Observer One Hundred Meters Away	Until Wind Changes	Emergency Response[7] Personnel	2.80 mg/m^3	<8.93 $\mu g/m^3$	Wind, 5.0 m/s Stability Class D
			Observer One Kilometer Away	Until Wind Changes	<1000	604 $\mu g/m^3$	<1.93 $\mu g/m^3$	Wind, 2.5 m/s Stability Class F
			Observer Three Kilometers Away	Until Wind Changes	<2000	133 $\mu g/m^3$	<424 ng/m^3	Wind, 2.5 m/s Stability Class F
MAXIMUM[13] RESIDUE SPILL ON WARM PAVEMENT	<<0.11	One Hour	Observer Ten Meters Away	Until Wind Changes	Emergency Response[7] Personnel	48.6 mg/m^3	<92.5 $\mu g/m^3$	Wind, 5.0 m/s Stability Class D
			Observer One Hundred Meters Away	Until Wind Changes	Emergency Response[7] Personnel	3.84 mg/m^3	<7.31 $\mu g/m^3$	Wind, 5.0 m/s Stability Class D
			Observer One Kilometer Away	Until Wind Changes	<1000	820 $\mu g/m^3$	<1.90 $\mu g/m^3$	Wind, 2.5 m/s Stability Class F
			Observer Three Kilometers Away	Until Wind Changes	<2000	182 $\mu g/m^3$	<346 ng/m^3	Wind, 2.5 m/s Stability Class F

Notes.

1. Assumes 400 lb/yr total organics; see § 5.1.3
2. Remote
3. Assumes plant personnel are evacuated
4. Impossible if [illegible] follows proposed protocols
5. 404 square meters covered by spill @ 60°C, spill assumed not to cool
6. Smoke and soot [illegible] concentrations only
7. Until area is cleared, may include innocent by-standers.
8. Total failure of carbon adsorption on highest volume vent line.
9. Assumes high velocity and high angle of impact, for other assumptions, see § 5.2.1.7
10. Assumes 26 gal. of fuel, temperature of smoke cloud of 400°C
11. 450 square meter spill on 60°C pavement
12. 50 square meter spill on 60°C pavement
13. 400 square meter spill on 35°C pavement.

Summary Table:

Expanded Version

SUMMARY TABLE

INHALATION EXPOSURE MODELS	EXPECTED EVENTS IN TWENTY YEARS	DURATION OF EVENT	FIRST RECEPTOR SECOND RECEPTOR THIRD RECEPTOR FOURTH RECEPTOR	DURATION OF EXPOSURE
PERMITTED[1] RELEASES	Continuous	24 Hours Per Day 365 Days Per Year	Riverport Warehouse and Docks	Yearly Average
			Henderson Community College	Yearly Average
			Residence Near Airport	Yearly Average
			Nearest Census Tract	Yearly Average
SPILL[5] INSIDE PLANT	Insufficient Data	24 Hours	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes

NUMBER OF PERSONS NEAR RECEPTOR	TOTAL ORGANIC POLLUTANT CONCENTRATION	TOTAL PCB CONCENTRATION	METEORLOGICAL CONDITIONS PRODUCING EXPOSURE
10	82.7 ng/m^3	<0.0827 pg/m^3	Evansville Composite
<1000	9.45 ng/m^3	<0.00945 pg/m^3	Evansville Composite
Unknown	8.48 ng/m^3	<0.00848 pg/m^3	Evansville Composite
2419	0.58 ng/m^3	<0.00058 pg/m^3	Evansville Composite
None[3]	37.1 $\mu g/m^3$	<1.93 ng/m^3	Wind, 2.5 m/s Stability Class F
None[3]	5.64 $\mu g/m^3$	<293 pg/m^3	Wind, 2.5 m/s Stability Class F
<500	201 ng/m^3	<10.5 pg/m^3	Wind, 2.5 m/s Stability Class F
<1000	16.6 ng/m^3	<0.86 pg/m^3	Wind, 2.5 m/s Stability Class F
			Wind, 2.5 m/s

POLLUTION[6] CONTROL EQUIPMENT FAILURE	Insufficient Data[4]	Seven Days	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes
PLANE CRASH PART ONE INITIAL IMPACT	0.00003	Several Seconds	Observer Ten Meters Away	Zero
			Observer One Hundred Meters Away	One Minute
			Observer One Kilometer Away	~One Minute
			Observer Three Kilometers Away	~Fifteen Minutes
PLANE CRASH[6] PART TWO FUEL FIRE	0.00003	Five Minutes	Observer Ten Meters Away	Zero
			Observer One Hundred Meters Away	Zero
			Observer One Kilometer Away	~Eight Minutes
			Observer Three Kilometers Away	~Ten Minutes
PLANE CRASH PART THREE SPILL IN PLANT	0.0003	72 Hours	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes

