APPENDIX D
Organization Chart for the
Bureau of Land Recycling and Waste Management

BUREAU OF LAND RECYCLING AND WASTE MANAGEMENT

September 30, 1999

J. Snyder, Director
S. Ballard, CT2
K. Mundis, SS2

HAZARDOUS WASTE MANAGEMENT
R. Shipman, EPM
D. Brandt, ESTI*
C. Gilmore, CT3
V. Williams, CT2

HAZARDOUS WASTE PERMITS
J. Hayes, SWPSS
J. Baker, SWPS
H. Lin, EPCS*
N. Molina, Hydro 2
C. Spahr, ESTI*
D. Womer, SE 4

COMPLIANCE AND MONITORING
Vacant, SWPSS
G. Kagle, SWPS
E. Karmilovich, SWPS
W. Rarick, Hydro 2
J. Roof, EC2

WASTE MINIMIZATION & PLANNING
L. Holley, EPM
J. Bednar, PA2
T. Snyder, CT2
D. Welker, CT3
Vacant, PA2

RECYCLING AND MARKETS
C. Hursh, SWPSS
E. D'Elia, SWPS
G. Harder, SWPS
G. Lincoln, SWPS
T. Pejack, SWPS
V. Tarentino, SWPS
Vacant, SWPS

PLANNING
Vacant, SWPSS
T. Hyatt, PA2
L. Knox, IW
S. Lohman, SWPS
L. Polk, DS1
J. Saxton, GSI*

LAND RECYCLING & CLEANUP PROGRAM
T. Fidler, EPM
D. Heimbach, CT2
J. Spontak, SWPS
M. Wooding, CT3

LAND RECYCLING
D. Hess, SWPSS
J. Clark-Graham, PA2
S. Fang, EC2
T. Leaver, Hydro 2
E. Shaw, SWPS
J. Shaw, EC2
T. Ung, SE3

HAZARDOUS SITES CLEANUP
D. Crownover, SWPSS
C. Kim, SWPS
R. Roush, EC2
D. Wary, SE3
Vacant, Hydro 2

CERCLA
C. Olewiler, SWPS
Vacant, EC2

STORAGE TANK CLEANUP
C. Swokel, Hydro Spvr.
D. Cordelli, Hydro 2
L. Hilbish, AA1
J. Stephenson, Hydro 2

MUNICIPAL AND RESIDUAL WASTE
W. Pounds, EPM
P. Arnt, CT2
M. Smith CT3

PERMITTING
S. Socash, SWPSS
T. Killian, SE3
G. Pine, Hydro 2
K. Satyaswaroop, SWPS

ENFORCEMENT AND BONDING
S. Sloan, SWPSS
E. Kaye, SWPS
J. Walker, AA1
T. Woy, SWPS

GENERAL PERMITS/BU
R. Hassinger, SWPSS
L. Buela, SWPS
W. LaCour, SWPS
S. Walters, EC2
Vacant, SE3

REMEDIATION SERVICES
R. Orwan, EPM
A. Cable, CT2
C. Crosson, CT3

TECHNICAL INVESTIGATIONS
K. Beard, SWPSS
J. Bartlett, SWPS
J. Fitzgerald, SE2
D. Killian, SWPS
P. Renwick, Hydro 2

SCIENTIFIC SERVICES
M. Arnold, SWPSS
J. Mattern, Hydro 2
B. Pathak, Hydro 2

GTAC/LAB CONTRACTS
G. Moulder, SWPSS
J. Benamati, AA1
H. Sharifi, SWPS
C. Sternbergh, EC2
D. Watson, C3

IRSC/REMEDIAL CONTRACTS
J. Adair, CEMGR
B. Brenan, FA
G. Hartenstein, SWPS
R. Hoffman, SWPS

REPORTING AND FEE COLLECTION
J. Beatty, EPM
T. Kunselman, CT3

FEE COLLECTION AND REPORTING
L. Tritt, SWPSS
R. Finkel, SWPS
Vacant, AA1

INFORMATION SERVICES
P. Pocavich, SWPSS
L. Fritz, DA2
A. Mann, ITG2
F. Teti, SWPS
C. Wilson, ITG2

DATA ENTRY
C. Thompson, CS2
P. Barbush, CT3
M. Dickey, CT2
S. Lear, CT2
S. Purdy, CT3
F. Seymour, CT2
S. Shirk, CT2
T. Truesdale, CT2
Vacant, CT2

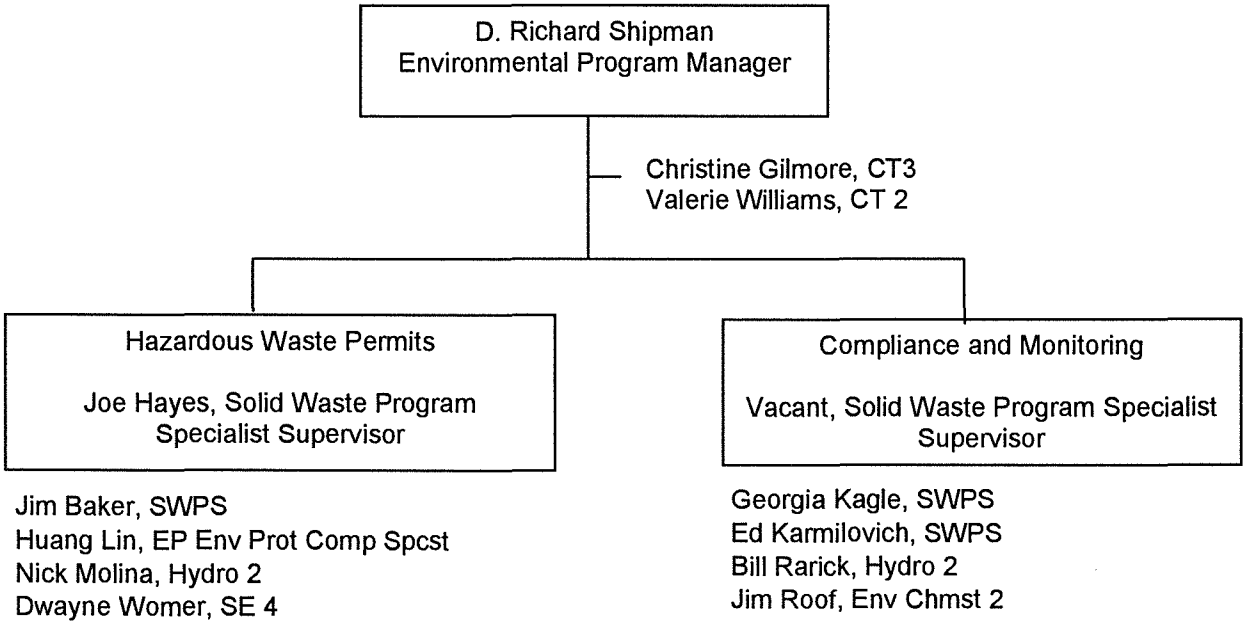
ASSISTANT DIRECTOR
G. Leader, EPM
R. Prough, CT3

PROGRAM DEVELOPMENT
Vacant, SWPSS
A. Berry, ITG1
M. Blake, PA2
M. Girton, ITT
D. Harris, PA2

PROGRAM SUPPORT
N. Miller, AO2
L. Balsbaugh, AA2
S. Kitchen, AA2
Vacant, AA1
N. Salazar, AO1
J. Biesecker, AA1
M. Gould, AA1

*Limited Term Position

DIVISION OF HAZARDOUS WASTE MANAGEMENT



Classification Abbreviations:

CT	Clerk Typist
Env Chemist	Environmental Chemist
Env Prot Spcst	Environmental Protection Specialist
Env Trainee	Environmental Trainee
EPCS	Environmental Protection Compliance Specialist
Hydro	Hydrogeologist
SE	Sanitary Engineer
SW Spcst	Solid Waste Specialist
SWPS	Solid Waste Program Specialist

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Bureau of Waste Management
Section Summaries

Division	Section & Description
Hazardous Waste Management	**Hazardous Waste Permits** This Section does all the work related to hazardous waste permits, closure plans and other *Resource Conservation and Recovery Act* (RCRA) activities (The regions are responsible for writing the permits and closure approvals). This Section provides guidance and oversight to the regions, drafts regulations, conducts public meetings/hearings and writes response documents in addition to providing training, meeting with business and industry on hazardous waste issues, helping to draft policy and acting as the liaison to the Environmental Protection Agency on RCRA permitting/closure actions. **Enforcement and Licensing** This section coordinates the hazardous waste compliance, enforcement, waste determination, transportation licensing program and the financial assurance requirements for hazardous waste facilities and attempts to assure that the programs for which the section has responsibility are implemented uniformly by the field offices. **Environmental Crimes** Works in conjunction with the Office of Attorney General to investigate and prosecute criminal violations of the Environmental Laws. The main thrust of the Section is to investigate the illegal transportation, storage and disposal of hazardous wastes. Other violations involving municipal, residual, and special handling wastes have also been prosecuted. Investigations involving violations of Air Quality Control and Water Management regulations have also been conducted.

Waste Minimization & Planning

Recycling and Markets

Responsible for providing educational, technical and financial assistance to advance the recycling of materials from the Commonwealth's municipal waste stream as related to the *Municipal Waste Planning, Recycling and Waste Reduction Act* (Act 101). The section works closely with the Regional Planning and Recycling Coordinators to promote uniformity in outreach and grants programs. It also interfaces with county and municipal recycling coordinators; recycling, source reduction and market development officials in other states on their respective issues, and participates in several interstate groups. This section also provides Act 101 funds to the Departments of Commerce, Community Affairs, Education, General Services, Transportation, the Pennsylvania Energy Office, and the Lieutenant Governor's Office to further the Commonwealth's ability to process, manufacture, and procure products made from recycled materials, and to educate our residents and local government officials on the benefits of recycling. The section maintains outside contracts for the Recycling Media Campaign, yardwaste composting educational and technical assistance, and the Pennsylvania Recycling Hotline (1-800-346-4242). Questions concerning Act 101 recycling programs, recycling grants, yard waste composting, recycling markets, and buying recycled products may be directed to this Section.

Planning

Responsible for developing and implementing the state municipal, hazardous and residual waste planning programs under the *Solid Waste Management Act* (Act 97) and the *Municipal Waste Planning, Recycling and Waste Reduction Act* (Act 101). This Section awards grants, develops policies and provides assistance to the regional Planning and Recycling Coordinators and the counties in developing and implementing county municipal waste plans. Planning also receives reports, analyze data and develops reports on municipal waste disposal capacity and inter/intrastate municipal waste flow. The updating of the state Hazardous Waste Facilities Plan and federal Capacity Assurance Plan (CAP) is coordinated by this Section.

Source Reduction

Responsible for coordinating the Department's multi-media Source Reduction Pollution Prevention Program, assisting the regions in the implementation of the source reduction strategy requirements of the residual and hazardous waste regulations and providing a pollution prevention technical assistance. It also serves as the state point of contact for several federal pollution prevention initiatives such as the:

33/50 Program- EPA initiative to achieve voluntary reductions of 17 toxic chemicals 33% by 1992 and 50% by 1995 through pollution prevention activities.

Environmental Technology Initiative- New program from EPA that provides grants for the development of pollution prevention and green technologies.

NICE3- (National Industrial Competitiveness through Energy, Environmental and Economics) Funds projects that demonstrate pollution prevention and energy conservation.

Common Sense Initiative- Designed to improve the current environmental regulation process by developing environmental protection strategies that focus on prevention on an industry-by-industry approach.

Hazardous Waste Minimization National Plan- Effort by EPA to increase the focus of the RCRA program on waste prevention and minimization.

Hazardous Sites Cleanup Program

HSCA Pre-Response

The central responsibility of this section is the "screening" of sites for responses under the *Hazardous Sites Cleanup Act* (HSCA). This screening (or site assessment) involves the assessment of site contamination, and threats posed by that contamination to human health and the environment as well as prioritizing all known potential sites, to focus state resources (staff time and HSCA fund monies) to sites with relatively larger and/or more immediate threats to human health or the environment. The particular functions assigned to this section generally involve assistance to the regional offices on various technical and decision documents, and providing recommendation to central management on decisions to pursue responses under HSCA. Other functions are associated with acting as a central "focal point" for these pre-response activities. In support of this, the section maintains information on these sites and coordinates with the Environmental Protection Agency and other offices and agencies both in and outside of the Department of Environmental Resources. Program guidance development, training, evaluations and general assistance are also a part of the responsibilities of the Pre-Response Section.

HSCA Response

Provides technical, program and enforcement oversight for all of the projects conducted at *Hazardous Site Cleanup Act* (HSCA) sites. The HSCA Response Section staff members function as technical experts to assist the regions in addressing technical issues at HSCA sites. Section staff members are also assigned as central office contacts for HSCA sites to provide the regional staff with a single point of contact in central office and to coordinate central office response activities.

GTAC/Lab Contracts

This section provides contractual services to the field offices to enable cleanups at remedial sites. Contractual services offered include basically two types: *general technical assistance services* (GTAC) which include environmental assessments, remedial investigations, feasibility studies, remedial design, risk/environmental assessments, data validation, field studies, technical support and consultation and limited legal assistance; and *laboratory services* which include Contract Laboratory Program (CLP) analytical services, non-CLP analytical services, specialized testing and support of field activities. Invoice processing and contract procurement and management activities are also functions that occur within this section. Although contracts are designed primarily to support HSCA field projects, work assignments for assistance outside of HSCA can be assigned to HSCA contractors with Program Director approval.

IRSC (Interim Response Services Contracts)/Remedial Contracts

Procures and manages the IRSCs for cleanup work at sites statewide for the six regional offices. This section reviews and approves contractor work assignments, contractor's work plans, change orders, subcontracts and contractor invoices in addition to providing contract training for the regional Hazardous Sites Cleanup Program (HSCP) staff and develops contract related policies and procedures to be followed for contractor usage. The section is also responsible for program approval of all remedial design documents and remedial contract procurement documents and also acts as the program liaison with the Bureau of Engineering on matters concerning the remedial construction on sites. This section does the program coordination and maintains data base information of off-site waste treatment/disposal from site cleanups.

Municipal and Residual Waste

Permitting

Drafts regulations and policies concerning the permitting of municipal and residual waste processing, incinerators, land application and disposal facilities. Municipal waste is usually household trash, construction/demolition waste, sewage sludge and infectious waste. Residual waste is usually non-hazardous industrial waste, coal ash, flyash, tires, used oil and used asphalt.

Enforcement and Bonding

Administers statewide municipal and residual facility inspection and enforcement program; develops policies and procedures and guidelines related to this program; provides training and technical expertise to Regional Office staff; maintains liaison with industry on transportation requirements. Reviews multi-site company insurance policies for compliance; provides assistance to Regional staff on bonding and insurance when necessary; monitors bonding requirements for permitted and closed facilities; oversees two trust fund programs developed under the *Municipal Waste Planning, Recycling and Waste Reduction Act* (Act 101).

General Permits/BU

Responsible for the review of all general permit applications for the processing and/or beneficial use of residual waste and the processing of infectious/chemotherapuetic waste. The review of these applications is culminated by either the issuance or denial of a general permit. This section is also responsible for the review and concurrence or nonconcurrence of residual waste coproduct determination concurrence requests. In addition, this section handles inquiries relative to the beneficial use of coal ash, municipal waste incinerator ash management, and infectious/chemotherapuetic waste management.

Remediation

Technical Investigations

Conducts and oversees investigations of contamination cases throughout the state. Negotiates legal agreements with companies to conduct site assessments, characterization and remediation. Provides technical assistance to Department staff, industry and the public relative to site clean-up issues. Provides guidance to Department staff and the public on the design and review of ecological risk assessments. Coordinates the Bureau's efforts regarding assessment of natural resource damages with other bureaus, state and federal agencies, and the regulated community.

Scientific Services

Provides technical expertise to waste management programs and to regional staff including such specialized services as: risk assessment and risk management functions related to contaminated sites, development of generic soil cleanup standards and groundwater parameters to implement groundwater protection, review of site-specific soil cleanup levels, environmental fate and transport modeling, database design and use, geographic information system application development, software/hardware platform optimization, network engineering and integration, Greenfields initiative implementation and technical support for non-remediation programs.

CERCLA (Comprehensive Environmental Response, Compensation and Liability Act)

Conducts a Central Office role with program oversight of the six Department of Environmental Resources Regional Offices and maintains a close working relationship with the Federal Environmental Protection Agency Region III Superfund Office. Program responsibilities include negotiation and coordination of site specific remedial cleanup activities of the hazardous waste Superfund sites. These activities include the review and development of: Remedial Investigations and Feasibility Studies, Record of Decisions, project design negotiations and operation and maintenance activities. Participation with the Federal EPA in developing State Superfund Contracts and maintaining a database reporting system and updating program guidance and policy.

Reporting and Fee Collection

Fee Collection and Reporting

Administers the *Hazardous Site Cleanup Act* (Act 108) hazardous waste transportation and management fee and the *Municipal Waste Planning, Recycling and Waste Reduction Act* (Act 101) recycling fee and host municipality benefit fee programs. Administers the hazardous and residual waste biennial report programs and oversees the hazardous waste generator and Treatment, Storage and Disposal Facilities (TSD) quarterly reporting. Other responsibilities include the resolution of problems with hazardous waste manifests and oversight of the hazardous waste manifest program.

Information Services

Responsible for the maintenance and reporting of data about municipal, residual and hazardous waste management. This includes data derived from hazardous waste manifests, hazardous and municipal waste fee reports and residual waste biennial reports. Both standard and ad hoc data reports are provided to the Bureau, the regional staff and the public. The section administers the Waste Information Management System (WIMS) and the Optical Imaging System (OIS). The section is working to apply advanced, emerging technologies such as Electronic Data Interchange (EDI) and Optical / Intelligent Character Recognition (OCR / ICR) to environmental data collection to reduce the burden on the facilities we regulate while making useful data available when it is needed.

Data Entry

Responsible for the processing of 228,000+ manifests, 57,000+ pages of varied quarterly reports and a varied amount of annual and biennial reports on an annual basis. The processing includes opening and sorting the mail, preparation for data entry, data entry, performing quality assurance/quality control measures on completed data and preparation of source documents for long-term storage.

Assistant Director

Program Development Section

Responsibilities include the coordination and formulation of substantive changes in bureau policies, regulations and program priorities. This section also coordinates the development and submission of proposed and final rulemaking, reviews proposed legislation relative to the waste management program and prepares legislative analysis with the Department's position. The duties of this section also include the management and administration of various training programs including the host municipal inspector training, in-service training, advanced entry-level employee training, etc. Section staff conduct program evaluations and analysis and serve as primary information contacts on issues related to the waste management program. Program Development also consults Bureau and regional staff in new and unique areas of the waste management program such as Toxic Release Inventory Data, Geographical Information Systems, Environmental Justice, etc.

Program Support

Staffed by administrative and clerical personnel, this section supports the Bureau's administrative needs. Activities include coordinating budget information with the Bureau of Fiscal Management, contracting--from development of a Request for Proposal and contract through payment of invoices, purchasing, personnel, Act 101 (*Municipal Waste Planning, Recycling and Waste Reduction Act*) and Act 108 *(Hazardous Sites Cleanup Act*) grant programs, Act 198 *(Pennsylvania Solid Waste Resource Recovery Development Act*) contracts, travel/training, leave accounting liaison, telephone coordination and the Automated Management Information System (AMIS).

APPENDIX E
Air Quality Operating Permit Protocol

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Quality

DOCUMENT NUMBER: 275-2101-001

TITLE: Air Quality Operating Permit Protocol

AUTHORITY: Act of January 8, 1960, P.L. (1959) 2119, No 787, as amended, known as The Air Pollution Control Act, (35 P.S. § 4001 et seq.)

POLICY: Provides permitting procedures.

PURPOSE: Provides Guidance for Regional Personnel in Reviewing Plan Approval Applications and Conducting Permit Inspections

APPLICABILITY: Staff/Regulated Public

DISCLAIMER:

The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect applicable statutory or regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department to give these rules that weight or deference. This document establishes the framework for the exercise of DEP's administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 16 pages

LOCATION: Vol. 02, Tab 01

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PLAN APPROVAL and OPERATING PERMITS

The permit processing activities are to be conducted in accordance with the policies and procedures contained in the Permit Manual. Copies of the Permit Manual are to be maintained and available to the entire permitting staff. New policies and guidance are to be brought to the attention of all affected staff. In addition to the Permit Manual, each Regional Office should maintain an updated compilation of:

A. 25 Pa. Code Article III (DEP Air Quality Regulations);

B. 40 CFR Part 60 (New Source Performance Standards);

C. 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants);

D. 40 CFR Part 63 (National Emission Standards for Hazardous Air Pollutants for Source Categories);

E. 40 CFR Part 52.21 (Prevention of Significant Deterioration Regulations); and

F. EPA's New Source Review Guidance Notebook.

Engineering Services is to be managed so that plan approval applications are processed within a review period consistent with the Department's Money Back Guarantee Program. The review period includes the time during which the application can actively be reviewed. The review period would not include time when the staff is awaiting additional information necessary for further review if the applicant has been so notified in writing. Whenever there is an opportunity for pre-application communication or negotiations, these occasions should be used to assist the applicant in preparing a complete application. This shortens and simplifies the application review.

The Department permit and emission tracking system (AIMS) should be used in a consistent manner such that the status and location of a particular application can be readily identified by any staff member.

The permit review, including an assessment of the support information, should be well documented in a review summary. The summary serves as a convenient reference whenever public inquiry is made concerning a proposed source or controls or when similar sources are proposed in other regions. The summary also identifies the person who is most familiar with the new source, modifications and/or controls installed.

The plan approval review summary should be a reflection of the complexity of the installation. The more complex will require greater detail greater detail while the routine should be as concise as possible. The review summary should contain the following information:

A. A complete but concise description of the process, the controls and any modifications that are proposed. A statement regarding rated capacities, important operating parameters and expected variations in these. For large or seldom encountered sources, an assessment should be made regarding the reasonableness of stated exhaust volumes, emission rates, etc.

B. A review of calculations that have been made and all assumptions that were used in completing them. Handwritten calculation sheets should not be destroyed but should be kept in the regional permit file. Maximum allowable emission rates should be stated. For major sources the annual maximum allowable emissions for all relevant pollutants should be estimated. This information is useful for modeling to determine background concentration for PSD sources. The "OFFICIAL USE ONLY" box of the plan approval application is to be completed in its entirety by the reviewer. Potential emissions are those emissions that the source **could** emit if operating 8760 hours/year at its maximum physical and/or operational design capacity less any federally enforceable limitations. Actual emissions are those emissions calculated based on the actual annual operating schedule taking into account all limitations and controls. The change in actual emissions are to take in account any reduction that might occur when the source in the application is replacing another source. These are to be estimates based on the best information available. Include the plant code and unit ID if the plant is included in the emission inventory.

C. A comparison of applicant stated emission rates with all applicable state and federal regulations.

D. Statements regarding applicability and compliance with all applicable regulations and requirements such as:

   a. NSPS
   b. NESHAP
   c. PSD
   d. Major Source NSR
   e. Bubble

f. All relevant policies/requirements specified in the Permit Manual
g. Monitoring and record-keeping requirements

E. Comparison of design parameters such as air to cloth ratio, pressure drop, etc. with acceptable values and engineering guides. References used in establishing acceptable parameter values should be cited.

F. Additional data obtained during the review that was not included with the original submittal of the application.

G. Inclusion or references to special reviews conducted by other Bureau personnel such as air quality modeling, environmental impacts and analysis or coordination conducted with other Bureaus.

H. A recommendation on unique conditions, if appropriate, to be placed on the plan approval and the reasons for them.

1.3 1992 Pennsylvania Air Pollution Control Act revisions

The Air Pollution Control Act (Act), as amended in 1992, contains a number of significant modifications to the previous plan approval requirements in the areas of reactivation, fees, compliance review, "shake-down", appeal rights, and general permits. These changes are discussed below.

A. Reactivation

Section 6.1(b.4) provides that during the term of a permit, a permittee may reactivate any source under the permit that has been out of operation or production for a period of one year or more if the permittee has submitted a reactivation plan to the Department and received written approval from the Department. The reactivation plan must describe the measures that will be taken to ensure the source will be reactivated in compliance with the applicable requirements.

The reactivation plan may be submitted to the Department either during the plan approval for the source or at any time during the term of the permit. In general, the Department will take action on the reactivation plan within thirty (30) days from its submittal unless additional time is needed based on the size or complexity of the reactivated source. It is important to recognize that the provisions described above for reactivation plans do not apply to a facility that does not have a current operating permit. In other words, if a facility has been out of operation for one year or more and that facility does not have an existing operating permit, a plan approval is required and all of the plan approval and associated federal requirements are applicable.

B. Plan Approval Fees

The current fees for Plan Approvals are contained in 25 PA Code §127.702 and outlined below:

Fees	Types of review required
$750	Sources which are not subjected to NSPS, NESHAPs, MACT, NSR and PSD.
$200	Source requiring a minor modification or extension of a plan approval.
$1,200	Sources subject to NSPS (National Standards of Performance for Stationary Sources) or NESHAPs (National Emission Standards for Hazardous Air Pollutants). If a source is subject to both NSPS and NESHAPs, the fee is doubled from $ 1,200 to $ 2,400
$3,500	Sources requiring approval under New Source Review (NSR) regulation, Subchapter E, Section 127 of 25 Pa. Code.
$5,500	Sources requiring the establishment of a MACT (Maximum Achievable Control Technology) limitation.
$15,000	Sources requiring approval under PSD (Prevention of Significant Deterioration) regulation Subchapter D, Section 127 of 25 Pa. Code.

* Please note the fees may be cumulative as described **below**
Examples:

A. If a source is subject to NSPS and New Source Review (NSR), enclose fee of $4700 ($1200 + $3500).

B. If a source is subject to MACT, NSPS and NESHAPs, enclose fee of $5900 ($3500 + $1200 + $1200).

C. Compliance Certification

Section 7.1 of the Act prohibits the Department from issuing, reissuing or modifying any plan approval if the Department finds

that the applicant or permittee or a general partner, parent or subsidiary corporation of the applicant or permittee is in violation of the act, the regulations, plan approval, operating permit or Department order. This requires that each application contain a review of the applicant or related party's compliance status. That compliance review evaluates whether the applicant, or any general partner, parent or subsidiary corporation of the applicant is in violation of the Air Pollution Control Act, the air quality regulations, any plan approval, permit or order of the Department in Pennsylvania or whether the applicant or related party has shown a lack of intention or ability to comply with the Act, plan approval, permit or order of the Department. The Department is implementing this provision by requiring plan approval applicants to complete and submit to the Department a compliance history form or compliance history supplement form as part of the plan approval application. It is also important to point out that a compliance history review is required for all plan approval transfers.

The Department has established a compliance docket. If the compliance review identifies an existing or continuous violation at an existing facility owned or operated by the applicant or a related party which has been placed on the compliance docket, the plan approval cannot be issued until the compliance problem is resolved. The placement of a violation on the docket is an appealable action. The Department intends to use the provisions in Section 7.2 of the Act to resolve existing compliance problems. Section 7.2 allows the Department to authorize certain existing non-complying sources to continue to operate out of compliance so long as the operating permit for the source is modified to incorporate a compliance schedule for achieving compliance. In other words, if during the compliance review for a plan approval application a violation is discovered and placed on the compliance docket, the plan approval will not be issued until the violation is resolved through a compliance schedule contained in the noncomplying source's permit. Once the noncomplying source's permit is modified, the plan approval can be issued. For noncomplying sources that do not have an operating permit, a fully executed consent order and agreement may be used to resolve the noncompliance.

D. Shake Down

The Act as amended now requires that operating permits be issued for a five-year term, temporary operating permits issued to facilitate shake-down of new sources can no longer be used. Plan approvals include a condition authorizing a new source to operate for purposes of shake-down. The shake-down provisions will be incorporated into the plan approval authorization and be triggered when the source notifies the Department that it will begin shake-down. The time-frames for source shake-down are as follows: the source may be granted the period necessary to shake-down or 180 days whichever is less and an extension of that time period can be granted for up to 120 days.

E. Plan Approval Appeals

Section 10.2 of the Act provides that any person aggrieved by the granting of a plan approval or any person who participated in the public comment process for the plan approval application shall have the right to appeal the plan approval decision to the Environmental Hearing Board within 30 days from the date of notice of that decision. This is a substantial modification to previous standing provisions and authorizes all commenters to file appeals of plan approval decisions regardless of whether they meet traditional rules related to standing. It is important to recognize that a person who does not comment on a plan approval may appeal the decision if the person is aggrieved by that decision; in other words, the normal rules of standing apply in that case.

F. Operating Permits

As with plan approvals, the Act made substantial modifications to the previous operating permit program. Permit terms, fees and public notice provisions have all been modified. New sources cannot be granted an operating permit unless they are in compliance with all the provisions of their plan approval including a demonstration that the source will operate in compliance with the plan approval requirements and any performance or emission standards established by EPA or the Department for the source.

Once a Title V operating permit is issued to a facility, all outstanding and future plan approvals or operating permits for that facility will be addded to the existing Title V operating permit through the administrative amendment process of §127.450(a)(5).

G. Grandfathered Sources

Section 6.1(b) requires that all sources, including pre-1972 sources, must obtain operating permits. Grandfathered, or pre-1972, sources are authorized to continue to operate so long as the applicable fees have been paid and until 120 days after the Department provides notice to the source that a permit is required or until November 1, 1996. Once a permit application is submitted, the source may continue to operate **if** the appropriate fees are paid and all applicable requirements are met.

H. Permit Term

Operating permits must be issued for a five-year term unless a shorter term is required to comply with the Clean Air Act or the permittee requests a shorter term. Under previous requirements, most permits were issued for a one-year term and renewals issued each subsequent year. Beginning October 1, 1992, all permits, including renewal permits, were issued for a five-year term. The Department has prepared a reissuance letter, an operating permit application form and an affidavit. These documents, along with the compliance history form or compliance history supplement form, must be submitted by all permit applicants in order to renew an existing permit.

I. Non-Title V Operating Permit Fees

In addition to the modifications of permit terms, Section 6.3 of the Act modifies the requirements for permit fees. 25 PA Code §127.703 describes the appropriate non-Title V operating permit fees. The annual operating permit administration fee is paid initially with the permit application and thereafter on the anniversary date of permit issuance. In other words, the initial operating permit application filed during the 1995-1998 calendar years must be submitted with a check for $500 to cover the two permitting fees. Again, it is important to note that state entities, instrumentalities and political subdivisions are required to pay these fees.

J. Public Notice

Section 6.1(b)(1) requires the Department to provide public notice and the right to comment on all operating permits prior to their issuance or denial and authorizes public hearings concerning any permit. The Department intends to follow the public notice provisions contained at 25 Pa. Code §127.41-127.52 in implementing this requirement. The Department's will publish notice in the Pennsylvania Bulletin providing an opportunity for comment on all operating permits. Consistent with existing practice, the public comment period will be thirty (30) days from the date of publication of the notice. There will be also be a notice

published in the Pennsylvania Bulletin containing the final decision to either issue or deny the operating permit.

K. Compliance Schedule

In evaluating permit applications, the compliance review and compliance schedule process described above will be followed. In addition, violations at existing sources, either grandfathered sources or repermitted sources with a valid operating permit, must be resolved with a compliance schedule contained in the operating permit issued to the source. The compliance schedule requirements will follow the provisions of Section 7.2 of the Act. For sources subject to an existing Consent Order and Agreement, the terms of that Agreement will be incorporated into the operating permit. It is also important to point out that a compliance history review is required for all permit transfers.

L. Department Failure to Issue a Permit

In addition, Section 6.1(b)(3) authorizes grandfathered or pre-1972 sources to file a permit application and, if no new permit is issued through no fault of the applicant, the source can continue to operate until the permit is issued.

Failure to take action on a complete permit application within 18 months is an appealable action under certain circumstances, described in Section 6.1(b)(3). The Environmental Hearing Board is authorized in such an appeal to require that the Department take action on an application without delay.

M. Operating Permit Appeals

The appeal procedures described for plan approvals are also applicable to operating permits.

A. General Information

Most inspections conducted prior to the issuance of an operating permit are to be performed by Engineering Services personnel. Exceptions should be limited to situations where assignment of this responsibility to non-Engineering Services staff is clearly warranted. If time allows, Operations staff may wish to accompany Engineering Services staff on the initial Operating Permit inspection to observe baseline operations. During these inspections, particular attention is to be given to assuring adherence with design parameters and specifications as stated in the application, the completion of all required acceptance tests and establishment of monitoring and record keeping programs. Attention should be given to the documentation of baseline parameters, verification of flow diagrams submitted as part of the application (or the preparation of flow diagrams during this inspection) so as to establish a base of information for subsequent re-inspections. Baseline parameters may be established by:

A. Observations;

B. In-place instrumentation readings; and

C. Data obtained using field test equipment.

Determination of appropriate procedures to obtain baseline data should be based upon the specific source/controls involved and the potential significance of air contaminant emissions. If the inspection involves VOC sources subject to Section 129.52, arrangements should be made to take appropriate coating samples.

B. Reference Documents

The inspector should make as complete use of the files as possible. All appropriate files should be reviewed so that the inspector can determine before the inspection what sources, controls and modes of operation are to be viewed.

C. Knowledge of Sources/Problems

The inspector should demonstrate a knowledge of the source, the control equipment and/or control techniques, and any monitoring and record-keeping procedures. This knowledge is largely dependent upon a combination of training, previous inspection practices and the information documented in the file.

D. Information Obtained

The inspector should, prior to entering the plant, attempt to view the facilities from a good vantage point to check for excessive visible emissions, sources of fugitive emissions and obvious plant operational problems. The inspector should then contact the

appropriate plant official who is authorized to conduct the inspector through the plant and who is able to provide needed information.

The inspector should attempt to verify information whenever possible and warranted. When appropriate, the inspector should attempt to verify maintenance procedures and operational practices with the workmen who are responsible for actually conducting them. He should check for new sources, source modifications and changes in operational procedures, products, raw materials or fuels. All previous problem areas and violations should be checked. Both stack and potential fugitive emission sources should be checked and, when appropriate, an opacity reading should be taken and recorded on the appropriate form. Evidence of control equipment malfunction and/or operating parameter anomalies should be noted and appropriate questions asked. Processes should be observed during representative or worst-case phases of the operating cycle.

E. Source/Control Operating Parameter Observations

The inspector should make use of the training from specialized inspection workshops. Process rates and control equipment parameters should be observed and recorded for comparison with baseline readings. When inspecting permitted sources, baseline data should be verified.

The inspector should know when and how to use the equipment in the Field Inspection Kit to assist in the inspection.

F. CEM Audit Inspections

These inspections are to be conducted by Engineering Services personnel in accordance with the Continuous Emission Monitoring System Inspection Manual.

G. NESHAP Inspections

The inspector of a facility with a source subject to NESHAPS must be familiar with the standards and special requirements. Because of the small number of sources in certain categories, there are requirements which are not a part of most inspector's general knowledge. The inspector should, therefore, become familiar with these special requirements and the hazards associated with these sources.

H. Source Testing

1. Observations

The inspector must be familiar with and make use of the Source Testing Manual and the requirements specified in Appendix A of 40 CFR Part 60 and Appendix B of 40 CFR Part 61 for the applicable pollutant being collected. The observation should include examination of the sampling location, the condition of the sampling equipment, the sampling train configuration, qualifications of testing personnel, sample recovery procedures, deviations from normal sampling practices, accessibility to calibration information and observations of system leak checks.

Monitoring of the source in conjunction with the testing program is mandatory. Source monitoring should include source operating rates, checks for excessive visible emissions, sources of fugitive emissions and any apparent source operating abnormalities.

2. Source Test Participation

Regional personnel are expected to participate during the performance of Department source tests and pretest inspections. The participation should include the monitoring of the operation of the source and control equipment, reporting pertinent operating parameters, notification of testing personnel in the event of any source or control equipment malfunctions, acquiring fuel, waste or process samples, and assisting stack test personnel when necessary.

I. Safety Practices

The inspector should utilize appropriate safety equipment, e.g., hard hat, safety shoes, safety glasses, and ear plugs. He should follow any special safety precautions posted in the plant and avoid or show caution regarding hazardous situations encountered in the plant.

J. Inspection Closing

The inspector should close the inspection by summarizing his findings for the plant official accompanying him and clearly

specifying any violations. He should outline the actions he expects the company to take, if any are required, and describe any further action the Department might take on noted violations.

K. Documentation/Follow-Up Actions

The inspector should take adequate notes to allow a detailed report to be made. The report should be written promptly and on an acceptable form or in a memorandum. A memorandum has the advantage of flexibility (the inspector is not bound by specific questions, categories and space) and, therefore, may be more effective for documentation of findings not well accommodated by the inspection report form. However, the memo format should not be used to avoid documenting the status of items covered by the inspection form. The preprinted entries on the report form act as a reminder to address these items, and use of the inspection form is, therefore, advantageous for many inspections. The inspection reports (report forms and/or memorandums) should contain enough documentation to allow an inspector unfamiliar with the plant to assume inspection of the facility by consulting the file. All observed violations should be noted in the report and the company should be notified in writing. This correspondence should be sent promptly.

General plan approvals and operating permits (general permits) are written to cover categories of similar source categories. The use of general permits makes it simpler for applicants to obtain their air quality permit and reduces the effort the Department must expend over the issuance of individual permits. The categories of sources covered by a general permit must be similar enough so that a single permit document can be written which describes all air quality requirements for the source category.

The Department first identifies the source category and then drafts all the applicable requirements into a single document which can serve to authorize the installation of a new source and/or permit the operation of new or existing source in the chosen category. The existence of the draft general permit is advertised and it is circulated for public review and comment. A 45 day comment period is provided. The general permit is then finalized in accordance with the comments received.