30	not modeled	not modeled	Wind, 2.5 m/s Stability Class E
30	15.6 µg/m^3	<311 pg/m^3	Wind, 2.5 m/s Stability Class E
<500	471 ng/m^3	<9.42 pg/m^3	Wind, 2.5 m/s Stability Class E
<1000	88.2 ng/m^3	<1.76 pg/m^3	Wind, 2.5 m/s Stability Class E
30	Zero	Zero	Wind, 1.0 m/s Army Stability Class 1
30	149 pg/m^3	<3.0 pg/m^3	Wind, 1.0 m/s Army Stability Class 1
<500	376 µg/m^3	<7.5 µg/m^3	Wind, 1.0 m/s Army Stability Class 1
<1000	37.8 µg/m^3	<756 pg/m^3	Wind, 1.0 m/s Army Stability Class 1
30	Zero	Zero	Wind, 1.5 m/s Stabilty Class A
30	Zero	Zero	Wind, 1.5 m/s Stabilty Class A
<500	406 ng/m^3	374 ng/m^3	Wind, 1.5 m/s Stabilty Class A
<1000	103 ng/m^3	95 ng/m^3	Wind, 1.5 m/s Stabilty Class A
None[3]	37.1 µg/m^3	<1.93 ng/m^3	Wind, 2.5 m/s Stability Class F
None[3]	5.64 µg/m^3	<293 pg/m^3	Wind, 2.5 m/s Stability Class F
<500	201 ng/m^3	<10.5 pg/m^3	Wind, 2.5 m/s Stability Class F
<1000	16.6 ng/m^3	<0.86 pg/m^3	Wind, 2.5 m/s Stability Class F

			Kilometers Away	Until Wind Changes
MAXIMUM[11] RESIDUE SPILL ON HOT PAVEMENT	<<0.074	One Hour	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes
LARGE[12] RESIDUE SPILL ON HOT PAVEMENT	<0.074	One Hour	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes
MAXIMUM[13] RESIDUE SPILL ON WARM PAVEMENT	<<0.11	One Hour	Observer Ten Meters Away	Until Wind Changes
			Observer One Hundred Meters Away	Until Wind Changes
			Observer One Kilometer Away	Until Wind Changes
			Observer Three Kilometers Away	Until Wind Changes

<1000	16.6 ng/m^3	<0.86 pg/m^3	Stability Class F
Emergency Response[7] Personnel	257 mg/m^3	<819 μg/m^3	Wind, 5.0 m/s Stability Class D
Emergency Response[7] Personnel	20.3 mg/m^3	<64.7 μg/m^3	Wind, 5.0 m/s Stability Class D
<1000	4.38 mg/m^3	<14.0 μg/m^3	Wind, 2.5 m/s Stability Class F
<2000	961 μg/m^3	<3.06 μg/m^3	Wind, 2.5 m/s Stability Class F
Emergency Response[7] Personnel	35.5 mg/m^3	< 113 μg/m^3	Wind, 5.0 m/s Stability Class D
Emergency Response[7] Personnel	2.80 mg/m^3	< 8.93 μg/m^3	Wind, 5.0 m/s Stability Class D
<1000	604 μg/m^3	< 1.93 μg/m^3	Wind, 2.5 m/s Stability Class F
<2000	133 μg/m^3	<424 ng/m^3	Wind, 2.5 m/s Stability Class F
Emergency Response[7] Personnel	48.6 mg/m^3	< 92.5 μg/m^3	Wind, 5.0 m/s Stability Class D
Emergency Response[7] Personnel	3.84 mg/m^3	< 7.31 μg/m^3	Wind, 5.0 m/s Stability Class D
<1000	828 μg/m^3	< 1.58 μg/m^3	Wind, 2.5 m/s Stability Class F
<2000	182 μg/m^3	< 346 ng/m^3	Wind, 2.5 m/s Stability Class F

Notes:

1. Assumes 400 lb/yr total organics; see § 5.1.1.
2. Remote.
3. Assumes plant personnel are evacuated.
4. Impossible if UNISON follows proposed protocols.
5. 401 square meters covered by spill @ 60°C, spill assumed not to cool.
6. Smoke and soot associated emmissions only.
7. Until area is cleared, may include innocent by-standers.
8. Total failure of carbon adsorption on highest volume vent line.
9. Assumes high velocity and high angle of impact; for other assumptions, see § 5.2.1.7.
10. Assumes 26 gal. of fuel, temperature of smoke cloud of 400°C.
11. 450 square meter spill on 60°C pavement.
12. 50 square meter spill on 60°C pavement.
13. 450 square meter spill on 35°C pavement.