Once the general permit is available for use, the applicant need only show that his source belongs to the category for which the general permit was written and agree to comply with the conditions established under the particular general permit. Therefore, the general permit application is very simple to complete. The applicant should become familiar with the terms and conditions of the general permit to assure that the applicable requirements will be met. No further public notice is needed prior to individual's being granted the general permit which will occur in less than 30 days after the application is submitted.

The Department has identified a number of sources for which it is drafting general permits. These source categories include: small combustion units; storage tanks for volatile organic liquids; crematory incinerators; silo/pneumatic conveying systems; induction furnaces; batch asphalt plants; and, burnoff ovens. Industrial partners are being sought by the Department to join in the identification of additional source categories and in the initial drafting of the general permits. Industrial associations should consider if their members would benefit from the existence of a general permit and consider partnering with the Department to establish new general permits.

A. Internet availability of forms

The Department has placed applications, instructions, and other miscellaneous forms on the World Wide Web site. Additional ones will be added as they are developed and approved for use.

B. Downloading permit forms and/or instructions

Pennsylvania Department of Environment Protection and natural resource agencies' World Wide Web home page can be accessed by typing **http://www.dep.state.pa.us.**

You may also download application forms by assessing the AIRHELP Bulletin Board (see instructions below on how to access the AIRHELP). All application forms have the file extension "frm". The Bulletin Board supports ANSI graphics but, even if your software does not support ANSI graphics, you can still access the Bulletin Board. The AIRHELP program is funded by the Commonwealth of PA through the Department of Environmental Protection (DEP). DEP has a contract with PRC Environmental Management, Inc. to manage the AIRHELP program for small businesses.

C. Accessing the AIRHELP Bulletin Board System

If you have a personal computer (PC), a modem and communications software, you can access the AIRHELP Bulletin Board from the Pennsylvania. AIRHELP Bulletin Board is available 24 hours a day by calling 1-800-864-7594. Important modem settings for accessing the Bulletin Board are: Parity = None, Data bits = 8, Stop bits = 1 and Duplex = Full

APPENDIX F
Risk Assessment Guidelines
for
Facilities Burning Hazardous Waste

RISK ASSESSMENT GUIDELINES

FOR

FACILITIES BURNING HAZARDOUS WASTE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JANUARY, 1993

RISK ASSESSMENT GUIDELINES FOR FACILITIES BURNING HAZARDOUS WASTE

Table of Contents

I. SCOPE

A. Introduction

This risk assessment guidance document will aid the Department of Environmental Resources (Department) in evaluating the risk associated with the release of toxic substances to the atmosphere from the burning of hazardous waste. It identifies the methodology that the Department believes is most appropriate for quantifying the risk from both inhalation and non-inhalation pathways of exposure. It was developed to aid in evaluating four types of hazardous waste burning: (1) commercial hazardous waste incinerators, (2) boilers and industrial furnaces subject to 40 CFR Parts 260 through 271 of the rules of the Environmental Protection Agency, (3) hazardous waste incinerators subject to chapters 127 and 264 of the Rules and Regulations of the Department and (4) HSCA and Superfund Cleanup sites which propose to use on-site incineration for remediation.*

The document is not intended to provide a comprehensive description of the information and activities the Department will consider in making decisions on the permitting of hazardous waste burning operations. Rather, it provides detailed information on the risk assessment that applicants will be required to submit as part of their air quality permit application. In addition to the risk assessment described in this document, the Department will require the applicant to meet all other permitting requirements.

This is one of two documents that will guide the Department in making air quality permitting decisions for these facilities. This document provides technical guidance on the assumptions and default factors that should be incorporated into the air quality risk assessment analysis. The second guidance document (a risk management guidance document) will provide a comprehensive discussion of all the factors the Department will consider in deciding whether to approve the burning of hazardous waste.

This document provides guidance rather than mandated methodology. The Department recognizes the need to tailor the risk assessment to each site. This provides increased assurance that all factors contributing to the risk are appropriately evaluated. In addition, it was not made a regulation in recognition of the changing nature of risk assessment. The Department plans to allow modifications and improvements in the risk assessment methodology as scientific data are available to support the use of assumptions that differ from those included in the guidelines.

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* Because of the significant variations anticipated in the sizes, duration of incineration and types of wastes to be burned at each of these facilities, the need for risk assessment will be evaluated on a case-by-case basis.

B. Activities covered by this document

This document provides guidance on the methodology that should be used to quantify the air quality related risk associated with five different scenarios, one chronic and four acute. The one chronic scenario will provide an estimate of the risk associated with long term exposure. The scenario will use maximum operating conditions and conservative (i.e. protective) exposure and dose-response assumptions to develop an upper bound risk assessment. In addition, the sensitivity and uncertainty analysis will identify the key factors which would influence the risk from each route of exposure and provide the range of risk due to the variations of those key factors.

The four acute scenarios will provide estimates of the risk associated with short term exposures that range from normal operation to a catastrophic event.

The risk assessment for all scenarios should include all stack and fugitive air emissions from on-site equipment and activity associated with the handling, storage, processing and burning of the hazardous waste. In addition, the risk assessment should include the air emissions resulting from the on-site disposal of any hazardous waste or ash. At an existing facility, the risk assessment should identify the risk due to the emission from the combustor/incinerator absent the hazardous waste burning, the burning of hazardous waste, the burning of residual waste (if any) and the burning of municipal waste (if any).

The assessment resulting from the evaluation detailed in this document should identify all plausible pathways of exposure and the amount of risk presented by each pathway. This includes the risk from direct exposure to chemicals released in the air and deposited on water or soil. The risk from indirect exposure pathways such as incorporation into the food chain should also be quantified and included in the risk assessment. The risk to both human health and the environment should be included in the risk assessment.

C. Types of pollutants covered by this assessment

Two categories of pollutants are emitted from the burning of hazardous waste: criteria and non-criteria.

The criteria pollutants are those for which National Ambient Air Quality Standards have been promulgated. The standards are the maximum concentrations of the pollutants in the outside air essential to protect human health. They are set by the EPA to include a margin of safety. These pollutants include: sulfur dioxide, particulate matter less than 10 microns in size, nitrogen dioxide, ozone, lead and carbon monoxide. The risk imposed by these pollutants are evaluated in accordance with the Department's comprehensive Chapter 127 review and are not covered in this document. (The potential carcinogenic effects of specific components of particulate matter, precursers to ozone and the neurobehavioral effects of lead are covered in this risk assessment guidance document as non-criteria pollutants.)

The non-criteria pollutants are the ones which are covered in this risk assessment guidance document. These are pollutants for which National Ambient Air Quality Standards have not been developed. These include: toxic metals, dioxins, furans, and organic substances that are not destroyed or are formed during the combustion process. The risk assessment methodology outlined in this document should be used to identify the substances that need to be considered in the risk assessment and the methodology that should be used to estimate the amount of risk posed by these substances.

D. Activities this document does not cover

This guidance document does not estimate or include the risk associated with transportation of hazardous waste to the facility with the exception of evaluating the risk of an accident which could occur at the facility. Offsite risk is addressed in the waste management permit application.

It is also beyond the scope of this document to provide guidance on the risk of burning any waste which is classified as explosive. Proposals to dispose of these wastes through burning would need to be evaluated on a case-by-case basis using a different methodology.

E. Preparation and review of this document

This document was prepared by the Department and has been subject to review by members of the Department's Air and Water Quality Technical Advisory Committee. A notice of the availability of this document was published in the Pennsylvania Bulletin to solicit public comment. In addition, copies of the document were sent to individuals and organizations that have expressed an interest in hazardous waste burning or that have expertise in risk assessment methodology.

F. Applicability

The guidance provided in this document applies to: (1) commercial hazardous waste incinerators (2) the burning of hazardous waste in boilers or industrial furnaces subject to 40 CFR Parts 260 through 271 of the rules of the Environmental Protection Agency (3) hazardous waste incinerators subject to chapters 127 and 264 of the Rules and Regulations of the Department and (4) HSCA and Superfund cleanup sites which propose to use on-site incineration for remediation.

II. OVERVIEW OF RISK ASSESSMENT

The risk assessment methodology, in general, uses a protective approach. This protective approach is incorporated in the scenarios to be analyzed and the methodology for calculating risk. The guidelines specify five scenarios to be analyzed, one long term and four short term. The methodology used to quantify the risk in these scenarios is structured to estimate the upper bound of risk. (The maximum risk is calculated so that there is reasonable assurance that the real risk is less than the calculated risk.) This approach provides a measure of assurance that any approval to burn hazardous waste will result in less actual risk than the amount on which the decision to issue the permit was based.

The guidance presented in this document is based on methodology that will identify the pollutants of concern, the scenarios that should be analyzed and the plausible exposure pathways specific to a site or facility. The following summaries the steps in this methodology:

A. Identification of Pollutants of Concern

The waste streams that will be burned at the facility should be evaluated for chemical composition, and each chemical should be characterized. In those circumstances where the chemicals to be burned at the facility can vary from day to day and minute to minute, the applicant should, based on the waste analysis plan, include the use of feasible worst case chemical surrogate waste streams in identifying the pollutants of concern. The potential formation of pollutants during and after burning of the hazardous waste should be considered. In addition, waste handling, storage, and processing should be evaluated to identify any potential for the release of toxic substances into the atmosphere. The pollutants of concern should include carcinogens and noncarcinogens.

B. Facility Operation Scenarios to be Analyzed

Chronic risks due to the operation of a facility should be assessed for "plausible maximum" risk assessment.

The plausible maximum scenario should consider:

- o maximum operating conditions
- o predictable operating problems (e.g. pollution control and combustion equipment malfunction)

Acute risk due to operation of the facility must be assessed for four scenarios -- normal maximum operation, an equipment malfunction (pollution control or combustion equipment), a moderate, on-site accident and a catastrophic event.

C. Emission Estimate and Dispersion Modeling

The accuracy of the overall risk estimation is dependent on the accuracy of the emission estimates for each substance that could be released to the atmosphere. This in turn is dependent on the accurate characterization of the waste streams and combustion control processes. The emission estimates are based on factors such as the maximum amount of waste that can be burned, the efficiency and expected failure rate of air pollution control devices, the expected number of emergency bypasses, the expected formation of products of incomplete combustion (PIC), and the destruction and removal efficiency (DRE) of principal organic hazardous constituents (POHC).

Atmospheric dispersion models are used to calculate the geographic dispersion and deposition of gases and particulates that are emitted from the stack and from all other locations on the premises. Input variables include the emission estimates, stack height, meteorological data, terrain elevation, particulate size, deposition velocity and other facility specific factors. The results of the modeling are predicted ambient air concentration and deposition rates that cause ground level contamination around the source.

D. Multi-pathway Exposure Assessment

Both direct and indirect pathways that contribute to the total multi-pathway exposure are assessed in this step. Direct pathways include inhalation, dermal exposure and ingestion of water, crops and soil on which the pollutants have been directly deposited. Indirect pathways are those that result from assimilation of the pollutants into food sources, and may include fish ingestion, meat, poultry, eggs, dairy products, and cow's and mother's milk. Additional pathways also may be present on a site specific basis.

The guidance for calculating the risk associated with each of these pathways includes standard exposure assumptions. Some of the assumptions are site specific, and some require additional fate and transport modeling such as surface runoff. Nevertheless, if scientific data are available to support the use of assumptions that differ from those included in the guidelines, the different assumptions may be used upon submission to the Department of adequate supporting documentation, during the protocol approval process.

In addition, standard EPA fate and transport models may be used to more accurately predict concentrations of contaminants in various media. For example, the models described in "Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions" (EPA/600/6-90/003) are acceptable for those pathways covered by that manual. However, they must be used with the scenarios and exposure assumptions set forth in the Department's Risk Assessment Guidelines.

Expected exposure pathways are as follows:

o **Inhalation** - assumes continuous exposure and an average adult's respiration rate during moderate activity.

o **Soil Ingestion** - assumes that the concentration of contaminants in indoor dust is the same as outside soil.

o **Dermal Absorption** - assumes a reasonable amount of time that a person is outside (e.g. frost-free days) and includes absorption from both soil and water (swimming).

o **Produce** - uses generic or site-specific product consumption rates and includes both home gardens and locally-grown commercial produce/fruit, if the area produces and sells produce locally.

o **Animal Products** - uses local animal product consumption rates, after first calculating the dose to the animal.

o **Drinking Water** - assumes water consumption rates for surface and groundwater as appropriate and includes dermal and inhalation dosages from bathing and other household water use.

o **Mother's Breast Milk** - assumes the mother is an aggregate pathway; that she can excrete contaminants in her milk; that she breast feeds a baby for a period of one year and that the child lives at the same location until a mature adult.

For calculating inhalation risk, the assumption should be made that all toxic substances remain suspended in the air and are available for inhalation. For calculating deposition risk, organic pollutants and metallic vapors should be considered as condensed particulates, while gaseous pollutants should be assumed to be adsorbed or absorbed onto particulate matter in accordance with the dispersion modeling requirements contained in Chapter 5. Only approved EPA dispersion, deposition and transport models should be used. Finally, exposures are assumed to last for a standard 70 year lifetime, not just for the projected life of the facility.

E. Risk Screening Procedure

Air contamination sources which have relatively minor risk are exempted from the multi-pathway exposure assessment when:

o Carcinogens - Aggregate inhalation risk from all substances is not more than one in ten million.

o Noncarcinogens - Inhalation risk from any substance is not more than one hundredth of the corresponding reference dose.

The ambient air concentrations of toxic substances should be calculated using the "plausible maximum exposure" risk assessment for chronic exposure, the normal maximum operation for acute exposure and the guidance for air emission dispersion modeling.

Note that the screening process applies to aggregate site-specific risk, not to individual chemicals or pathways.

F. Human Health Risk Assessment

When the exposure via each pathway has been determined, the concentration or dose of each substance should be combined with its toxicity factors. The results should be presented in tabular form, so that the risks posed by each chemical, by each pathway can be used to make risk management decisions. Carcinogenic risk is presented as individual risk, and non-carcinogenic risk is presented as a fraction of individual reference doses.

G. Ecological Risk Assessment

Ecological risk assessment is a very important component of risk assessment. Ecological Risk, in combination with applicable environmental exclusionary siting criteria and the consideration of environmental assessment considerations found at 25 PA Code section 269.50, would result in a comprehensive environmental assessment. However, because specific guidelines or qualitative risk assessment information are under development by EPA, comprehensive methodology for assessing environmental risk will not be presented here. Nevertheless, ecological risk assessment remains a goal of the agency and methods will be incorporated into future risk assessments as they are developed.

At a minimum, the applicant should consider the ecological risk from the proposed facility within the guidelines of Section 269.50. Where one of the identified environmental features listed within this section occurs within the specified distances, the risk associated with this feature should be evaluated.

H. Sensitivity and Uncertainty Analyses

The risk assessment should display the uncertainty associated with the results using a probalistic distribution around major input variables that have parametric properties (such as emission estimates). At least the mean, standard deviation and the percentiles of the distribution of possible results should be reported.

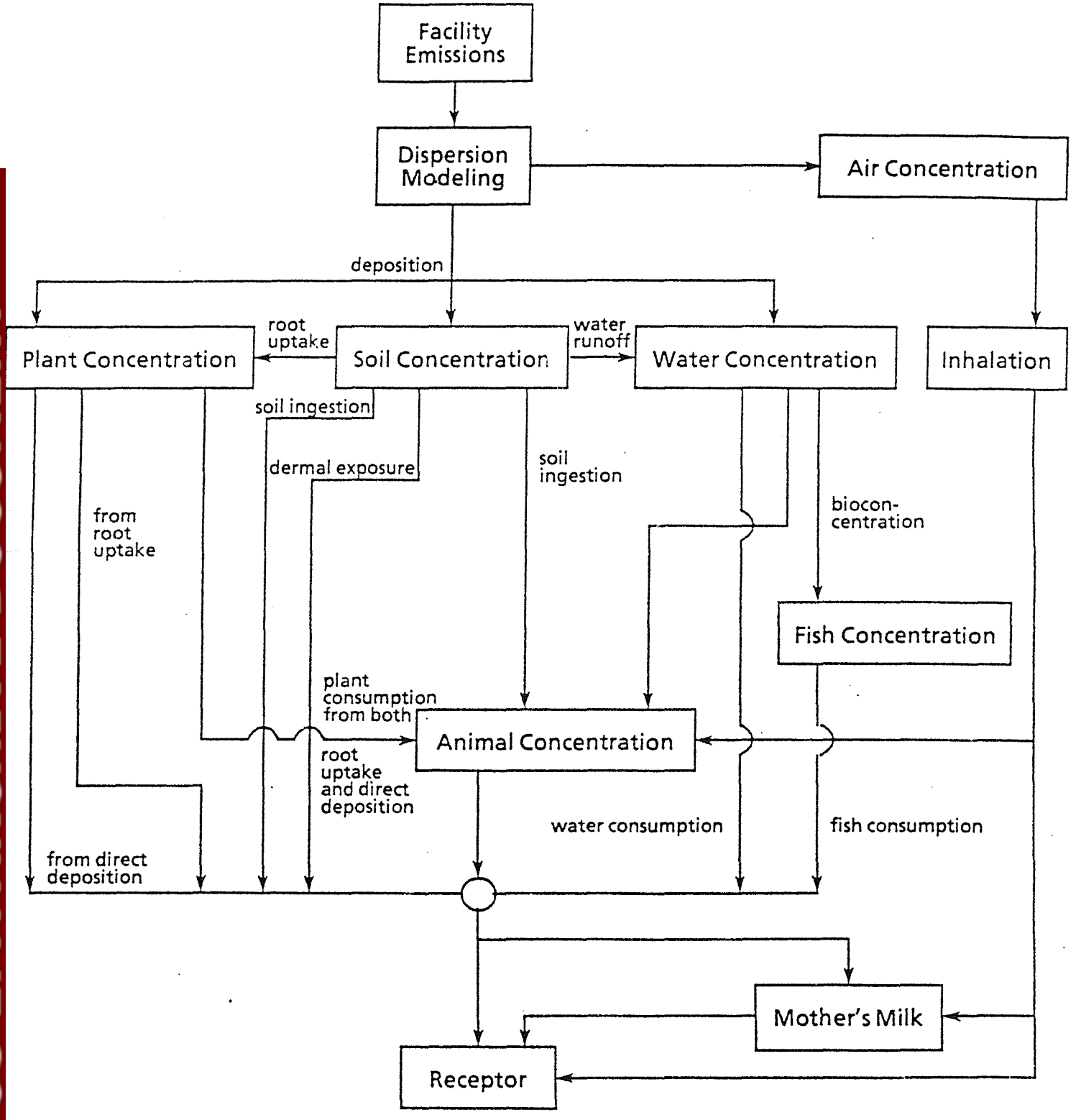
The sensitivity analysis should vary both the input parameters and exposure assumptions to determine how much an effect each has on appropriate pathways and on the final aggregate risk. It should include an estimate of the effect that the most influential variables have on the risk assessment.

The uncertainty analysis should include a narrative description of the sources of uncertainty and an estimation of the magnitude of their effect. The sensitivity and uncertainty analysis should be performed and presented separately for each route of exposure.

I. Application of Completed Risk Assessments

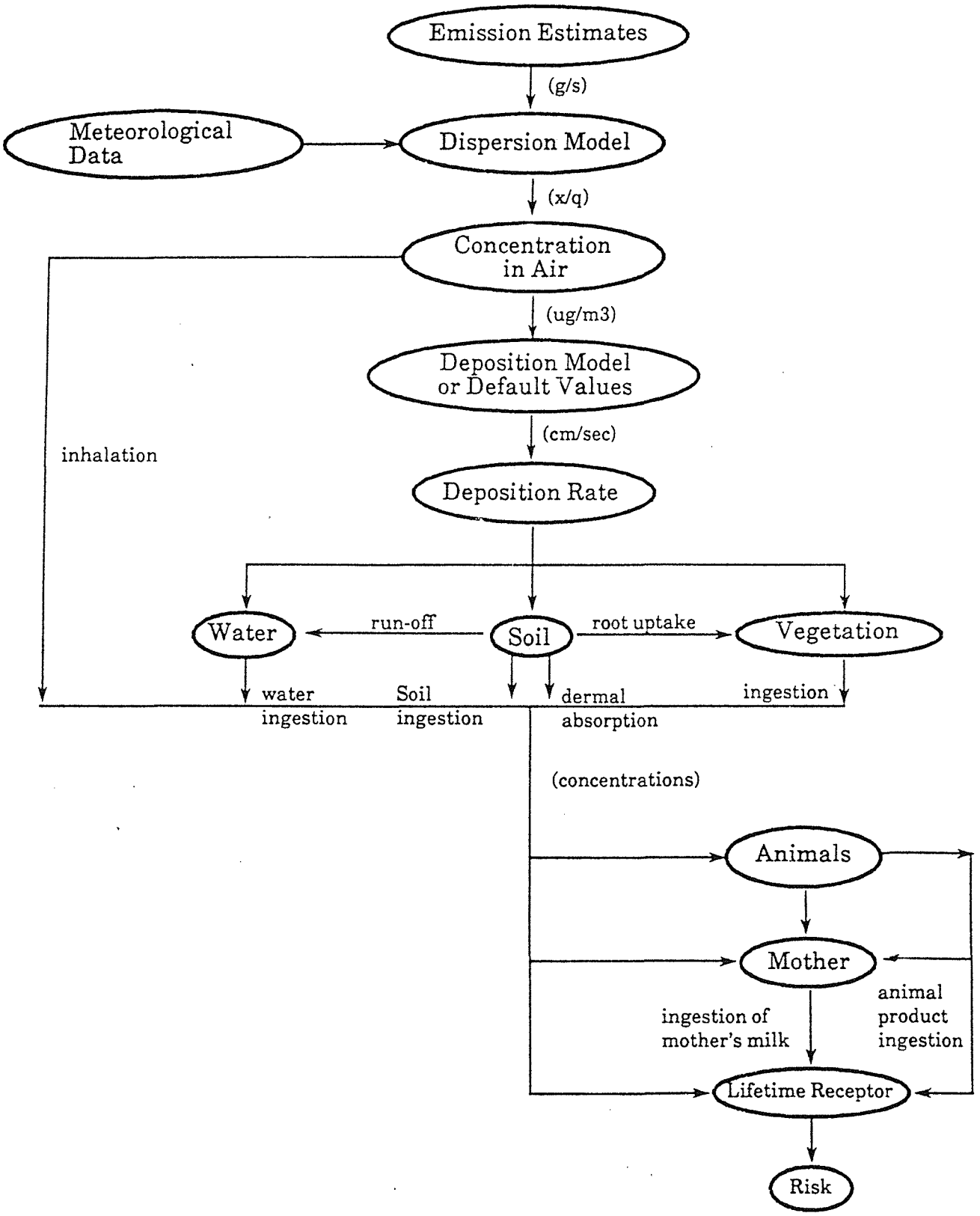
The health and ecological risk assessments, along with the sensitivity and uncertainty analyses, will be used by the Department in reviewing air quality permit applications to burn hazardous waste. The Department's decisions on whether to approve any hazardous waste burning will be guided by the risk management document.

EXPOSURE ROUTES



Source: CAPCOA "Hot Spots" Guidelines

EXPOSURE FLOWCHART



III. POLLUTANTS OF CONCERN

The risk assessment document should include an evaluation of the risk associated with the potential release to the atmosphere of any toxic pollutants from the handling, storage, processing or burning of hazardous waste. The potential pollutants identified should include both carcinogenic and noncarcinogenic pollutants and account for the total risk that would result from all processes associated with the burning of hazardous waste. The following activities need to be analyzed to identify potential pollutants:

- The chemical composition of the waste streams using feasible worst case chemical surrogate waste streams.

- Pre-combustion activities (transfers, storage, mixing/blending, feeding), and post-combustion disposal or use, including substances identified through other facility permits.

- Combustion and emergency stack use (POHC, PIC, metals, total hydrocarbons, particulates, acids, and other pollutants.)

- Other activities on the site, such as recycling and on-site landfilling.

The risk assessment should identify the characteristics of each waste stream to be burned. The characteristics identified should include, but are not limited to: moisture content, BTU content, flash point, viscosity, waste feed particle size, presence and anticipated concentration of the elements Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur and Phosphorus, the pH, and the presence and anticipated concentrations of halogens, total halides, heavy and/or toxic metals, and specific toxic substances. Chemicals burned as fuel (i.e. containing greater than 8000 BTU/lb.) are to be included in this description. Any on-site mixing or blending methods to burn "batches" of waste should be described. The description of mixes should include a determination of BTU and the other listed characteristics. Both annual average composition and potential range of variability should be described.

Formation of PICs under various operating conditions of the particular type of combustor should be described. The correlation of PIC formation, DRE and POHC with temperature variation, chlorine content and total halides in the waste, carbon monoxide and total hydrocarbons should be documented.

Examples of the types of pollutants that could be emitted from the burning of hazardous waste should be accounted for and include, but are not limited to: toxic metals, acid aerosols, PCBs (polychlorinated biphenyls), chlorobenzenes and chlorophenols, pesticides, insecticides, fungicides, dioxins/furans, PICs and those organic substances which may be difficult to burn (POHCs). The Department may identify and address additional pollutants of concern during review of a specific application.

Toxic pollutants and hazardous wastes for which the Department has regulatory implementation responsibilities are listed in the following federal statutes: Clean Air Act (List of Hazardous Air Pollutants), Clean Water Act (List of Priority Pollutants), Safe Drinking Water Act (List of MCL chemicals), Resource Conservation and Recovery Act (Lists of Hazardous Waste) and the Department's regulations.

Hazardous waste is divided into two broad types: listed and characteristic. Listed hazardous wastes contain one or more of approximately 400 substances that are toxic, ignitable, corrosive or reactive. Waste may be listed as hazardous if it comes from non-specific sources ("F" waste), from specific industrial processes ("K" waste), certain discarded commercial products ("U" waste), or is a discarded, acutely hazardous commercial product ("P" waste).

Characteristic hazardous waste exhibits properties of ignitability, corrosivity, reactivity, or contains certain materials that leach at higher than specified levels (toxicity characteristic). Waste types tend to be listed as generic categories, such as "spent halogenated solvents used in degreasing" or "still bottoms."

Each waste "batch" should be tested for specific chemical composition in the manner described at the beginning of this chapter.

IV. FACILITY OPERATION SCENARIOS TO BE ANALYZED

A. Chronic Risks

The following scenario should be analyzed to quantify the chronic health effects (cancer and non-cancer effects):

"Plausible Maximum" Risk Assessment. The risk assessment should use maximum operating conditions and the conservative exposure and dose-response assumptions discussed in this document. In addition, expected failures in the air pollution control and combustion equipment and the use of a bypass stack should be considered in the assessment. The maximum operating conditions should be the maximum rated capacity of the facility or the operating limitations included in the permit application. The plausible maximum risk assessment should provide an upper bound risk assessment. The risk quantified would very likely be substantially greater than the actual risk expected from the operation of the hazardous burning unit.

Chronic risks for the plausible maximum risk assessment should be assessed on the basis of maximum annual air contaminant emission rates determined using the maximum hourly operating rates requested in the plan approval application (i.e. hours of operation, maximum amount of waste that would be burned per hour, etc.). The annual emission rates used in this assessment also are to reflect predictable operating problems (sub-optimal operating conditions), such as process upsets, emergency bypasses and air pollution control equipment malfunctions. A detailed explanation of the sub-optimal operating conditions, the

expected frequency and duration of their occurrence and their impact on the determination of the annual emission rate values used in the risk assessment should be provided with the assessment.

Any permit issued will limit the facility's operation to the information used in the plausible maximum risk assessment. Any subsequent request for operation increases or major modifications in operation levels will require modifying the plausible maximum risk assessment for evaluation of that request.

B. Acute Risks

Four scenarios should be analyzed to describe acute health effects. The four scenarios are: maximum normal operation; an equipment malfunction; an on-site accident; and a catastrophic event. The assessment should discuss the likelihood, duration and implications to human health and the environment of each scenario, and should include the air emissions from any and all likely release routes (air, land, and water).

1. Normal maximum operation. This scenario should be based on the maximum hourly emission rates that would occur from the facility operating at the maximum rated capacity or the maximum operating conditions requested in the permit application. It does not include malfunctions.

2. An equipment malfunction. This scenario should analyze any disruption of the combustion process in which the contents of the combustion chamber are exhausted through a by-pass stack, or the failure of a major component that results in a substantial reduction in the effectiveness of the air pollution control equipment. The potential effects of a power outage should also be considered.

3. An on-site accident. This scenario should analyze a rupture of a storage tank, spill of a volatile substance during handling or storage or an event of a similar magnitude. It should include the release of a volatile carcinogen and an acute irritant, where these wastes are proposed for incineration, and should identify both the incremental cancer risk as well as the acute non-cancer risk. Include the nearest waterway as a possible recipient of liquids spilled on-site, where it is feasible that a spill at the facility could reach the nearest waterway. Transportation accidents occurring at the facility should be evaluated under this scenario.

4. A catastrophic event. This scenario should analyze an explosion and fire to storage tanks, or an event of a similar magnitude. Fault tree analysis including both human error and equipment failure, should be provided as well as the severity of the consequences of the event.

The situations to be considered for the moderate and catastrophic event scenarios should be based on, but are not limited to, those situations addressed in 25 Pa. Code §§264.51-264.56 pertaining to

Preparedness, Prevention & Contingency Plans (i.e. fire, explosion, emission or discharge of hazardous waste or hazardous waste constituents to air, soil, surface water or groundwater).

V. AIR EMISSION ESTIMATES AND DISPERSION MODELING

A. Emission Estimates

The emission data for each of the pollutants of interest are to be reported for individual emitting processes within the facility. Emitting processes include, but are not limited to, the handling, storage, processing, burning and the on-site disposal of any hazardous waste or ash. The emission factors used in calculating emissions and the emission quantification method used (i.e. source test results or an alternative estimation method) for each emission factor should also be reported. Information regarding the hours of operation should be reported for each emitting process.

The emission estimates are required to be submitted as total annual emissions. For acute scenarios of less than one hour, emission rates during the release period should be provided. The emission estimate also should include the frequency of hourly maxima. These emission estimates should be completed for the scenarios that are required to be analyzed as part of the risk assessment.

For each stationary process unit that handles, stores, processes, or burns hazardous waste, a total mass-balance of major substances must be performed. The mass balance should indicate how much of each chemical in the feed is burned or released to the atmosphere and all other waste streams. The mass balance should include the fugitive emissions, stack exhaust, scrub/wash water, ash, etc.

An analytical scan of the emissions should be performed, wherever possible, to identify the individual organic substances being emitted. It is understood that the emissions could contain some groups of organic compounds that are very difficult to separate into individual substances. The mass fraction of the groups of organic compounds that cannot be separated into individual substances should be determined. Dioxins and furan should not be included in the groups of organic compounds that cannot be separated.

Tables showing emission estimates and toxicity factors for each substance should be presented. For identified substances without potency factors, their mass should be included in the total mass of unidentified emissions, and the total unidentified mass should be assigned toxicity factors equal to he average toxicity of the identified substances.

The distributions of metals among air emissions, fly ash, and bottom ash should consider particle size range, chemical speciations, chlorine content of the waste, temperature, oxidation efficiency and how

easily volatile forms of the metals (especially lead, cadmium, mercury, and arsenic) are formed. If no actual monitoring data is available, estimates of the metal emission should be based on worst case chemical surrogate waste streams, and the mass-balance with predicted partitioning should be presented. A discussion of surface area-weighting or mass-weighting for particulate adsorption should be included.

B. Exhaust Conditions

In addition to emission quantities from all emission points, the mode of release of air contaminants such as fugitive, stack or roof monitors and the exhaust parameters (temperature, velocity, release height, etc.) should be reported. The release parameters required are specific to the model utilized for each emission point.

C. Modeling Requirements

The acquisition of site representative meteorological data by the applicant should be considered as soon as possible after the proposed site and facility meets preliminary siting criteria. Whereas some smaller facilities may be granted air quality permits based on screening air quality dispersion modeling, it is more likely that the majority of proposed facilities will require refined modeling utilizing at least one year of meteorology. Therefore, it is recommended that the applicant consult with the Department's meteorologist early in the application process.

Not less than one year of site-representative meteorological data will be acceptable for refined air quality modeling. This policy is applicable to both simple and complex terrain modeling domains. In most cases meteorological data from nearby airports are not suitable for risk assessment modeling.

The Department recommends that the applicant use the procedures for the siting of meteorological observation networks outlined in the EPA Publication No. EPA-450/4-87-007 "Ambient Air Monitoring Guidelines for Prevention of Significant Deterioration", 1987. Even if the proposed facility does not meet the criteria for a PSD analysis, the guidance is applicable to all air quality monitor and meteorological data acquisition siting requirements. Another EPA document that should be used in planning a meteorological data acquisition site is EPA-450/4-87-013 "On-Site Meteorological Program Guidance for Regulatory Modeling Applications." This guidance document outlines in detail meteorological instrumentation options and quality assurance procedures.

The Department requires that a formal protocol defining the meteorological data acquisition program be submitted for approval before data collection commences. This protocol should define items such as the site location, general topographical description, height of the proposed tower, and description of the meteorological instruments to be installed. A description of quality assurance procedures to be used in the data acquisition program should also be submitted.

Prior to beginning any refined air quality modeling, the Department requires that the applicant develop a modeling protocol and submit it to the Department meteorologist for review. The protocol should include a description of the models proposed for use in the analysis. For refined modeling, one year of on-site meteorological data should be used as input to the selected model. This protocol also should include a description of the facility, emission estimates, exhaust parameters, a plot plan of the proposed facility and the dimensions of buildings adjoining the source stack.

The selection of the model/models to be used in the dispersion analysis is site/facility dependent. Reference Document II provides information regarding model selection. Due to the continuing state of speciality model development, the applicant should consult the Department meteorologist for guidance. Decisions regarding model selection are made on a case-by-case basis according to facility/site specific parameters.

VI. MULTI-PATHWAY EXPOSURE ASSESSMENT

This section of the risk assessment provides guidance on the calculation of the dose of each chemical received by various receptors through each major pathway or route of exposure.

Before proceeding with the actual risk assessment, the applicant should submit to the Department a risk assessment protocol which defines the general approach, the site-specific pathways and input parameters (or methods by which these will be obtained), any parameter for which documentation for use of alternative values will be requested, and other items described in these guidelines.

A. General assumptions

The risk assessment should be based on the following assumptions:

1. For inhalation, all toxic pollutants should be assumed to be in a form that is respirable including all particulates and organic vapors. The dispersion modeling should assume that there will be complete plume reflection.

2. For non-inhalation routes of exposure, all toxic pollutants should be assumed to be in a form that will be deposited on the surface. The dispersion modeling should assume that deposition will account for all pollutants in the plume. Deposition velocity shall be estimated by the methods of Sehmel and Hodgson.

3. The emission rate is or should be assumed to be constant for a 70 year period. The risk assessment should consider the release of toxic pollutants to the atmosphere from all applicable sources at the site. Stack and fugitive air emissions from the handling, storage, processing and burning of hazardous waste and the on-site disposal of any hazardous waste or ash should be included in the Risk Assessment.

B. Description of the site and surrounding area

The applicant should qualitatively describe the area surrounding the location of the proposed facility. The description should include: 1) land use patterns (present and anticipated) 2) population characteristics including sensitive receptors (such as schools, nursing homes, hospitals) 3) ecological undeveloped areas (wetlands, watersheds, etc.) and 4) nearby industrial or commercial activity.

The study area is defined as the area for which excess lifetime cancer risk from all pollutants is equal to or greater than 10^{-7} from inhalation. The study area must be approved by the Department prior to the submittal of final risk assessment report.

C. Zone of Impact

To depict the potential toxic impacts, the applicant should provide maps of normalized concentration isopleths for each of the following: 1) the annual average ground level concentration of pollutants; 2) the annual average ground level deposition rate; 3) the 1 hour maximum ground level concentration; and 4) the less than 1 hour acute exposure concentration. The annual average maps should also identify the points of maximum concentration and deposition. Figures 1, 2A, 2B, 3 and 4 provide examples for this mapping.

The annual average ground level concentration map should be accompanied by a map which converts the concentration isopleths to aggregate inhalation risk isopleths for carcinogenic and non-carcinogenic pollutants. The risk isopleth map should be correlated with a table specifying the concentration and inhalation risk associated with each pollutant, including unidentified emissions. (see Table 1 for an example) Figure 5 provides an example of these maps.

The maps should also show the area in which the total excess lifetime cancer risk from inhalation is equal to or greater than 10^{-7}, and the location and risk of the hypothetical individual with maximum inhalation exposure.

(Note that this process maps the risk to ensure that all the significant risk areas in the impact area have been identified; it does not identify the acceptable levels of risk.

For the noncarcinogens, the maps should also show the area in which the total risk from inhalation is greater than one hundredth of the reference dose for the substance that poses the greatest risk. The isopleths should be normalized for noncarcinogens and keyed to a table that shows the percent of reference dose for each noncarcinogen, including unidentified emissions. (see Table 2 for an example)

In addition, each map should identify locations where sensitive human receptors may be present on a regular basis (such as schools, nursing homes, hospitals, etc.) within the following zones: 1) the 10

(-6) (1 in 1,000,000) risk zone, 2) 1 mile of the facility boundaries and 3) 1 mile of the maximum 1 hour ground level concentration.

The annual average ground level deposition map should also identify the location of the point of maximum deposition. Tables should be provided which list the risk resulting from carcinogens and non-carcinogens (including unidentified emissions) for each route of exposure and each pollutant in different zones or at specific locations. (see Tables 3 and 4 for examples)

D. Land use within the impact area

1. Residential exposure scenarios and assumptions should be used whenever there are or may be residences near the site. Under this land use scheme, residents are expected to be in frequent, repeated contact with contaminated media. The assumptions in this case account for daily exposure over the long term.

2. Agricultural scenarios (for farm families) include assumptions of homegrown produce, milk, meat, poultry and eggs, and also includes assumptions of pasturage and homegrown livestock feed. Assumptions for farm families are the same as other families except they are assumed to produce 75% of their own total diet.

In rural areas, a hybrid of the two scenarios will pertain to many residents, such as the fraction of diet grown and consumed locally.

3. Recreational land use includes hunting and fishing, and other outdoor activities. These should be developed on a site-specific basis. It also includes "trespassers" or "site visitors." Recreational use should account for hunting and fishing seasons, but should not ignore the potential for subsistence (out-of-season) catches. Factors which limit exposures can also be included, such as a school year which limits outdoor activities, but a plausible maximum exposure should be used.

Description of Figures and Tables

Figure 1. Annual average normalized ground level concentration (GLC).
Shows isopleths resulting from dispersion modeling which include both gaseous and particulate pollutants.
Shows sensitive receptors, major geographic features.
Shows the point of maximum concentration.

Figure 2A. Annual average ground level deposition rate preportional to particle surface area.

Figure 2B. Annual average ground level deposition rate proportional to particle mass.
Shows isopleths resulting after the particulate portion of the GLC depositing on the ground.
Shows sensitive receptors, major geographic features.
Identifies the geographical point of maximum deposition for each indirect pathway (for use in Tables 1 and 2).

Figure 3. 1 Hour maximum ground level concentration.

Figure 4. Aggregate inhalation risk isopleths for carcinogenic pollutants.
Converts Map 1 isopleths into aggregate inhalation cancer risk, including that fraction of the unidentified emissions assumed to be carcinogenic.
Correlates with Table 1.

Figure 5. Aggregate inhalation risk isopleths for noncarcinogenic pollutants.
Converts Map 1 isopleths into aggregate inhalation noncancer risk, including that fraction of the unidentified emissions assumed to be noncarcinogenic.
Correlates with Table 2.

Table 1. Plausible Maximum Carcinogenic Risk.
Links risk isopleths from Map 4 with inhalation cancer risk, by chemical, including unidentified carcinogenic pollutants.
Shows the maximum non-inhalation risks within each pathway from deposition, from the geographical points identified in Maps 2 A and 2 B, for each carcinogen.
Sums the cancer risks within each pathway.

Table 2. Plausible Maximum Non-Carcinogenic Risk.
Links risk isopleths from Map 5 with inhalation noncancer risk, by chemical, including unidentified noncarcinogenic pollutants, expressed as percentage of

Reference Dose.

Shows the maximum non-inhalation risks within each pathway from deposition, from the geographical points identified in Maps 2 A and 2 B, for each non-carcinogen.

Sums the non-cancer risks within each pathway.

Table 3. Average Cancer Risk from Each Pathway.

Based on the calculated study-area average GLC and deposition rates of carcinogens derived from plausible maximum emission rates and plausible maximum exposure assumptions.

Table 4. Average Non-Cancer Risk from Each Pathway.

Similar to Table 3.

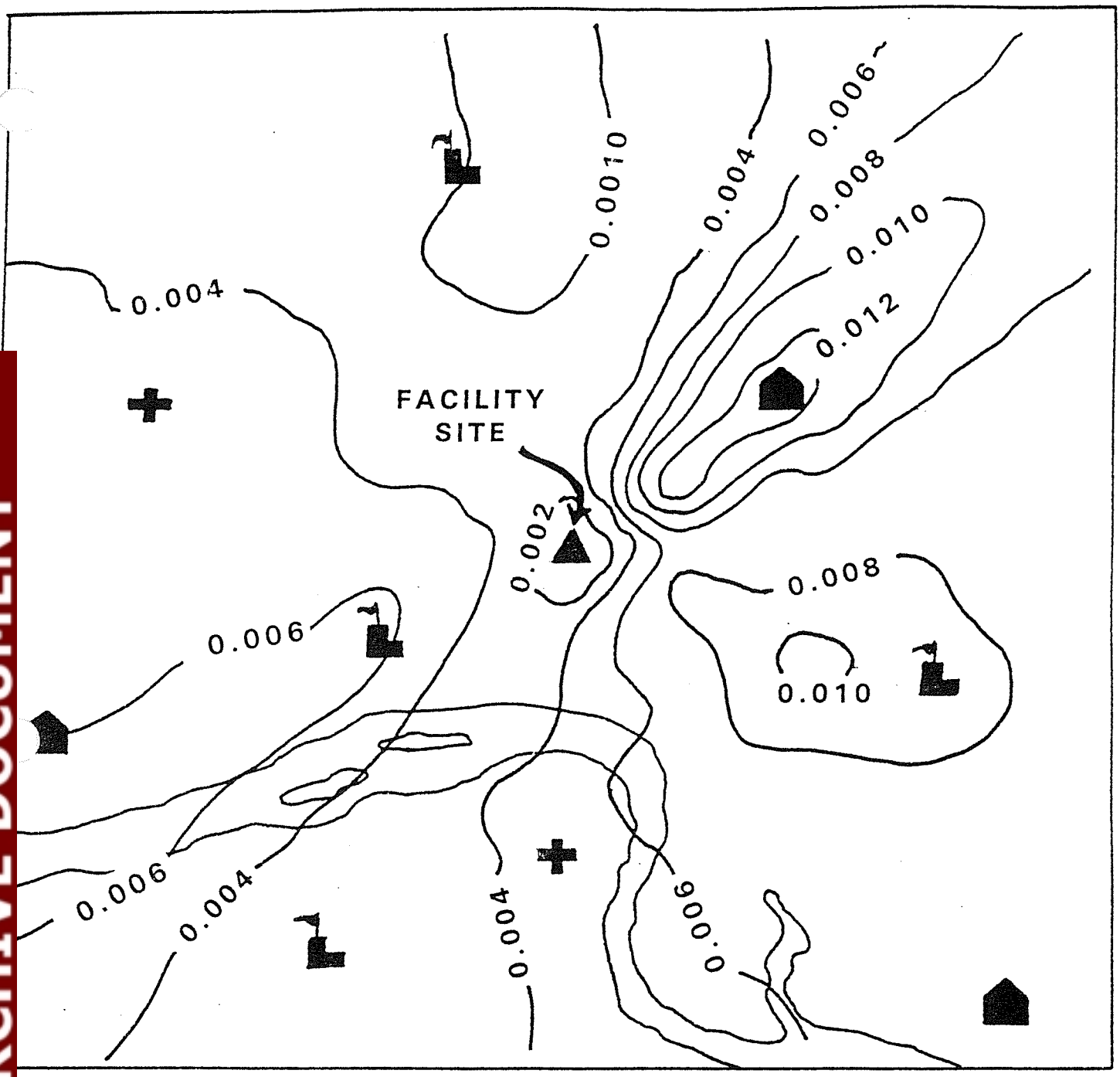


FIGURE 1

ISOPLETHS OF ANNUAL AVERAGE
NORMALIZED GROUND LEVEL
AIR CONCENTRATIONS
SURROUNDING THE FACILITY

Units = ug/m^3 (For An Emission Rate of 1 gram/sec)

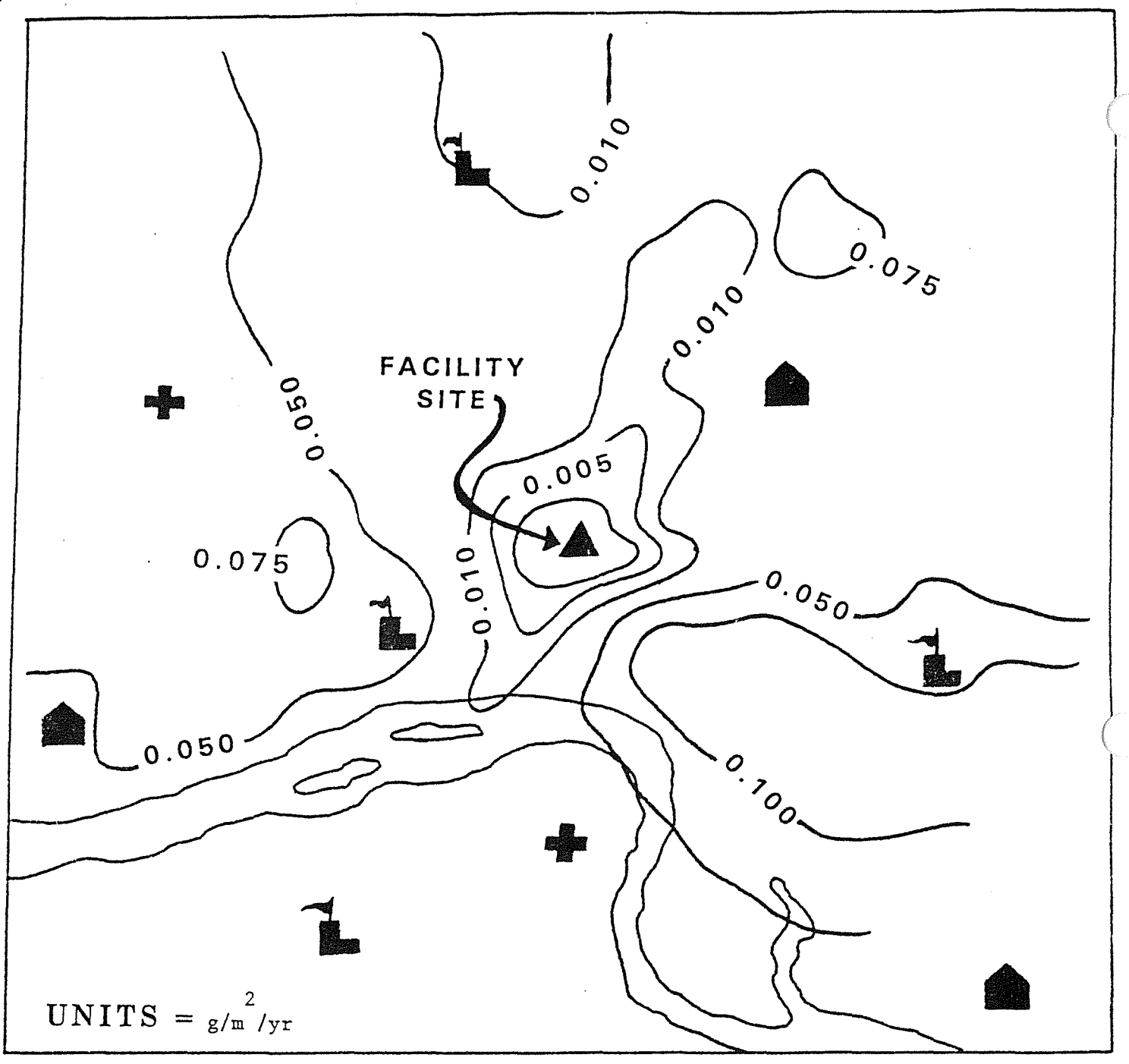


FIGURE 2A

ANNUAL AVERAGE GROUND LEVEL
DEPOSITION PROPORTIONAL TO
PARTICLE SURFACE AREA

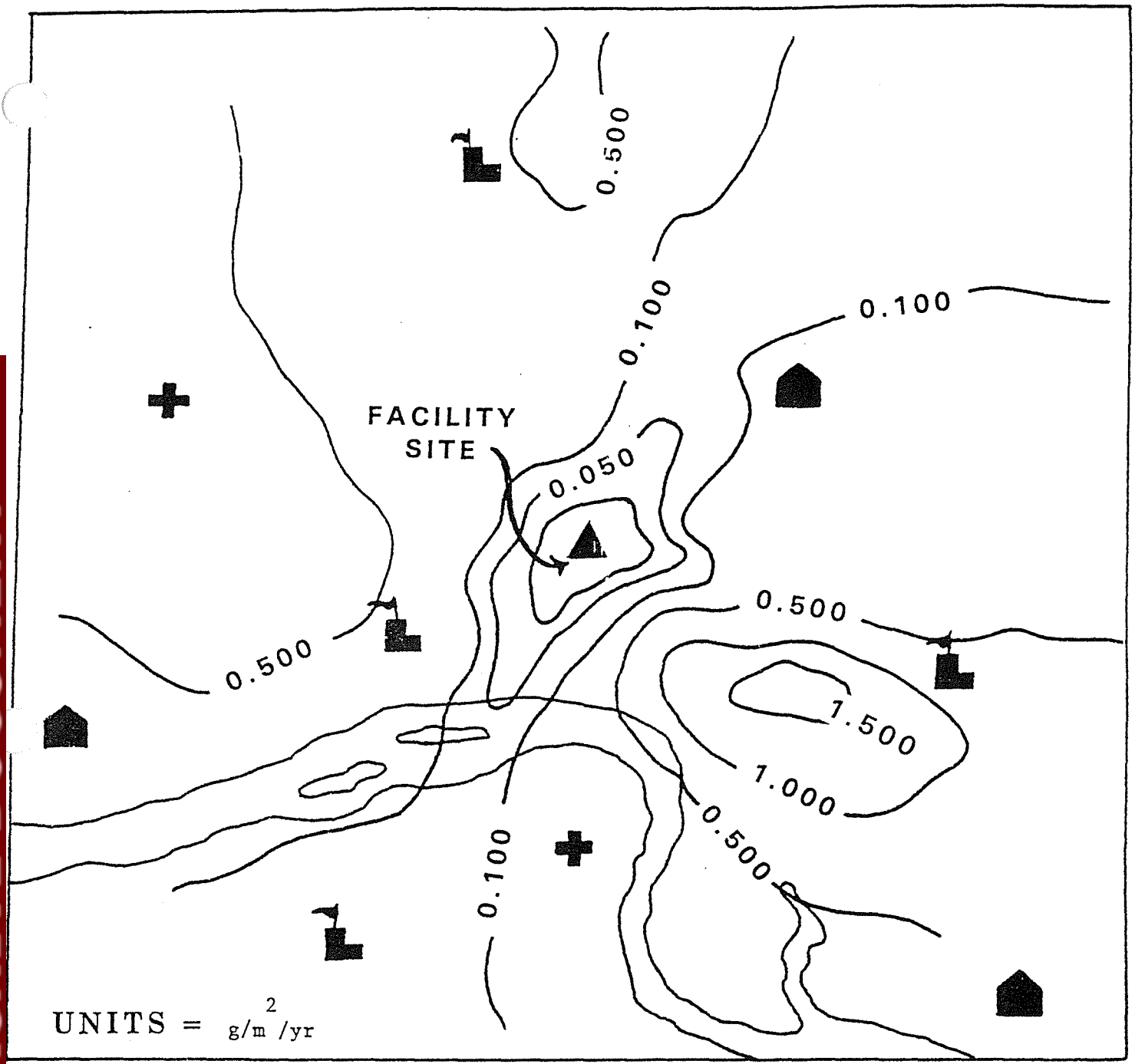


FIGURE 2B

ANNUAL AVERAGE GROUND LEVEL
DEPOSITION RATE PROPORTIONAL TO
PARTICLE MASS

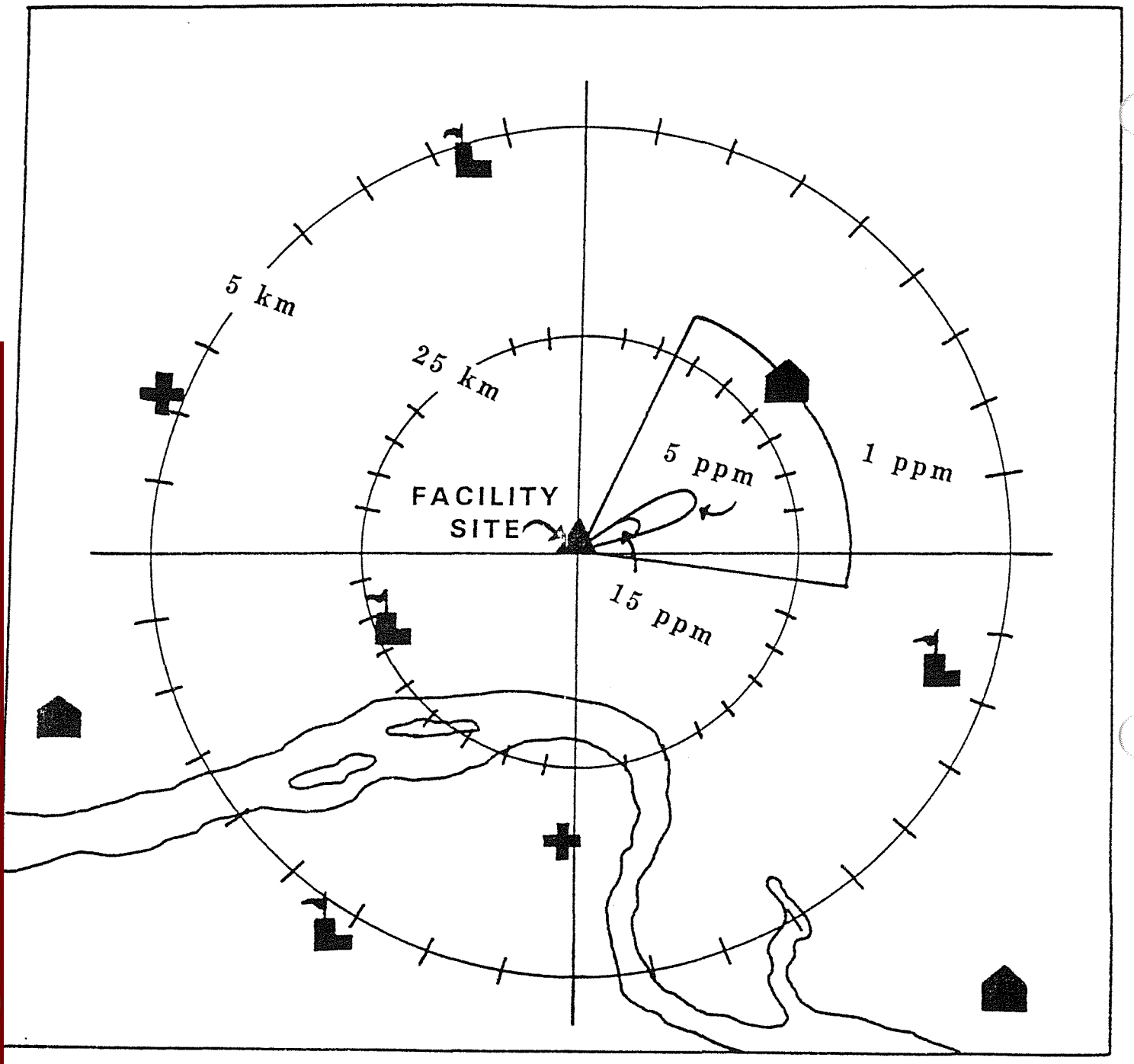


FIGURE 3

ONE HOUR MAXIMUM GROUND
LEVEL CONCENTRATION

CONC	MAX DIST
5 ppm	1.53 km
15 ppm	812 m
1 ppm	443 km

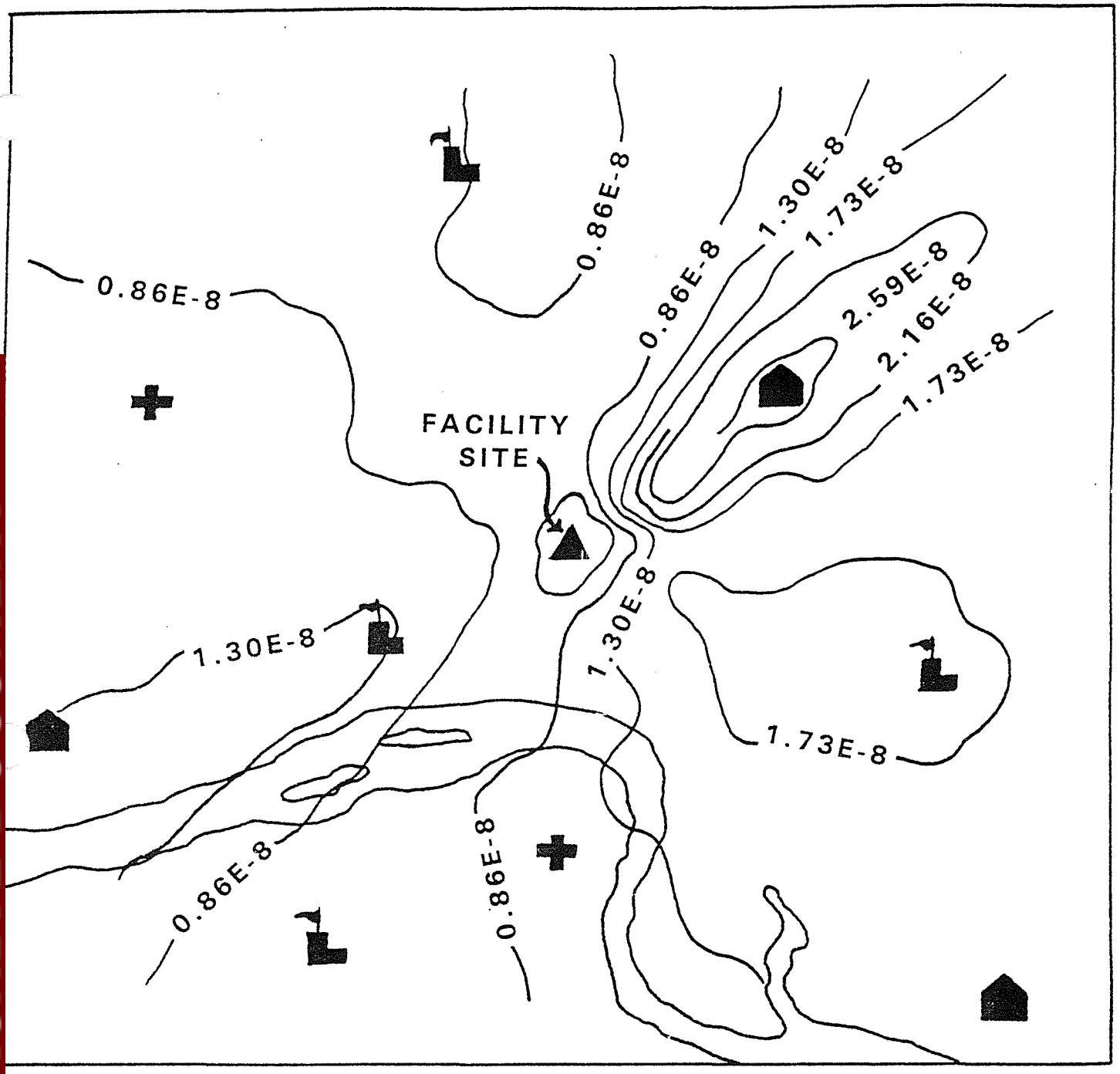


FIGURE 4

AGGREGATE INHALATION RISK ISOPLETHS FOR CARCINOGENIC POLLUTANTS

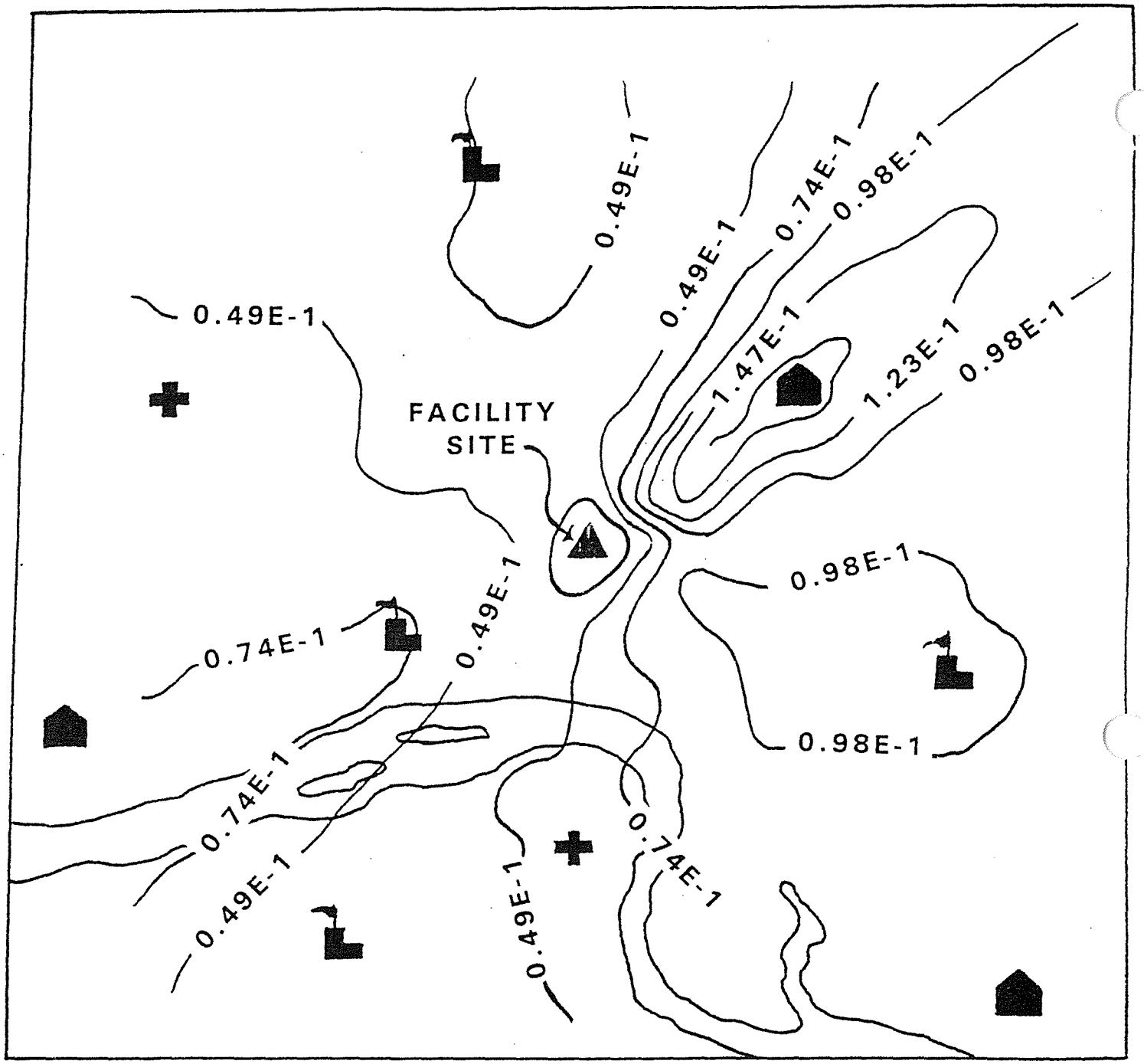


FIGURE 5

AGGREGATE INHALATION RISK
ISOPLETHS FOR NON-CARCINOGENIC
POLLUTANTS

TABLE 1
SUMMARY OF INCREASED LIFETIME CANCER RISKS ACROSS CHEMICALS OF CONCERN
MAXIMUM RISKS DUE TO PLAUSIBLE MAXIMUM SCENARIO

Chemical	Exposure Pathway (Increased Lifetime Cancer Risk)						
	Inhalation	Ingestion of Soil	Dermal Absorption of Soil	Ingestion of Drinking Water	Ingestion of Homegrown Produce	Ingestion of Commercial Produce	Ingestion of Human Milk
ldehyde	5.50E-09	NA	NA	NA	NA	NA	NA
rsenic	2.90E-09	1.90E-08	1.94E-08	7.30E-09	4.30E-08	4.20E-09	NA
eryllium	1.50E-09	7.90E-11	8.08E-11	1.90E-09	1.00E-09	1.10E-10	NA
admium	5.30E-10	NA	NA	NA	NA	NA	NA
hromium VI	6.50E-06	NA	NA	NA	NA	NA	NA
ickel	7.30E-09	NA	NA	NA	NA	NA	NA
AH: Carcinogenic	1.50E-09	6.30E-10	6.45E-10	7.90E-11	4.20E-08	5.40E-09	NA
CBs	2.70E-11	1.10E-10	1.13E-10	1.30E-11	2.00E-09	2.40E-11	1.80E-09
ioxins/Furans	1.60E-10	2.40E-08	2.46E-08	1.80E-09	2.20E-07	1.10E-08	3.60E-07
otal	6.50E-06*	4.38E-08	4.48E-08	1.11E-08	3.08E-07	2.07E-08	3.62E-07

Chemical	Exposure Pathway (Increased Lifetime Cancer Risk)						
	Ingestion of Fish from Lake #1	Ingestion of Fish from River #1	Ingestion of Fish from Pond #1	Incidental Ingestion of Water from Lake #1	Incidental Ingestion of Water from Pond #1	Dermal Absorption from Lake #1	Dermal Absorption from Pond #1
ldehyde	NA	NA	NA	NA	NA	NA	NA
rsenic	2.10E-11	1.70E-09	2.10E-10	1.00E-12	1.00E-11	3.30E-13	3.30E-12
eryllium	2.50E-11	2.10E-09	2.50E-10	2.70E-13	2.70E-12	8.50E-14	8.50E-13
admium	NA	NA	NA	NA	NA	NA	NA
hromium VI	NA	NA	NA	NA	NA	NA	NA
ickel	NA	NA	NA	NA	NA	NA	NA
AH: Carcinogenic	-	-	-	1.20E-16	1.20E-15	3.80E-17	3.80E-16
CBs	5.90E-08	7.00E-08	5.90E-07	1.60E-17	1.60E-16	5.00E-18	5.00E-17
ioxins/Furans	3.60E-07	7.60E-07	3.60E-07	1.00E-15	1.00E-14	3.20E-16	3.20E-15
otal	4.19E-07	8.34E-07	9.50E-07	1.27E-12	1.27E-11	4.15E-13	4.15E-12

= Not applicable
= Not calculated for PAHs since they are not expected to bioaccumulate in fish
.50E-06 equals an increased cancer risk of 6.5 indivisuals out of one million individuals

TABLE 2
SUMMARY OF INCREASED LIFETIME NON-CANCER RISKS ACROSS CHEMICALS OF CONCERN
MAXIMUM RISKS DUE TO PLAUSIBLE MAXIMUM SCENARIO

Chemical	Exposure Pathway (Increased Lifetime Non-Cancer Risk - Hazard Indices)						
	Inhalation	Ingestion of Soil	Dermal Absorption of Soil	Ingestion of Drinking Water	Ingestion of Homegrown Produce	Ingestion of Commercial Produce	Ingestion of Human Milk
senic	NA	9.40E-06	9.26E-06	3.70E-06	2.20E-05	2.10E-06	NA
ryllium	NA	3.70E-09	3.79E-09	8.70E-08	4.80E-08	5.10E-09	NA
dmium	NA	2.20E-05	2.25E-05	4.40E-05	4.30E-04	1.80E-05	NA
romium III	6.80E-08	1.20E-09	1.23E-09	4.60E-08	1.30E-07	8.60E-12	NA
romium VI	NA	7.60E-09	7.78E-09	2.80E-07	8.20E-07	1.70E-09	NA
drogen Chloride	1.40E-01	NA	NA	NA	NA	NA	NA
ad	6.50E-04	1.50E-04	1.53E-04	1.00E-04	4.20E-04	3.70E-05	NA
ercury	6.50E-03	1.50E-03	1.53E-03	1.00E-03	4.20E-03	3.70E-04	NA
ckel	NA	4.70E-07	4.81E-07	1.10E-06	1.30E-05	2.60E-07	NA
AH: Noncarcinogen	1.30E-06	4.70E-08	4.81E-08	4.60E-09	2.50E-06	3.20E-07	NA
Bs	7.80E-07	8.40E-07	8.60E-07	9.70E-08	1.50E-05	1.90E-07	9.80E-04
oxins/Furans	3.00E-04	1.50E-04	1.53E-04	5.40E-04	1.40E-03	7.10E-05	1.60E-01
tal	1.47E-01*	1.83E-03	1.88E-03	1.69E-03	6.50E-03	4.99E-04	1.61E-01

Chemical	Exposure Pathway (Increased Lifetime Non-Cancer Risk - Hazard Indices)						
	Ingestion of Fish from Lake #1	Ingestion of Fish from River #1	Igestion of Fish from Pond #1	Incidental Ingestion of Water from Lake #1	Incidental Ingestion of Water from Pond #1	Dermal Absorption from Lake #1	Dermal Absorption from Pond #1
senic	1.00E-08	8.60E-07	8.60E-06	5.70E-10	5.70E-09	1.80E-10	1.80E-09
ryllium	1.20E-09	9.80E-08	9.80E-07	1.40E-11	1.40E-10	4.30E-12	4.30E-11
dmium	4.70E-06	3.90E-04	3.90E-03	6.90E-01	6.90E+01	2.20E-09	2.20E-08
romium III	9.10E-11	7.60E-12	7.60E-11	7.20E-12	7.20E-11	2.30E-12	2.30E-11
romium VI	5.60E-10	4.50E-11	4.50E-10	4.50E-11	4.50E-10	1.40E-11	1.40E-10
drogen Chloride	NA	NA	NA	NA	NA	NA	NA
ad	4.20E-06	4.40E-08	4.40E-07	4.20E-08	4.20E-07	8.40E-09	8.40E-08
ercury	4.10E-01	6.70E-01	6.70E+01	3.10E-06	3.10E-05	9.50E-07	9.50E-06
ckel	6.20E-10	5.20E-08	5.20E-07	1.70E-10	1.70E-09	5.40E-11	5.40E-10
AH: Noncarcinogen	NC	NC	NC	1.30E-13	1.30E-12	3.70E-12	3.70E-11
Bs	4.50E-04	5.40E-04	5.40E-03	1.30E-13	1.30E-12	4.20E-14	4.20E-13
oxins/Furans	2.30E-03	4.90E-03	4.90E-02	7.10E-12	7.10E-11	2.20E-12	2.20E-11
tal	4.13E-01	6.76E-01	7.19E-01	6.90E-01	6.90E-01	9.61E-07	9.61E-06

= Not applicable. Listed chemical is not carcinogenic by this route of exposure. For breast milk, only uptake of PCBs and dioxins/furans was calculated.
= Not calculated for PAHs since they are not expected to bioaccumulate in fish.
17E-01 equals 14.7% of the threshold concentration of non-carcinogenic adverse health effects.

TABL

SUMMARY OF INCREASED LIFETIME CANCER RISKS ACROSS CHEMICALS OF CONCERN
AVERAGE RISKS - STUDY AREA USING EMISSION RATES DUE TO PLAUSIBLE MAXIMUM SCENARIO

Chemical	Exposure Pathway (Increased Lifetime Cancer Risk)						
	Inhalation	Ingestion of Soil	Dermal Absorption of Soil	Ingestion of Drinking Water	Ingestion of Homegrown Produce	Ingestion of Commercial Produce	Ingestion of Human Milk
ldehyde	2.09E-09	NA	NA	NA	NA	NA	NA
rsenic	1.10E-09	3.23E-09	3.31E-09	1.24E-09	7.31E-09	4.20E-09	NA
eryllium	5.70E-10	1.34E-11	1.37E-11	3.23E-10	1.70E-10	1.10E-10	NA
admium	2.01E-10	NA	NA	NA	NA	NA	NA
hromium VI	2.47E-09	NA	NA	NA	NA	NA	NA
ickel	2.77E-09	NA	NA	NA	NA	NA	NA
AH: Carcinogenic	5.70E-10	1.07E-10	1.10E-10	1.34E-11	7.14E-09	5.40E-09	NA
CBs	1.03E-11	1.87E-11	1.91E-11	2.21E-12	3.40E-10	2.40E-11	3.60E-10
ioxins/Furans	6.08E-11	4.08E-09	4.17E-09	3.06E-10	3.74E-08	1.10E-08	7.20E-08
otal	9.85E-09*	7.45E-09	7.62E-09	1.89E-09	5.24E-08	2.07E-08	7.24E-08

Chemical	Exposure Pathway (Increased Lifetime Cancer Risk)						
	Ingestion of Fish from Lake #1	Ingestion of Fish from River #1	Igestion of Fish from Pond #1	Incidental Ingestion of Water from Lake #1	Incidental Ingestion of Water from Pond #1	Dermal Absorption from Lake #1	Dermal Absorption from Pond #1
ldehyde	NA	NA	NA	NA	NA	NA	NA
rsenic	2.10E-11	1.70E-09	2.10E-10	1.00E-12	1.00E-11	3.30E-13	3.30E-12
eryllium	2.50E-11	2.10E-09	2.50E-10	2.70E-13	2.70E-12	8.50E-14	8.50E-13
admium	NA	NA	NA	NA	NA	NA	NA
hromium VI	NA	NA	NA	NA	NA	NA	NA
ckel	NA	NA	NA	NA	NA	NA	NA
AH: Carcinogenic	-	-	-	1.20E-16	1.20E-15	3.80E-17	3.80E-16
CBs	5.90E-08	7.00E-08	5.90E-07	1.60E-17	1.60E-16	5.00E-18	5.00E-17
oxins/Furans	3.60E-07	7.60E-07	3.60E-07	1.00E-15	1.00E-14	3.20E-16	3.20E-15
otal	4.19E-07	8.34E-07	9.50E-07	1.27E-12	1.27E-11	4.15E-13	4.15E-12

= Not applicable. Listed chemical is not carcinogenic by this route of exposure. For breast milk, only uptake of PCBs and dioxins/furans was calculated.
= Not calculated for PAHs since they are not expected to bioaccumulate in fish.
85E-09 equals an increased cancer risk of 9.85 individuals out of one billion individuals.

TABLE 4
SUMMARY OF INCREASED LIFETIME NON-CANCER RISKS ACROSS CHEMICALS OF CONCERN
AVERAGE RISKS - STUDY AREA USING EMISSOIN RATES DUE TO PLAUSIBLE MAXIMUM SCENARIO

Chemical	Exposure Pathway (Increased Lifetime Non-Cancer Risk - Hazard Indices)						
	Inhalation	Ingeston of Soil	Dermal Absorption of Soil	Ingestion of Drinking Water	Ingestion of Homegrown Produce	Ingestion of Commercial Produce	Ingestion of Human Milk
senic	NA	1.60E-06	1.64E-06	6.29E-07	3.74E-06	3.57E-07	NA
ryllium	NA	6.29E-10	6.44E-10	1.48E-08	8.16E-09	8.67E-10	NA
dmium	NA	3.74E-06	3.83E-06	7.48E-06	7.31E-05	3.06E-06	NA
romium III	2.58E-08	2.04E-10	2.09E-10	7.82E-09	2.21E-08	1.46E-12	NA
romium VI	NA	1.29E-09	1.32E-09	4.76E-08	1.39E-07	2.89E-10	NA
drogen Chloride	5.32E-02	NA	NA	NA	NA	NA	NA
ad	2.47E-04	2.55E-05	2.61E-05	1.70E-05	7.14E-05	6.29E-06	NA
rcury	2.47E-03	2.55E-04	2.61E-04	1.70E-04	7.14E-04	6.29E-05	NA
kel	0.00E+00	7.99E-08	8.18E-08	1.87E-07	2.21E-06	4.42E-08	NA
H: noncarcinogen	4.94E-07	7.99E-09	8.18E-09	7.82E-10	4.25E-07	5.44E-08	NA
Bs	2.96E-07	1.43E-07	1.46E-07	1.65E-08	2.55E-06	3.23E-08	1.96E-04
oxins/Furans	1.14E-04	2.55E-05	2.61E-05	9.18E-05	2.38E-04	1.21E-05	3.20E-02
al	5.60E-02	3.12E-04	3.19E-04	2.87E-04	1.11E-03	8.48E-05	3.22E-02

Chemical	Exposure Pathway (Increased Lifetime Non-Cancer Risk - Hazard Indices)						
	Ingestion of Fish from Lake #1	Ingestion of Fish from River #1	Igestion of Fish from Pond #1	Incidental Ingestion of Water from Lake #1	Incidental Ingestion of Water from Pond #1	Dermal Absorption from Lake #1	Dermal Absorption from Pond #1
enic	1.00E-08	8.60E-07	8.60E-06	5.70E-10	5.70E-09	1.80E-10	1.80E-09
yllium	1.20E-09	9.80E-08	9.80E-07	1.40E-11	1.40E-10	4.30E-12	4.30E-11
dmium	4.70E-06	3.90E-04	3.90E-03	6.90E-01	6.90E-01	2.20E-09	2.20E-08
omium III	9.10E-11	7.60E-12	7.60E-11	7.20E-12	7.20E-11	2.30E-12	2.30E-11
omium VI	5.60E-10	4.50E-11	4.50E-10	4.50E-11	4.50E-10	1.40E-11	1.40E-10
drogen Chloride	NA	NA	NA	NA	NA	NA	NA
ad	4.20E-06	4.40E-08	4.40E-07	4.20E-08	4.20E-07	8.40E-09	8.40E-08
rcury	4.10E-01	6.70E-01	6.70E-01	3.10E-06	3.10E-05	9.50E-07	9.50E-06
kel	6.20E-10	5.20E-08	5.20E-07	1.70E-10	1.70E-09	5.40E-11	5.40E-10
H: noncarcinogen	NC	NC	NC	1.30E-13	1.30E-12	3.70E-12	3.70E-11
Bs	4.50E-04	5.40E-04	5.40E-03	1.30E-13	1.30E-12	4.20E-14	4.20E-13
oxins/Furans	2.30E-03	4.90E-03	4.90E-02	7.10E-12	7.10E-11	2.20E-12	2.20E-11
al	4.13E-01	6.76E-01	7.19E-01	6.90E-01	6.90E-01	9.61E-07	9.61E-06

= Not applicable.
: Not calculated for PAHs since they are not expected to bioaccumulate in fish.

VII. INSIGNIFICANT RISK SCREENING PROCEDURE

This section sets forth a screening procedure that can be used to exempt from the multi-pathway exposure assessment those sources or facilities which have relatively minor risk.

Any hazardous waste burning operation that would result in ambient air concentrations of toxic substances that meet the following criteria shall be exempt from preparing the multi-pathway exposure assessment.

- Carcinogens - Aggregate inhalation risk from all substances of not more than one in ten million.

- Noncarcinogens - Inhalation risk from each substance of not more than one hundredth of the corresponding reference dose.

The ambient air concentrations of toxic substances should be calculated using the "plausible maximum" risk assessment, and the guidance for air emission dispersion modeling. The risk should be calculated for the Maximum Exposed Individual.

VIII. HUMAN HEALTH RISK ESTIMATION

After the exposure (or dose) of each pollutant is calculated, the maximum individual excess lifetime cancer risk, and estimated acute and chronic non-cancer health effects should be calculated. Exposure should be assumed to continue for 70 years.

The risk assessment should include a discussion of the adverse health effects associated with each major pollutant and/or pollutant class, including teratogenicity, carcinogenicity, mutagenicity, immunotoxicity, neurotoxicity, reproductive effects and wildlife or ecological effects where known. Primary or secondary references should be given.

In addition, the risk associated with organic compounds that cannot be separated into individual substances should be assumed to have a toxicity equivalent to the weighted average toxicity of the substances which are separately evaluated.

A. Estimation of Cancer Risk

Risk = Dose x Slope Factor

or: Risk = Ground Level Concentration x Unit Risk

Sources of unit risk factors or cancer potency slope factors should generally be limited to EPA documents. The preferred source is IRIS (EPA's Integrated Risk Information System), an informational database that contains EPA-wide consensus on the carcinogenicity classification of many chemicals, their references doses and potency factors, and summaries of the data that were used during the deliberations. A

secondary source is HEAST (quarterly Health Effects Assessment Summary Tables), also prepared by EPA. Any other source of toxicity factors, should none exist in either of the EPA databases, should be documented.

All carcinogens for which a cancer potency factor has been calculated, should be included in the risk assessment. For carcinogens (class A, B and C) for which no potency factor has been calculated, a Reference Dose divided by 10 should be used for the carcinogenic routes of exposure. Substances which have been determined to be carcinogenic by only one route of exposure may use the reference dose for the non-carcinogenic routes.

B. Estimation of Non-cancer Risk

Acute and chronic non-cancer health risks are determined by comparing the exposure doses to health effect levels.

The noncancer effects should be estimated using a hazard index approach. The hazard index is defined as the ratio of actual intake of any chemical to its "reference dose". The reference dose is the concentration calculated by EPA to generally be below that which would be expected to cause any adverse health effects in the most sensitive tissue in the most sensitive sub-population over a lifetime of exposure.

Some carcinogens also have noncancer toxicity, i.e. they also have reference concentrations as well as cancer potency factors. These should be used in assessing non-cancer risk.

Chronic effects should be estimated using the annual average concentrations and comparing them to reference doses or reference concentrations.

For short-term or acute effects, the magnitude and frequency of hourly maxima expected during "normal" operations should be addressed separately, and compared to acute or subchronic inhalation values (available in EPA-BIF rules, CAPCOA, CARB) and short-term drinking water health advisories (EPA), as appropriate. In addition, under the accident scenarios, acute exposures due to accidental releases should also be compared to these standards. Both types of comparisons should address known locations of sensitive receptors.

C. Risk Reporting

1. Chronic Inhalation Risks (Plausible Maximum Scenario)

The annual average ground level concentration map as required in section VI (C) should be converted to a series of risk based isopleths in two maps. One map should be for carcinogenic risks (Table 1) and the other for non-carcinogenic risks (Table 2). These maps are generated by combining the actual average concentration with the chemical specific potency factors (unit risk, cancer slope or reference dose as appropriate) from all pollutants. Where the applicant determines a

chemical to be not applicable for a particular pathy, explanation should be provided which explains why the chemical was determined not to be applicable.

For example: a normalized isopleth concentration of x ug/m^3 would be converted into cumulative cancer risk as follows: An emission rate of 1 gm/sec produces a ground level concentration (GLC) of x ug/m^3.

For carcinogens:

$$\Sigma \quad \text{risk} = x * [\, E1 * Pf1 + E2 * Pf2 + \ldots\ldots \,]$$

where: E1 = emission rate of pollutant 1 (gram/sec).

Pf1 = potency factor (unit risk estimate) of pollutant 1 (mg/m^3)-1.

For non-carcinogens:

$$\text{Dose-Inhalation (mg/kg/day)} = \frac{20\ m^3/day * GLC}{70\ kg * 1000} = GLC * 0.000286$$

Reference dose (RfD) is expressed as mg/kg/day

Hazard index (HI) = DI/RfD

$$\Sigma \text{ risk} = \Sigma HI = x * 0.000286 [\, (E1 / Rfd1) + (E2 / RfD2) + \ldots]$$

2. Inhalation Tables

The risk isopleth maps should be correlated with tables specifying the concentration and chronic inhalation risk associated with all pollutants.

3. Non-Inhalation Chronic Risks

The maximum risk from each pathway for both carcinogens and non-carcinogens must be computed and the location of the maximum risk for each pathway must be identified.

For example: For soil-based pathways, (such as soil ingestion, dermal absorption of soil and home-grown produce) the maximum risks will be calculated using the maximum deposition rate of the pollutants on the soil. For the water-based pathways, (such as fish intake or ingestion of water) the actual deposition rates on the water bodies will be used. If several water bodies are present in the study area, the risk from each water body must be calculated and identified in the risk assessment. The maximum risk from each pathway for each pollutant should be presented in a table. In this table the cumulative risk from all pollutants for each pathway shall also be included. (see Tables 3 and 4 for examples)

4. Average chronic risk from the study area

The risks for each pathway for the study area should be calculated using the area-weighted average ground level air concentrations over the study area and the area-weighted average deposition rates of all pollutants. The deposition rates of the pollutant are also averaged over the study area. The emission rates of the pollutants are derived from the "plausible maximum" scenario. The resultant risk from each pathway for each pollutant should be presented in a table. In this table the cumulative risk from all pollutants for each pathway should also be included. (see Table 3 for an example)

References

1. EPA. Methodology for Assessing Health Risk Associated with Indirect Exposure to Combustor Emissions. January 1990 (EPA/600/6-90-003)

2. EPA. Exposure Factors Handbook, July 1989 (EPA/600/8-89/043)

3. EPA. Superfund Public Health Evaluation Manual, October, 1986. (EPA/540/1-86/060). and: Supplemental Guidance: "Standard Default Exposure Assumptions." OSWER Directive 9285.6-03.

4. EPA. Superfund Exposure Assessment Manual. April 1988 (EPA/540/1-88/001).

5. EPA. The Risk Assessment Guidelines of 1986. April, 1987 (EPA/600/8-87/045).

6. EPA. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03.

7. CAPCOA (AB 2588 Risk Assessment Committee of the California Air Pollution Control Officers Association). Air Toxics "Hot Spots" Program Risk Assessment Guidelines. January 1991.

8. CAPCOA Air Toxics Assessment: Volume I: Toxic Air Pollutant Sources Assessment Manual. October, 1987.

9. EPA. Hazardous Waste Incineration Guidance Series, volumes I through VI.

10. EPA. Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A) [a revision of #2].

11. Travis CC and Cook SC. Hazardous Waste Incineration and Human Health, CRC Press, Boca Raton, FL. 1989.

12. EPA. Proposed rule regulating use, disposal of sludge from pulp, paper mills using chlorine bleaching processes (40 CFR Part 744, May 10, 1991), and supporting documents.

13. EPA. Final rule regulating the Burning of Hazardous Waste in Boilers and Industrial Furnaces (40 CFR Parts 260, 261, 264, 265, 266, 270, and 271, February 21, 1991).

Reference Document 1

ACRONYMS AND DEFINITIONS

BIF - EPA Boilers and Industrial Furnaces air emission standards for the burning of hazardous waste, final rules, 2-21-91

CAPCOA - California Air Pollution Control Officers Association

CARB - California Air Resources Board

CEM - Continuous Emission Monitoring

DER - Pennsylvania Department of Environmental Resources

Dioxin - Polychlorinated and Tetrachlorinated Dibenzo-p-Dioxins

DRE - Destruction and Removal Efficiency

EPA - U.S. Environmental Protection Agency

Furan - Polychlorinated and Tetrachlorinated Dibenzofurans

GLC - Ground Level Concentration

HC - Hydrocarbons

HEAST - EPA's quarterly Health Effects Assessment summary tables

Hexavalent - in this document refers to chromium in its valence state of 6.

HWI - Hazardous Waste Incinerator

IARC - International Agency for Research on Cancer

IRIS - EPA's Integrated Risk Information System

Isopleth - the line on a map which outlines a zone of risk or pollutant concentration level

MEI - Maximum Exposed Individual

NAAQS - National Ambient Air Quality Standards

NPDES - National Pollutant Discharge Elimination System

OSWER - Office of Solid Waste and Emergency Response

PAH - Polyaromatic Hydrocarbons

PCB - Polychlorinated Biphenyl

PCDD/PCDF - Polychlorinated Dibenzo-p-Dioxins/Dibenzofurans

PIC - Product of Incomplete Combustion

POHC - Principle Organic Hazardous Constituent

PSD - Prevention of Significant Deterioration

RAFT - Risk Assessment Fate and Transport Modeling System

RfC - Reference Concentration

TCDD/TCDF - Tetrachlorinated Dibenzo-p-Dioxins/Dibenzofurans

TEF - Toxicity Equivalent Factor (for PCDD/DF)

TRI - Toxics Release Inventory

Reference Document 2

RECOMMENDED AIR QUALITY MODELS AND PROCEDURES FOR REFINED RISK ASSESSMENTS

There are numerous models which may be used in determining risk assessment impact. Only a few have been listed below. In general, the Department requests that the applicant use recognized "guideline" models in the analysis. (These "guideline" models have been developed specifically by the Environmental Protection Agency to address a great variety of impacts. The models are reviewed and tested rigorously before attaining the status of "guideline".) The models used are site-specific and decisions regarding the applicability of a given model should be made on a case-by-case basis. Therefore, the Department requires that the applicant discuss the models proposed for the analysis before dispersion modeling is performed.

Guideline models are designed to estimate groundlevel concentrations of pollutants in simple or complex terrain. (Simple terrain refers to receptor points at or below the stack height of the emission source. Complex terrain refers to receptor points that are located above the source height of the emitter.)

For certain facilities with relatively low potential hazardous waste emissions the applicant may wish to consider using the EPA guideline model SCREEN or TSCREEN. SCREEN is a computer model update of the manual procedures originally contained in the original Volume 10 of the "Guidelines for Air Quality Maintenance Planning and Analysis" and the later Vol. 10R. The program can be used to generate estimates of groundlevel concentrations from stationary sources under various operating conditions in simple or complex terrain. Options are available that consider building effects, receptors above groundlevel, and fumigation. The SCREEN model produces estimates of maximum 1-hour groundlevel concentrations of the pollutant. An estimate of the annual concentration may be determined by multiplying the one-hour value by a factor of 0.08.

TSCREEN is a screening model which is used to estimate ambient concentrations from various toxic/hazardous instantaneous or continuous emissions. This model is described in a "Users Guide to TSCREEN, A Model for Screening Toxic Air Pollutant Concentrations" EPA-450/4-90-013. This computer model supplements the document "A Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants" EPA-450/4-88-009.

The guideline models ISCST, ISCLT and COMPLEX 1 currently serve as the basic models for use in risk assessment studies. Users guides for these models are referenced in "Guideline on Air Quality Models (revised)." EPA-450/2-78-027R and Supplement A.

The models listed above should be used when refined air quality modeling is required to support the permit application. These models in their guideline form are normally used to develop estimates of

groundlevel concentrations (ug/m^3) for the inhalation phase of the analysis. Studies based upon operating experience have shown most hazardous waste particulate emissions to be less than 2 micrometers in diameter during normal operation. Therefore, these emissions can be treated as gaseous for the purposes of modeling. The annual groundlevel concentrations produced by these models are referenced to tabular concentrations with predetermined carcinogenic risk-specific doses.

Quite frequently within the Commonwealth, the proposed site is located in an area where a combination of simple and complex terrain exist within the modeling domain. In this event, the applicant will be required to model the proposed facility utilizing the "intermediate terrain" concept. Further guidance on this procedure is provided in EPA modeling documents.

The EPA recently announced toxic analysis versions of ISCST and ISCLT names TOXST and TOXLT, respectively. These computer codes are referenced, but not described in the document, "A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants", March 1992(EPA-450/4-92-001). Users guides for these models are in preparation, but are listed as references below. Unlike the basic ISCST and ISCLT models, these models have been expanded to develop master files for post-processing for risk assessment. TOXST estimates maximum 1-hourly groundlevel concentrations and receptor-specific expected annual number of exceedances of short-term concentration thresholds. Acute hazard index values are calculated at each receptor by the TOXX post-processor in which a Monte-Carlo simulation is performed for intermittent sources.

TOXLT uses STAR meteorological data to produce estimates of annual groundlevel concentrations at user specific receptors. A post-processor called RISK subsequently calculates life-time cancer risks and chronic non-cancer hazard index values at each receptor.

Certain portions of the risk assessment application will require the development of deposition estimates as input to multi-pathway analyses described elsewhere in this document. Deposition values calculated by the guideline models are normally expressed in terms of grams per square meter per year. Although both ISCST and ISCLT have dry deposition options, there is general agreement among regulatory agencies and consultants that these algorithms should not be used to develop deposition estimates. It is recommended that the guideline computer codes be altered to allow for the calculation of deposition velocity based on particle size, surface characteristics and atmospheric conditions. These techniques are based upon the work of Sehmel and Hodgson and have been adopted for computer applications by the California Air Resources Board.

Because wet deposition processes do contribute to the total groundlevel concentration of a toxic pollutant, the applicant is encouraged to include this potential effect in the deposition part of the analysis. However, the integration of precipitation data into the standard dispersion equations in order to assess the "washout" of pollutants in a plume is difficult. In addition to hourly

meteorological data normally used in a computer model, detailed information on precipitation events in the source area is required. The scavenging process is dependent upon particle size, the physical and chemical characteristics of the particle, and the precipitation rate. Hanna et al. (1982) and Yamartino (1985) provide additional details on the topic.

For complex terrain analyses, the deposition algorithms discussed above may be applied to the guideline models COMPLEX 1 and RTDM. However, risk assessments based upon these models must be carefully evaluated because of the assumptions present in all Gaussian complex terrain models.

The applicant is not restricted to using the models listed above. Several other models may be considered for plant-specific and site-specific applications. In addition, models developed subsequent to the release of this guidance document and applicable to a particular project should be submitted to the Department meteorologist for review. A brief list of specialized models follows:

1) INTOXX (Integrated Toxic Expected Exceedance).

This model utilizes the dispersion output from ISCST to develop estimates of "expected exceedances" of defined "thresholds" from intermittent releases of airborne toxic chemicals. The main model TOXX simulates random, intermittent emissions and estimates expected exceedances. It can combine separate calculations of exceedance of multiple threshold concentrations in a single execution and calculate exceedances from the combined effects of simultaneous releases of two to eight toxic pollutant species.

2) INPUFF

INPUFF is a Gaussian integrated puff model designed to estimate accidental (instananeous) or continuous releases from a stack. Estimates of groundlevel concentration can be made for multiple point sources for up to 100 receptors and 144 separate meteorological periods.

REFERENCES

"Screen Procedures for Estimating the Air Quality Impact of Stationary Sources", EPA-450/4-88-010, August 1988 (DRAFT).

OR

"The SCREEN Model User's Guide (In preparation) EPA-450/4-92-006.

"User's Guide to TSCREEN, A Model for Screening Toxic Air Pollutant Concentrations" EPA-450/4-90-013.

"A Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants" EPA-450/4-88-009.

"A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants", March 1992. EPA-450/4-92-001.

"Toxic Modeling System Short-Term (TOXST) User's Guide" EPA-450/4-92-002.

"Toxic Modeling Long-Term (TOXLT) User's Guide" EPA-450/4-92-003.

"Deposition Rate Calculations for Air Toxic Source Assessments" CARB, Air Quality Modeling Section. September 16, 1987

"A Model for Predicting Dry Deposition of Particles and Gases to Environmental Surfaces." Sehmel, G.A. and W.H. Hodgson, 1978. Battelle Pacific Northwest Laboratories, U.S. Department of Energy PNL-SA-6721

"Handbook on Atmospheric Diffusion". Steven R. Hanna, Gary A. Briggs, and Rayford P. Hosker. 1982. Technical Information Center, U.S. Department of Energy.

"Handbook of Applied Meteorology". Edited by D.D. Houghton. 1985. John Wiley and Sons

Reference Document 3

EXPOSURE ALGORITHMS AND EXPOSURE FACTORS

Exposure algorithms and recommended default values are presented below. Exposure factors should be the default values provided in this document, or in EPA or CAPCOA manuals. If site-specific values are calculated (which is required for some pathways), they should be "plausible maximum values" and submitted to the Department for review in advance. If scientific data are available to support the use of assumptions and default values that differ from those included in the guidelines, the different assumptions may be approved upon the submission to the Department of adequate supporting documentation. However, the Department recommends, for the sake of consistency, the use of simple (and usually the most conservative or protective) assumptions. Not all of the CERCLA assumptions used in the Exposure Factors Handbook are considered appropriate for application to air-borne exposures.

NOTE: The risk assessment should use 70 years as the anticipated exposure period for carcinogens. The exposure period should not be based on the expected facility life or the "average" length of residential occupancy.

SPECIFIC EXPOSURE PATHWAYS

A. Estimating Concentrations in Air, Soil and Water

1. Air

GLC = Emission rate (g/sec) x X/Q ($ug/m^3/g/sec$)

GLC = ground level concentration (ug/m^3)
X/Q = Dilution factor provided by dispersion modeling

2. Soil

$$C(soil) = \frac{Dep * [1.0-exp(-Ks*Tc)] * 10^5}{Z * BD * Ks}$$

C(soil) = soil concentration of pollutant after total time period of deposition (ug/kg)

Dep = annual deposition rate of pollutant ($g/m^2/yr$)

Ks = soil loss constant (yr^{-1})

Tc = total time period over which deposition occurs 70 years - individual not affected by mothers milk pathway **See assumption #3.**

26 years - mother's exposure in breast milk pathway
44 years - adult in mother's milk pathway

Z = depth of incorporation (cm)
1 cm (play grounds, residential); 15 cm (agricultural)

BD = soil bulk density (g/cm^3)

$$Ks = Ksl + Ksd + Ksv$$

Ksl = Soil loss constant due to leaching (yr^{-1})
Ksd = Soil loss constant due to degradation (yr^{-1})
Ksv = Soil loss constant due to volatilization (yr^{-1})

$$Ksl = \frac{P + I - Ev}{\theta * Z * [1.0 + (BD * Kd/\theta)]}$$

P = average annual precipitation (cm/yr)
I = average annual irrigation (cm/yr)
Ev = average annual evapotranspiration (cm/yr)
θ = soil volumetric water content (ml/cm^3)
Z = soil depth from which leaching removal occurs (cm)
BD = soil bulk density (g/cm^3)
Kd = soil water partitioning coefficient (ml/g)

$$Ksd = \frac{\ln 2}{t1/2}$$

t1/2 = pollutant half-life due to degradation in soil (yr)

$$Ksv = Ke * Kt * 31{,}536\ s/yr$$

Ke = equilibrium constant (cm^{-1})
Kt = gas phase transfer coefficient (cm/sec)

$$Ke = \frac{3.1536 * 10^{10} * H * 10^{3}}{Z * Kd * R * T * BD}$$

H = Henry's law constant ($atm\text{-}m^3/mole$)
Z = soil depth (cm)
Kd = soil water partitioning coefficient (ml/g)
R = ideal gas constant (l-atm/mole - degrees K)
T = temperature (K)
BD = soil bulk density (g/cm^3)

$$Kt = 0.482 * u^{0.78} * N^{-0.67} * de^{-0.11}$$

Kt = gas phase mass transfer coefficient (cm/s)
u = wind speed (m/s)
N = Schmidt number for gas phase
de = effective diameter of contaminated area (m)

$$N = \frac{\mu a}{pa * Da}$$

μa = viscosity of air (g/cm-s)
pa = air density (g/cm^3)
Da = diffusion coefficient of pollutant in air (cm^2/s)

Assumptions: 1) Pollutants are uniformly mixed in the soil; 2) The mother is exposed for her first 25 years, the infant is exposed for 1 year of breast feeding while the mother's exposure continues, and then the adult resides there for 44 more years (for a total of 70 years as the exposure period); 3) The average concentration of pollutants accumulated at the 35 year time period should be assumed to remain constant and be used in the risk calculations for the entire 70 year period.

3. Surface water concentration

The surface water concentration of a given pollutant is based on runoff and soil erosion, as well as direct deposition of pollutants onto the water body.

This pathway does not include discharges from the facility covered by a NPDES permit, if any.

C(water) = C(deposition) + C(runoff)

C(deposition) = concentration in water due to direct deposition onto water (ug/1)

$$C(\text{deposition}) = \frac{Dep * WBIA * 10^3}{DV}$$

Dep = Annual deposition rate of pollutant ($g/m^2/yr$)

WBIA = Site specific area of water receiving fallout (m^2)

DV = Site specific dilution volume for water body per year or mean annual flow rate (m^3/yr)

For lake: mean lake volume (m^3/yr) + mean annual outflow from the lake

For river: mean annual flow (m^3/yr)

$$C\ (\text{runoff}) = \frac{Xe * WSIA * Mm * 10^{-1}}{DV * BD * Z}$$

C (runoff) = Concentration in water due to soil run off (ug/1)

Xe = Soil loss rate per unit area watershed over time (kg/km^2-yr)

WSIA = Watershed impact area (km^2)

Mm = Maximum contaminant mass per area of soil (kg/km^2)

DV = Site specific dilution volume for water body per year or mean annual flow rate (m^3/yr)

For lake: mean lake volume (m^3/yr) + mean annual outflow from the lake

For river: mean annual flow (m^3/yr)

Z = Depth of incorporation (cm)

BD = Soil bulk density (g/cm^3)

$Xe = R * K * LS * C * Ps * 908.18\ Kg/ton * 1/(4.047*10^{-3})\ acre/Km^2$

R = Erosivity (rainfall/runoff) factor (yr^{-1})
R is the erosion potential for average annual rainfall at a given location

K = Soil erodability fator (ton/acre)
K is an experimentally determined value using the predominant soil type at the location

LS = Topographic or slope length factor (unitless)

C = Cover management factor (unitless)
This factor represents the vegetative crop, crop sequence, crop rotation and tilling practices

Ps = Supporting practice (sediment delivery) factor (unitless)
This factor depends on the agricultural techniques such as contouring and terracing

$Mm = Dep * [\ 1 - exp\ (-k1 * Tc)\ ]\ /k1$

Where: Dep = annual deposition for contaminant (kg/km^2-yr).

k1 = first-order loss rate (yr^{-1}).

Tc = total time period over which deposition occurs
70 years - **see assumption #2**

The first-order loss rate, k1, can be calculated by adding the loss rates due to infiltration (k1I), erosion (k1E), and degradation (k1D):

$k1 = k1I + k1E + k1D$

The equations for k1I, k1E, and k1D are as follows:

$k1I = IR\ /\ (\ \theta\ *\ Z\ *\ [\ 1 + (BD * Kd\ /\ \theta)\ ]\ )$

Where: k1I = first-order loss rate for infiltration (yr^{-1})
IR = infiltration rate (cm/yr).
θ = volumetric water content of the soil (ml/cm^3).
Z = depth of incorporation (cm).
BD = bulk density of soil (kg/m^3).
Kd = distribution coefficient (m^3/kg).

$$k1E = \frac{Xe * Kd * BD * 10^{-4}}{(BD * Z)\ [\theta + (Kd * BD)]}$$

Where: k1E = first-order loss rate for erosion (yr^{-1}).
All other terms are previously defined (including units).

$k1D = \ln 2 / t1/2$

Where: $k1D$ = first-order loss rate for degradation (yr^{-1}).

$t1/2$ = contaminant half-life due to degradation in soil (yr).

Assumptions: 1) All contaminants entering the receiving water are absorbed to eroded particles and do not partition between soil particles and water. 2) The average concentration of pollutants accumulated at the 35 year time period should be assumed to remain constant and be used in the risk calculations for the entire 70 year period.

B. Concentration in Vegetation and Animal Products

1. Concentration in Vegetation

= deposition x bioavailability + translocation or uptake.

$$C(veg) = C(dep\text{-}veg) * BIO + C(trans)$$

C(veg) = average concentration in and on specific types of vegetation (ug/kg).

C(dep-veg) = concentration due to direct deposition

$$C(dep\text{-}veg) = Dep * IF/(k*Y) * (1-exp\{-kT\})$$

Dep = Deposition per day ($ug/m^2/d$)
IF = Interception fraction
  root crops = 0
  leafy crops = .2
  vine crops, fruit = .1
k = Weathering constant (1/d)
  0.693/14 (d)
Y = Yield (kg/m^2)
T = Growth period (d)
  40 - 90 days, depending on crop

BIO = Bioavailability (chemical-specific; see CAPCOA)

C(trans) = concentration due to root translocation or uptake (ug/kg).

$$= C(soil) * UF$$

UF = uptake factor based on soil concentration (see CAPCOA)

<u>Assumption:</u> no loss through metabolic degradation within the plant.

2. Concentration in animal products

= (Inhalation + water ingestion + feed ingestion + pasture/grazing ingestion + soil ingestion) x Transfer coefficient.

Anim-Inhal = RR * GLC

RR = animal specific respiration rate (see CAPCOA)
Assumption: all inhaled material is 100% absorbed.

Anim-Water = WI * %SW * C(water)

WI = Animal specific water ingestion (see CAPCOA)
%SW = percentage of daily water intake from the contaminated source; site specific based on survey.

Anim-Feed = (1 - %G) * FI * L * C(feed)

%G = percent of diet provided by grazing - site specific
FI = Feed ingestion rate (kg/d) (see CAPCOA)
L = percent of non-pasturage part of the animal's diet that is produced locally - site specific.
C(feed) = calculated from vegetation pathway above.

Anim-Pasture = %G * C(grass) * FI

%G = Percent of diet provided by grazing - site specific
C(grass) = concentration in grass, through vegetation pathway above.
FI = pasturage ingestion rate (see CAPCOA)

Anim-Soil = SI * C(soil)

SI = 3% of the grazing animals diet consists of soil.

Transfer Coefficient - see CAPCOA (assumes that this factor is the same for all exposure routes, that cow's milk and goat's milk are the same, that all meat is the same, and that eggs and meat are the same).

3. **Concentration in fish** = (concentration in water) x Bioconcentration

C(fish) = C(water) * BCF

Bioconcentration and Bioaccumulation factors are available in EPA documents and in CAPCOA Table 1 and EPA manuals. Assumes that all contaminants in water are available for bioaccumulation in a soil or ash matrix.

ESTIMATING EXPOSURE DOSES

Once the concentration of each contaminant in the air, water, soil, crops, and so on has been estimated, the dose to a person at that location via each route of exposure is estimated, using the following generic equation:

$$\text{Dose} = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

C = Concentration of the chemical in each medium (conservative estimate of the media average contacted over the exposure period)

IR = Intake/Contact Rate (upper-bound value)

EF = Exposure Frequency (upper-bound value)

ED = Exposure Duration (upper-bound value)

BW = Body Weight (average value=70Kg)

AT = Averaging Time

1. **Inhalation Dose**

Dose-Inhal (mg/kg/day) = RR * GLC / Body weight * 1000

GLC = Ground level concentration (ug/m^3)
RR = Respiration rate for 70 kg adult = 20 m^3/day
1000 = Micrograms to milligram conversion factor

Assumption: 100 % of the inhaled material is absorbed

2. Soil Ingestion

$$\text{Dose-soil} = C(\text{soil}) * I(\text{soil}) * GI * BIO * 10^{-6} / BW * 1000$$

Dose is expressed as mg/kg/d
C(soil) = average soil concentration (ug/kg)
I(soil) = soil ingestion rate = 150 mg/d (this is the average of children's rate (200 mg) and adults' rate (100 mg).
GI = Gastrointestinal absorption (see CAPCOA; assume 100% if no data is available)
BIO = Bioavailability (see CAPCOA; for most substances it is all bioavailable, therefore BIO = 1)
BW = 70 kg body weight

3. Dermal Absorption (soil, swimming)

Dermal absorption from either soil/dust or water includes factors for exposed skin area, loading rate of soil/dust onto the skin, concentration of contaminant and ability of the contaminant to absorb through skin. Absorption through the skin while swimming also includes the average amount of time swimming (in the impact area's lakes), and from soil may include a reasonable amount of time spent outdoors. If there is a household water pathway, dermal absorption during bathing should be included.

$$\text{Dose-dermal} = \frac{C * SA * SL * ABS}{\text{Body weight} * 10^9}$$

C = Soil or water SA = Surface area of exposed skin = 4656 cm^2
SL = Soil loading on skin = 1.45 $mg/cm^2/d$
ABS = fraction absorbed through skin or permeability constant - see CAPCOA
Body weight = 70 kg
10^9 = Micrograms to kilogram conversion factor

4. Homegrown and Local Commercial Produce

This pathway includes home gardens and local commercial vegetable and fruit production. Concentration of contaminants in different types of produce (root, leaf and vine or fruit) are calculated by standard methods, and then multiplied by the amount of each type of produce in "average" diets; these factors must be well documented. A site-specific factor for the average fraction of produce homegrown or produced locally may be calculated and documented for non-urban areas. No loss during preparation is assumed.

Dose-veg = C(veg) * IF * GI * L / BW * 1000

C(veg) = calculated above (ug/kg)
IF = daily consumption of produce (fruits, vegetables)
- Root crop = 200 g/d
- Vine crop = 200 g/d
- Leafy crop = 100 g/d
- Fruits = 140 g/d
- Note; 100 g = 3.5oz.

GI = Gastrointestinal absorption, as above
L = Fraction of diet which is homegrown - site specific; includes home gardens and locally grown commercial produce, if applicable. For farm families, L = 75%.
BW = 70 kg body weight

Assumptions: (1) no loss during preparation, (2) use of other produce consumption values may be presented (if documented).

5. **Animal Products** (Fish, Meat, Poultry, Dairy, Eggs, Cow's Milk)

This pathway sums all local animal-product dietary pathways, (according to the land use scenarios). The contribution of each animal product to a typical local diet must be determined on a site specific basis. No loss of contaminant during preparation is assumed to occur.

Dose-anim = C(anim) * I(anim) * GI * L / BW * 1000

C(anim) = concentration in any applicable animal product
I(anim) = intake rate of each animal product
milk = 300 g/d
meat (including poultry, eggs) = 75 g/d
fish (recreational) = 20.85 gm/day
from fresh water or estuarine sources
Note: 100g = 3.5 ounces

GI = gastrointestinal absorption, as above
L = Fraction of animal products produced locally.
For farm families, L = 75%.
BW = 70 kg body weight

Note: For small waterbodies or for areas of localized contamination in large waterbodies site specific data is recommended. Site specific or seasonal factors must be approved by the Department Toxicologist.

Assumptions: (1) no loss during preparation, (2) as dietary habits change, these values may change (if documented).

6. **Drinking Water**

This pathway is appropriate if the impact area includes a potential impact on any surface water or groundwater source that is used as drinking water. It assumes ingestion of 2 liters of water a day over a lifetime.

Dose-water = C(water) * I(water) * GI * BIO / BW * 1000

I(water) = daily water ingestion (2 Liters/d)
GI and BIO (as above)
BW = 70 kg

7. Mother's Breast Milk

This is an aggregate pathway that assumes (very conservatively) a woman is exposed for her first 25 years of life to the maximum permitted facility emissions, that she then has a child whom she breast feeds for 1 year while the exposures continue, and that the child then continues to live for 44 years at the same location with exposures as calculated for other children and adults. Substances which accumulate in fat (PCBs and PCDD/PCDFs) are generally of the most concern by this pathway.

$$\text{Dose-milk} = C(\text{milk}) * I(\text{milk}) * 365\ \text{d} * 1\ \text{year} / 25{,}000 * BW$$

$C(\text{milk})$ = concentration in mother's milk
$= AI * T\ 1/2 * f1 * f2 / (f3 * .693)$

- AI = aggregate intake by mother through all paths
- $T\ 1/2$ = half life of the contaminant in the mother
- $f1$ = fraction of the contaminant partitioning to fat (assume 90%).
- $f2$ = % fat in mothers milk (assume 4%)
- $f3$ = % of mother's body weight that is fat (assume 33%).

$I(\text{milk})$ = Daily intake rate of breast milk by infant (assume .9 kg/d)

BW = body weight of infant (assume 6.5 kg)

8. Examples of other pathways to be developed on a site-specific basis

If a land use survey within the zone of impact indicates that there may be other routes of exposure, these routes of exposure should also be presented. The Department can provide specific advice on the development or use of acceptable algorithms. For example, if household water is a potential route of exposure, then exposure to volatile contaminants through non-drinking routes (showering, cooking, etc.) can be significant. If swimmable water is impacted, then swimming will be a relevant pathway (dermal absorption and water ingestion while swimming).

SPECIAL NOTE ON DIOXIN

Because of the special concerns about dioxins/furans, the Department will pay special attention to exposure estimates for these compounds. Both human and wildlife food chain modeling from agricultural exposure to dioxin are discussed in EPA's Proposed Rule Regulating Use, Disposal of Sludge from Pulp, Paper Mills Using Chlorine Bleaching Processes, 56 FR 21802, May 10, 1991. The Department will evaluate the results of this modeling in relation to the most current information. For risk assessment purposes, EPA's TEF approach should be used. ("Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of PCDDs and PCDFs (3-89) EPA 625/3-89/016.")

References: EPA: Exposure Factors Handbook (1989)
Standard Default Exposure Factors (1991)
Calif: CAPCOA Air Toxics "Hot Spots" Program (1991)
PADER: Risk Assessment Fate and Transport Modeling System (RAFT) (1990)